What's Up With The Mud

Quantifying the Phosphorus Sorption Capacity of Hawaiian Coastal Wetlands

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A Brief Outline…

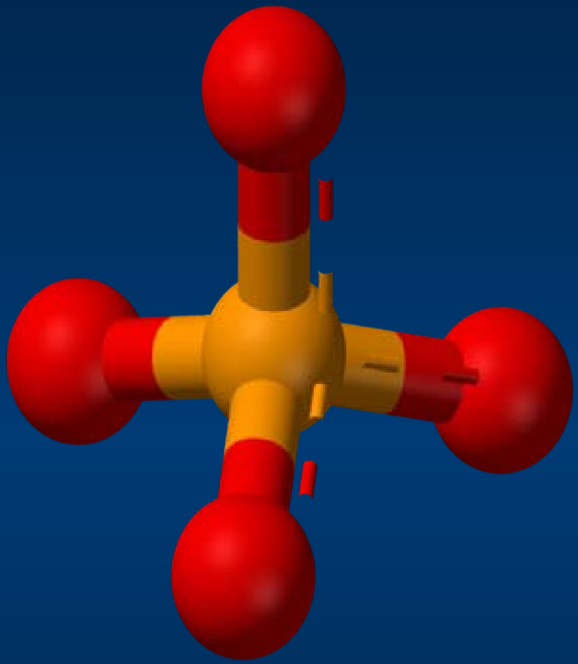
- ✓ Introduction & Background
- ✓ Objectives & Hypotheses
- ✓ Methodology
- ✓ Results
- ✓ Conclusion

COASTAL WETLANDS

Kawaiele Wetland, Kauai

- Provide many valuable functions
  - ✓ Protect & Stabilize Shoreline
  - ✓ Flood Control
  - ✓ Act as Sediment Traps
  - ✓ Biogeochemical Cycling

PHOSPHORUS



Schematic of phosphate (PO_4^{3-}) molecule

- ✓ Primary limiting nutrient
- ✓ Travels attached to soil particles
- ✓ Strength of sorption determines bioavailability
- ✓ Factors affecting sorption…
  - ✓ Texture
  - ✓ Mineralogy
  - ✓ Competing Ions
  - ✓ Organic Content

PHOSPHORUS

But too much P can lead to…

1) Waterway Eutrophication

2) Invasive Species Dominance

3) Coral Reef Degradation

in poor condition reef physical structure is deteriorating
as coral growth does not keep pace with the rate of erosion

Molokai Sea Farms ~100% Batis cover
pollution/eutrophication.html
http://www.maui-tomorrow.org
/issues/ocean/reefdeclines.html

Wetlands are a primary defense mechanism

OBJECTIVES

i. Measure P sorption capacity

ii. Examine any variability in P sorption

    i. Within sites along the hydrologic gradient

    ii. Among sites of different wetland types

iii. Determine if P sorption is correlated to commonly-measured soil variables

HYPOTHESES

i. Position along hydrologic gradient will account for a significant amount of variance within sites

ii. P sorption will vary across different site types (i.e. soil orders, created vs. natural, fresh vs. euhaline)

iii. Soil variables will be correlated with P sorption

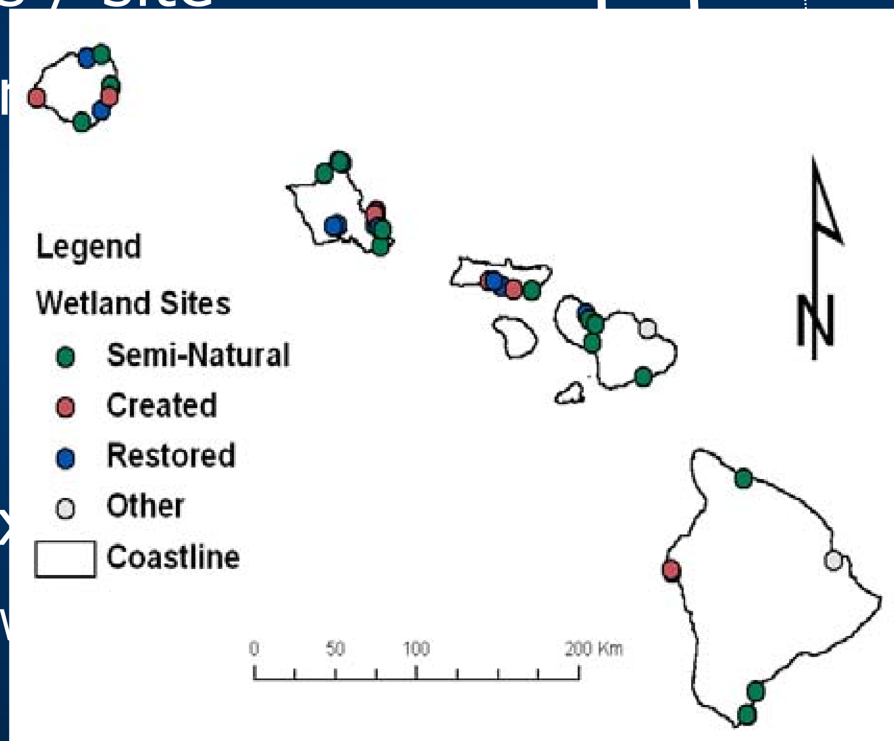
METHODOLOGY

40 sites on 5 islands

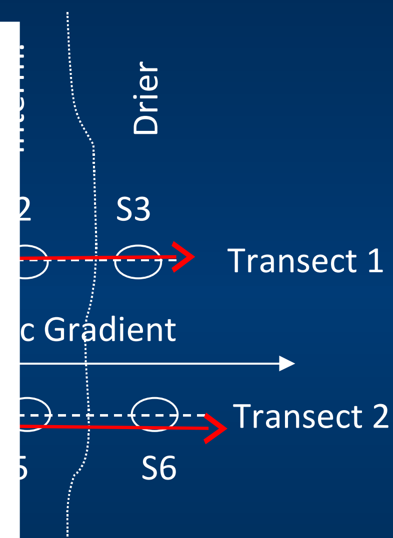
- ✓ 2 transects / site
  - ✓ 3 co
- ✓ P sorption
- ✓ PSI Index

PSI = x

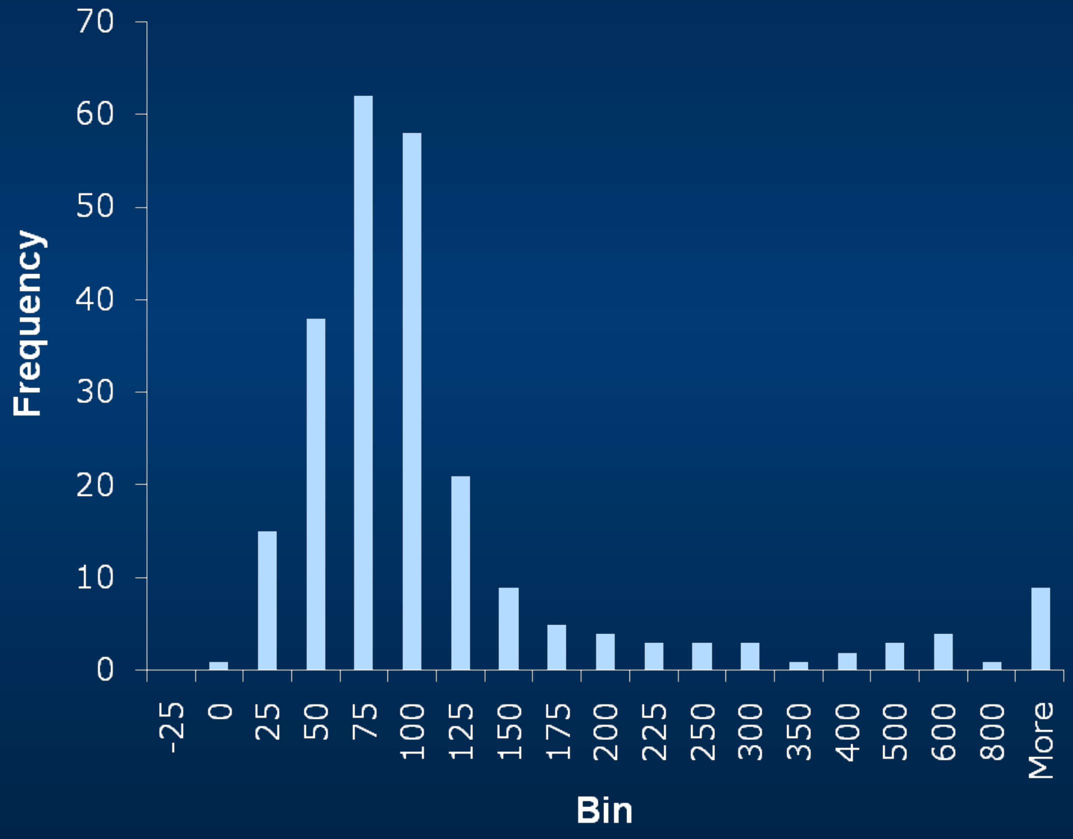
(Bache & W



Schematic of Riparian or tidal sites



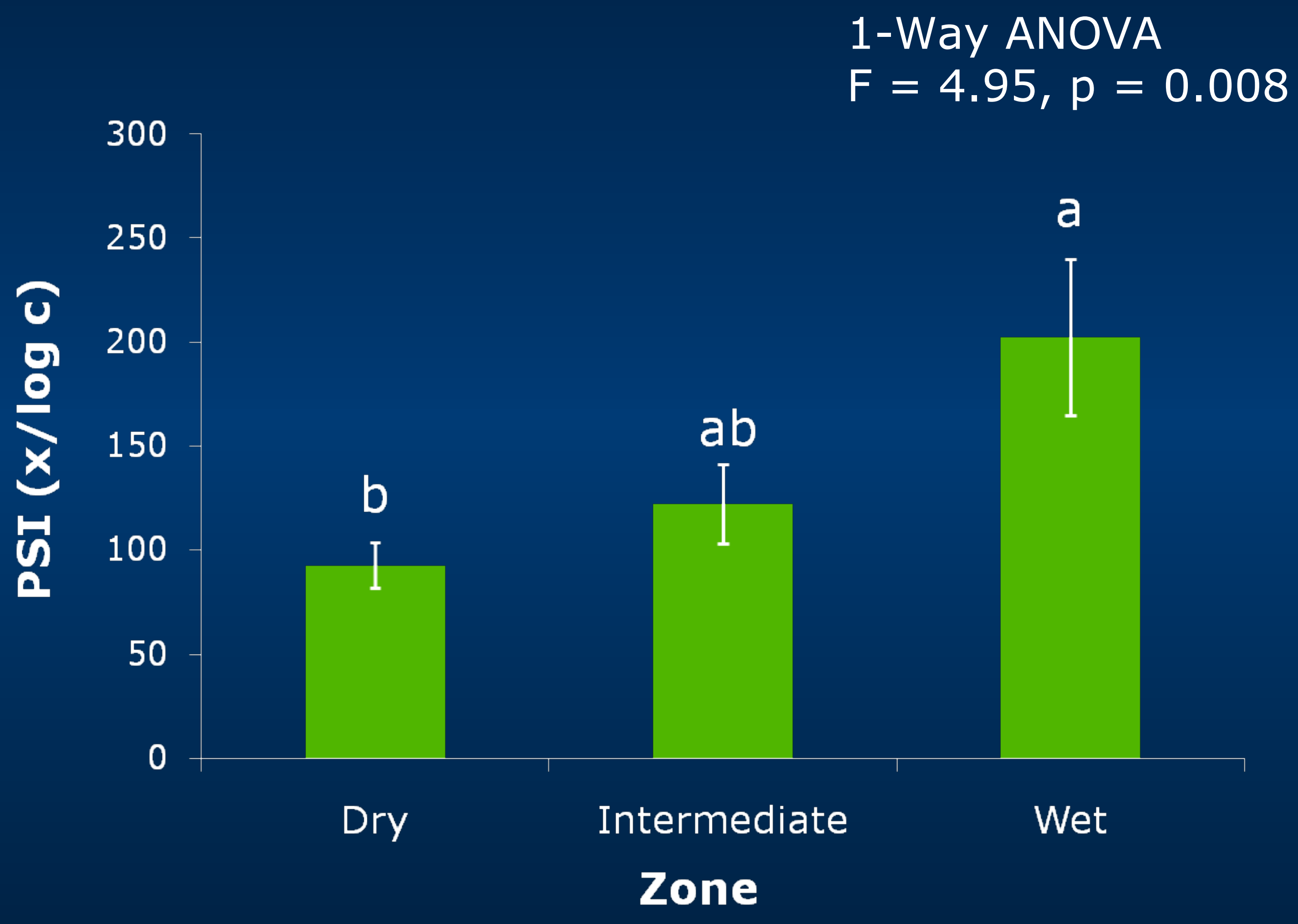
STATISTICAL SUMMARY



PSI = x/log c

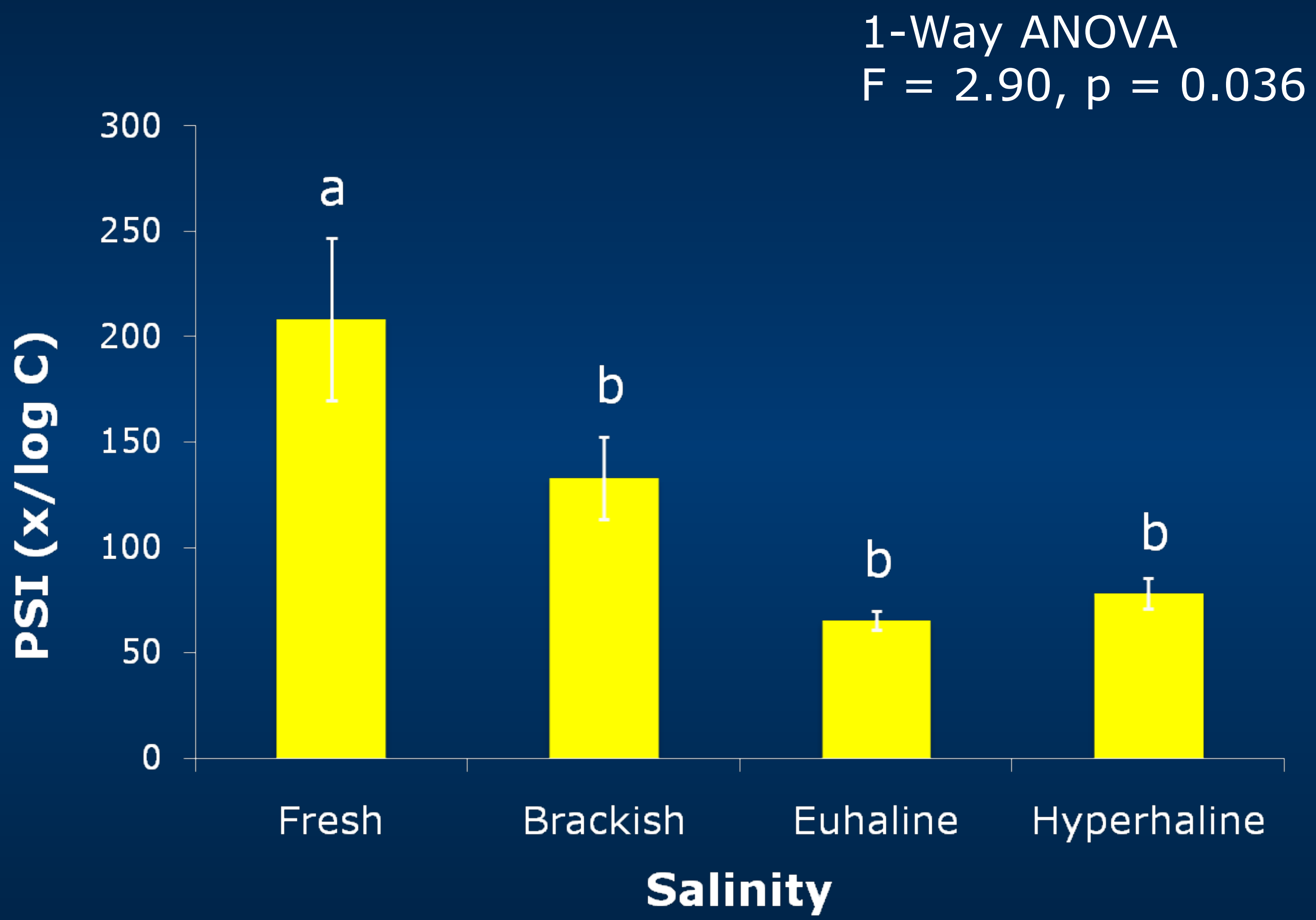
	PSI
Mean	139.9
Standard Error	14.9
Median	76.7
Range	1748.9
Minimum	-16.4
Maximum	1732.5
Count	242

HYDROLOGIC EFFECTS



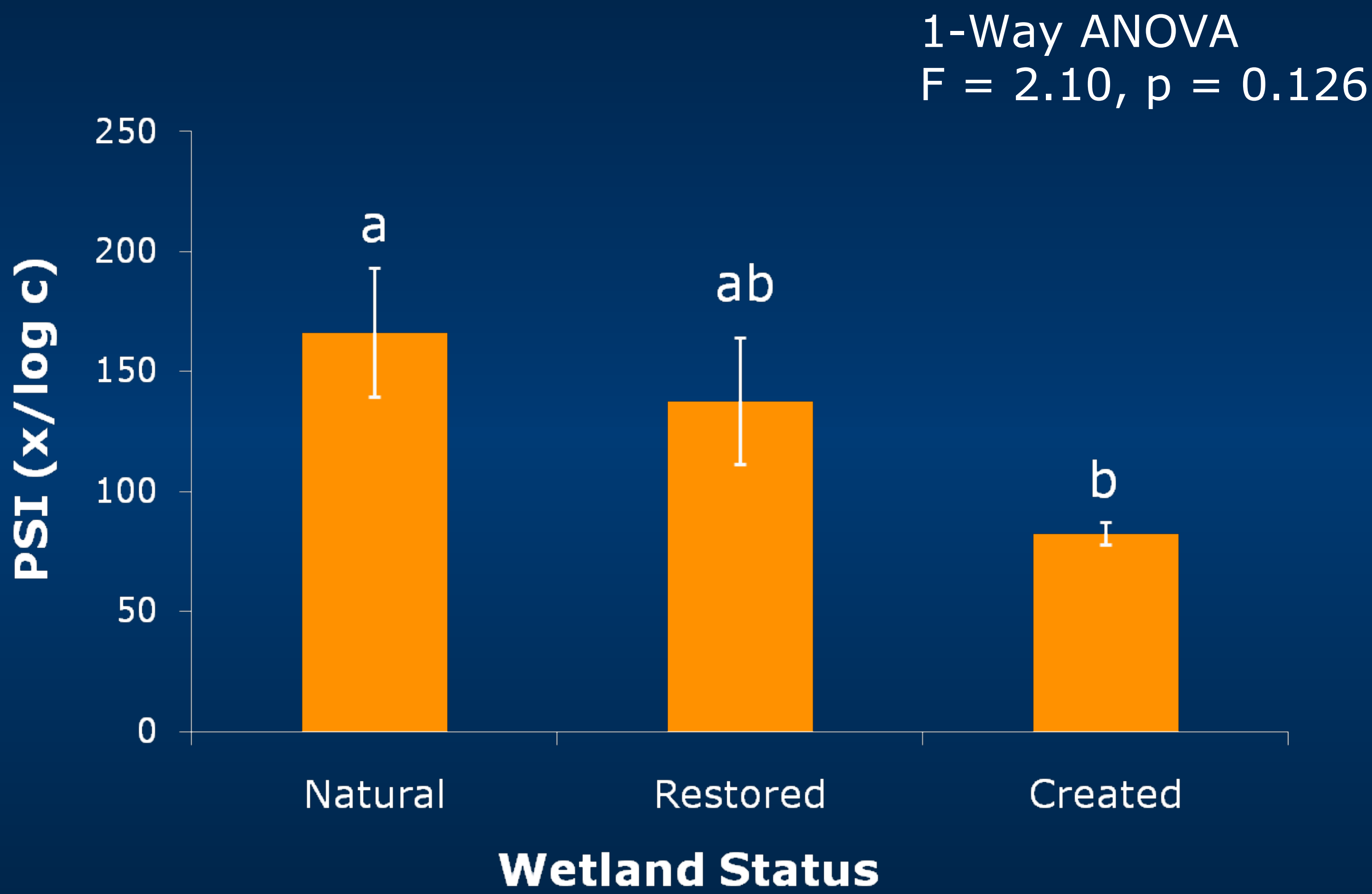
Bars represent the means (± 1 standard error). Different letters indicate a significant difference (p<0.05)

SALINITY EFFECTS



Bars represent the means (± 1 standard error). Different letters indicate a significant difference ($p<0.05$)

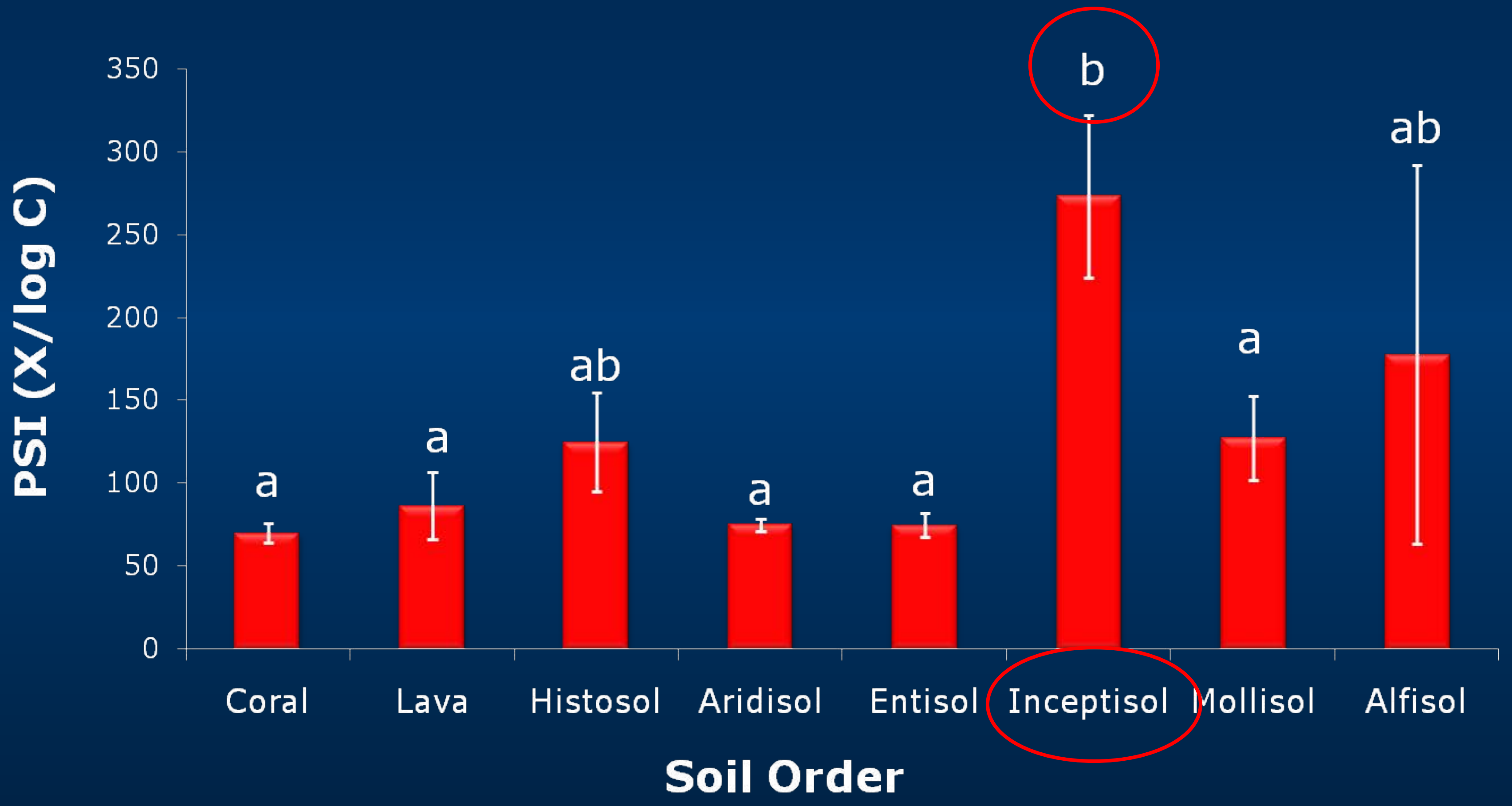
EFFECTS OF STATUS



Bars represent the means (± 1 standard error). Different letters indicate a significant difference (p<0.05)

SOIL ORDER EFFECTS

1-Way ANOVA
F = 3.97, p = 0.000



Bars represent the means (± 1 standard error). Different letters indicate a significant difference ($p<0.05$)

CORRELATIONS

	pH	LOI°	TC°	Clay (%)	Silt (%)	Sand (%)	Al_{ox}†	Fe_{ox}†
PSI	-0.41	0.20	n.s.*	n.s.*	0.17	-0.18	n.s.*	n.s.*

- Not significant at p-value < 0.05

° Variable log transformed

† Correlation carried out on subset of data (n = 48)

CONCLUSION

Objective: To examine P sorption in coastal wetlands

Result: Yes, hydrologic gradient, salinity & soil order significant, but not wetland status

Implications:

- Help identify wetlands best at sorbing P
- Determine wetlands at risk from P overload
- Identify best predictive characteristics

Future research:

- Continue to measure amorphous Fe and Al

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Thank You