The effects of oil exposure and nutrient addition on salt marsh communities across the northeastern Gulf coast

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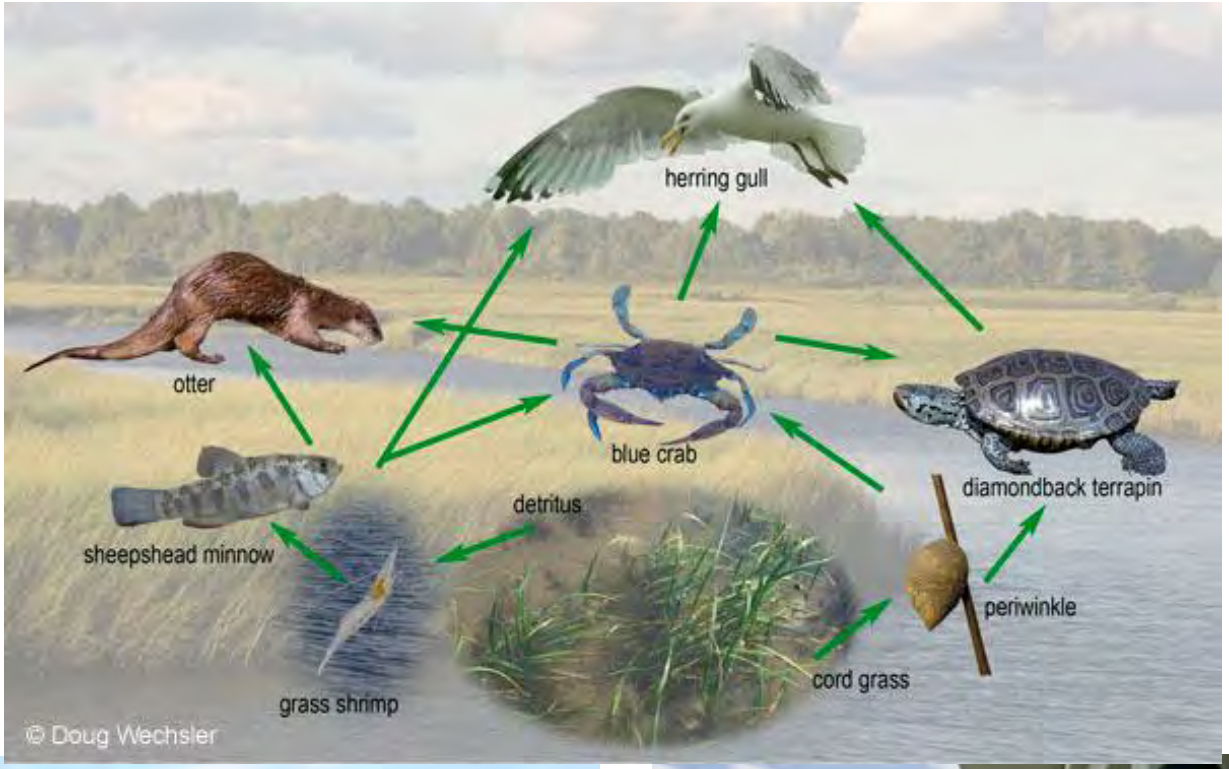
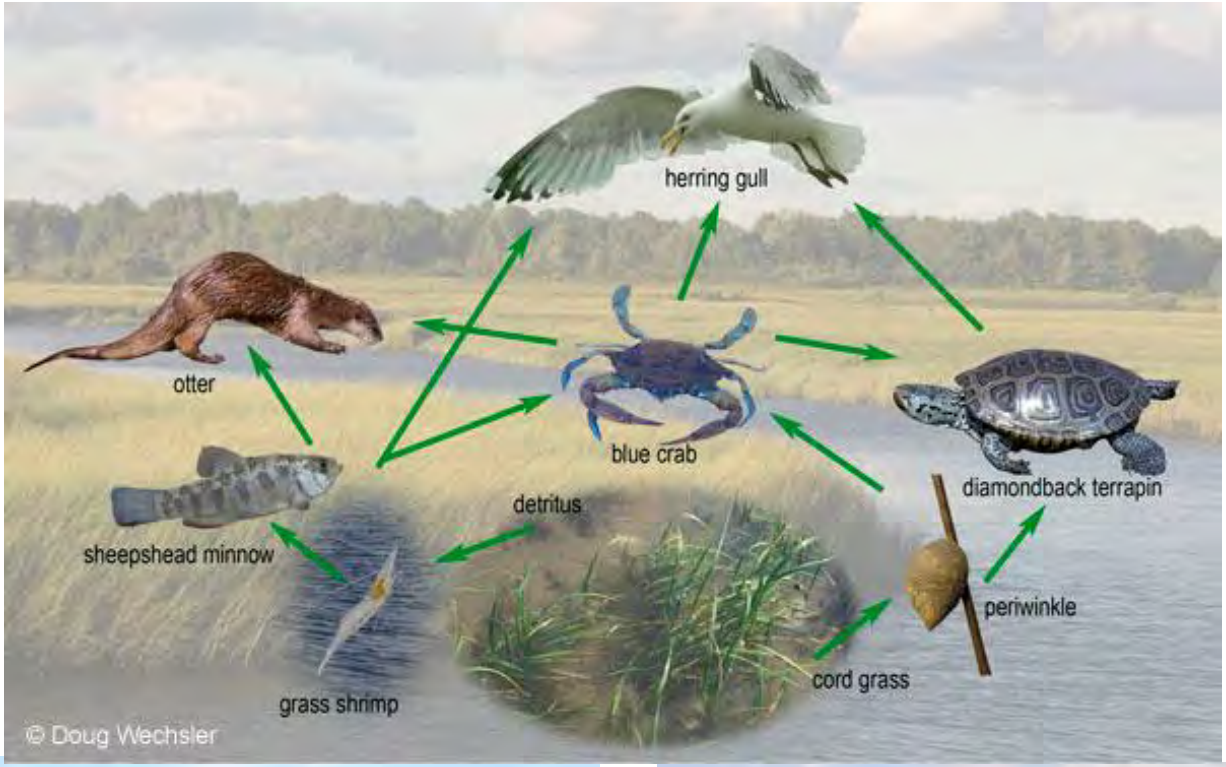
Salt Marshes Dominate the Intertidal of the Gulf coast

…Provide Us with a Number of Services



…Provide Us with a Number of Services



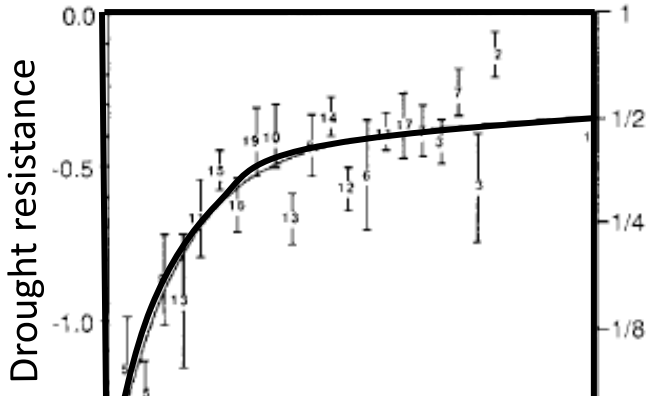
…And Make First Contact with Oil

That May Be Impossible to Clean

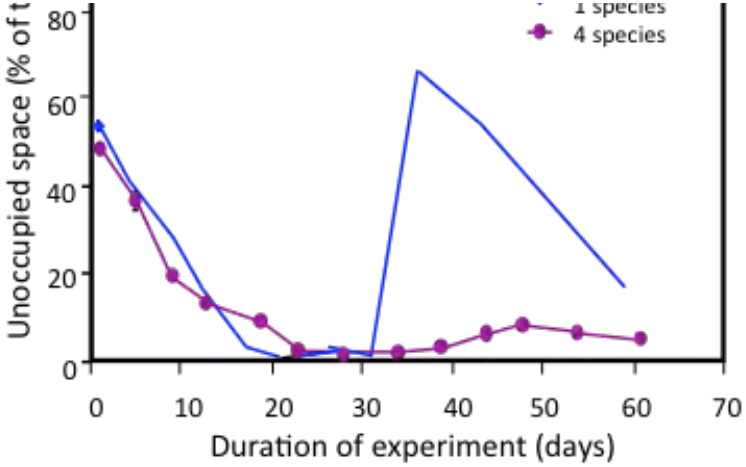
Post-Spill Protective Measures

Limited Quantity

Species Diversity & Disturbance



Are Diverse Marshes More Resistant to Oil Disturbance?



Nutrient Addition and Marsh Recovery

Fertilization

NH4+ ~100-500-N mg kg^{-1} of soil,
pore water range ~ 100-670-N mg L^{-1}

Will Fertilization Enhance Grazing?

RESEARCH OBJECTIVES

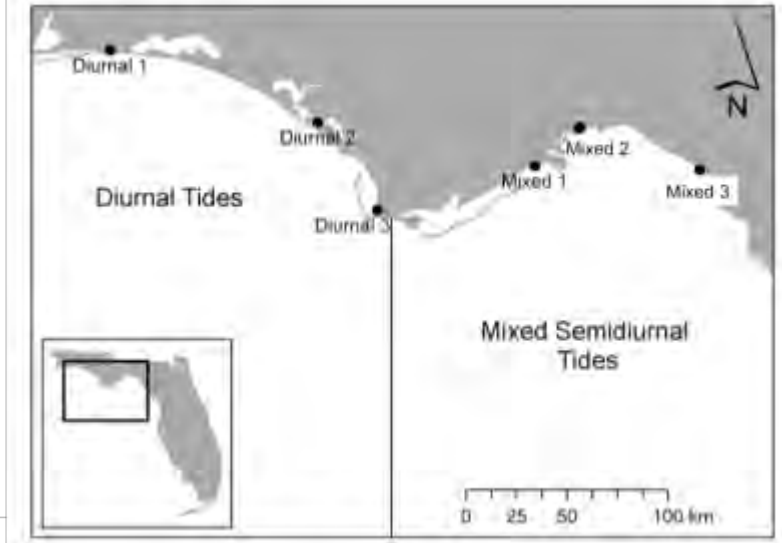
(1) Characterize spatial and temporal variation in diversity of marsh plants as well as exposure to oil

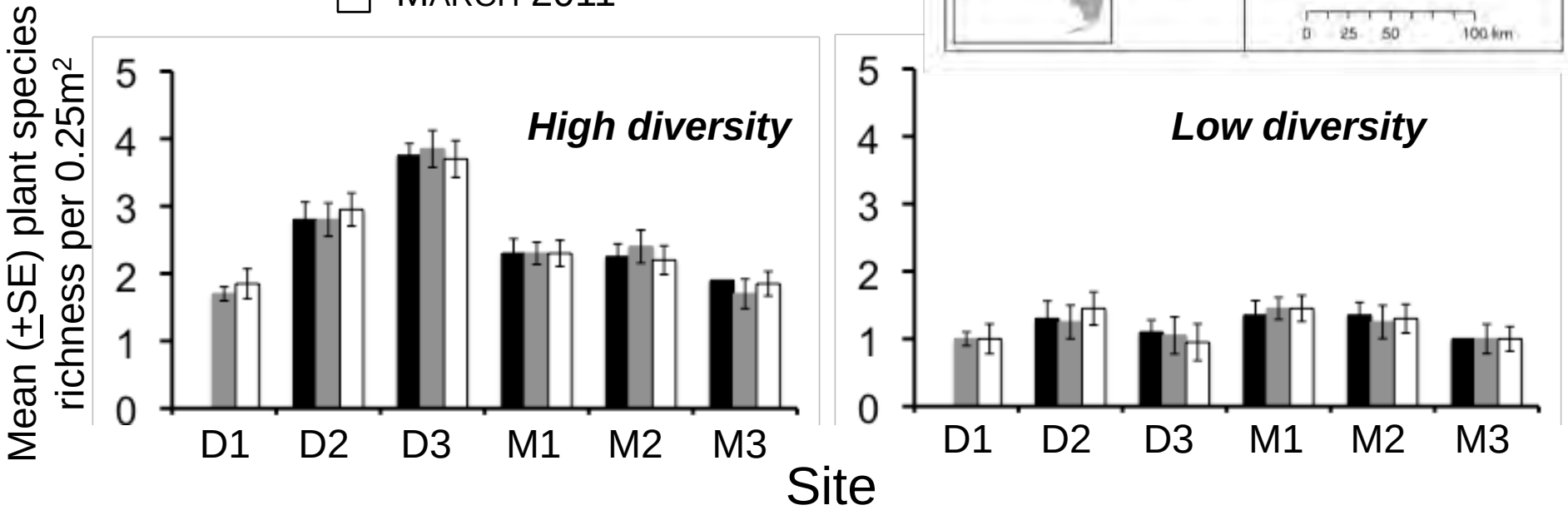
(2) Manipulate marsh plant diversity to examine influence of diversity on oiling impacts

(3) Experimentally examine how nutrient fertilization influences snail behavior

OBJECTIVE 1

DIVERSITY OF MARSH PLANTS IN PANHANDLE & BIG BEND OF FLORIDA



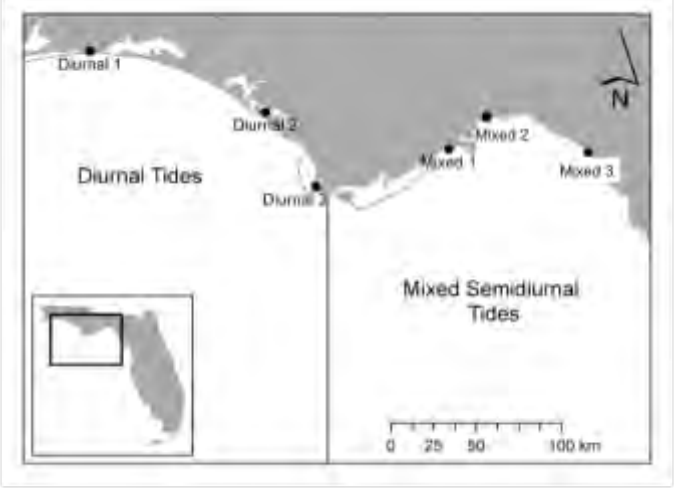


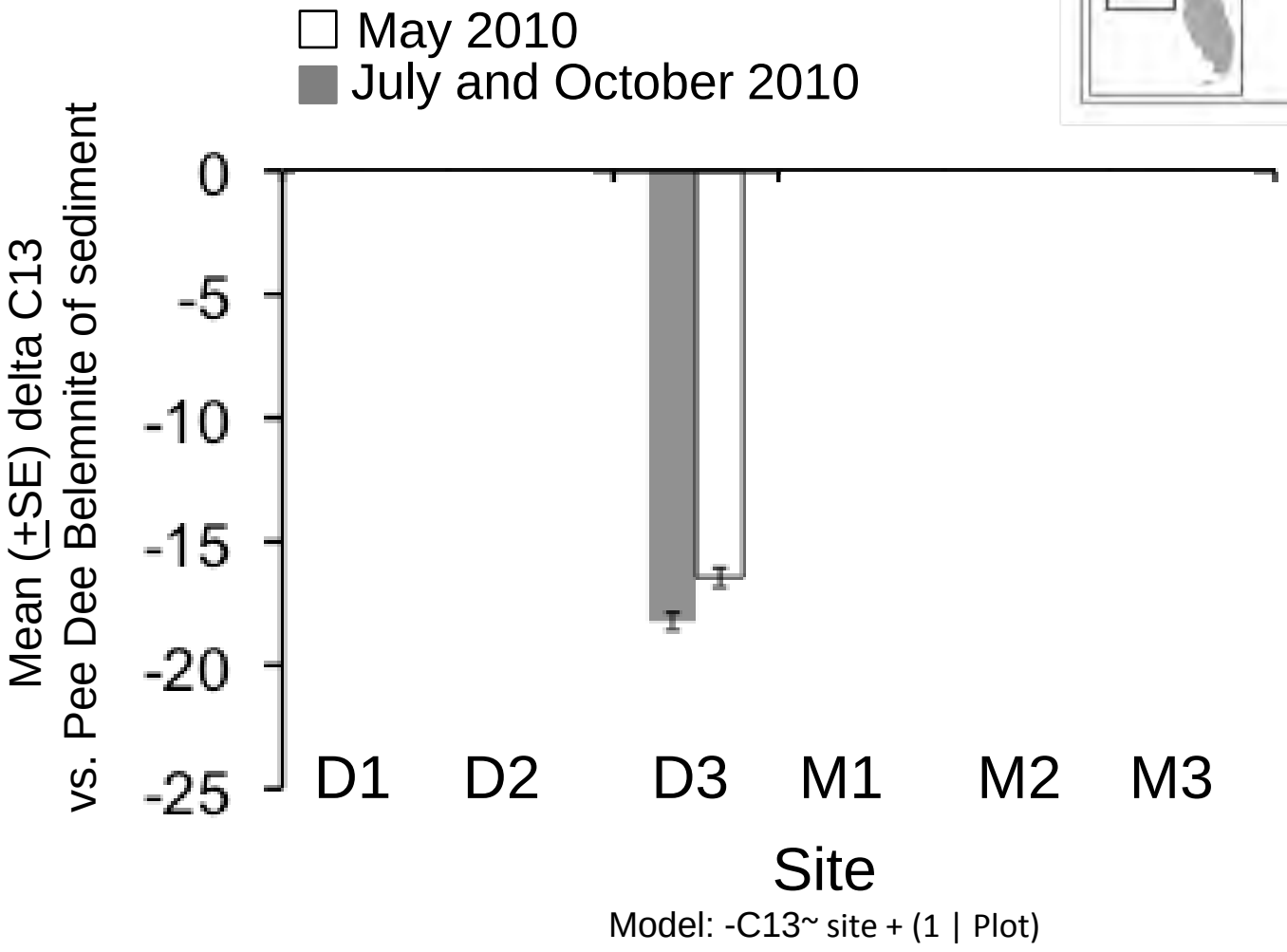
Model: Species.rich ~ diversity * site * time + (1 |Plot)

RANGE OF DIVERSITY VARIES ACROSS SITES

OBJECTIVE 1

CHANGES IN CARBON ISOTOPIC SIGNATURE OF MARSH SEDIMENTS ACROSS PANHANDLE & BIG BEND OF FLORIDA





Model: -C13~ site + (1 | Plot)

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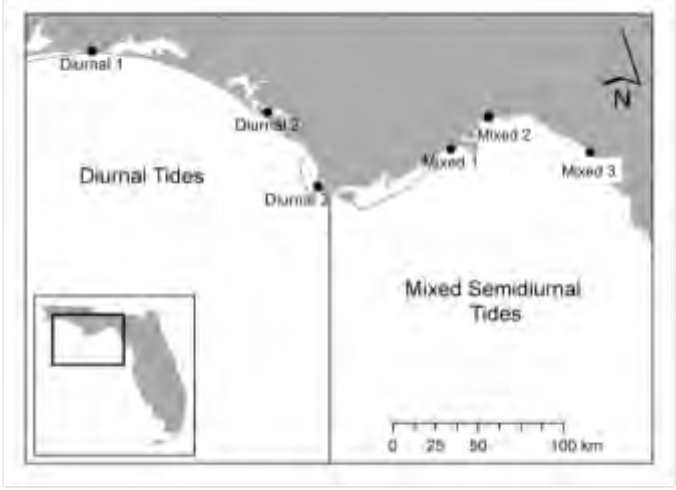
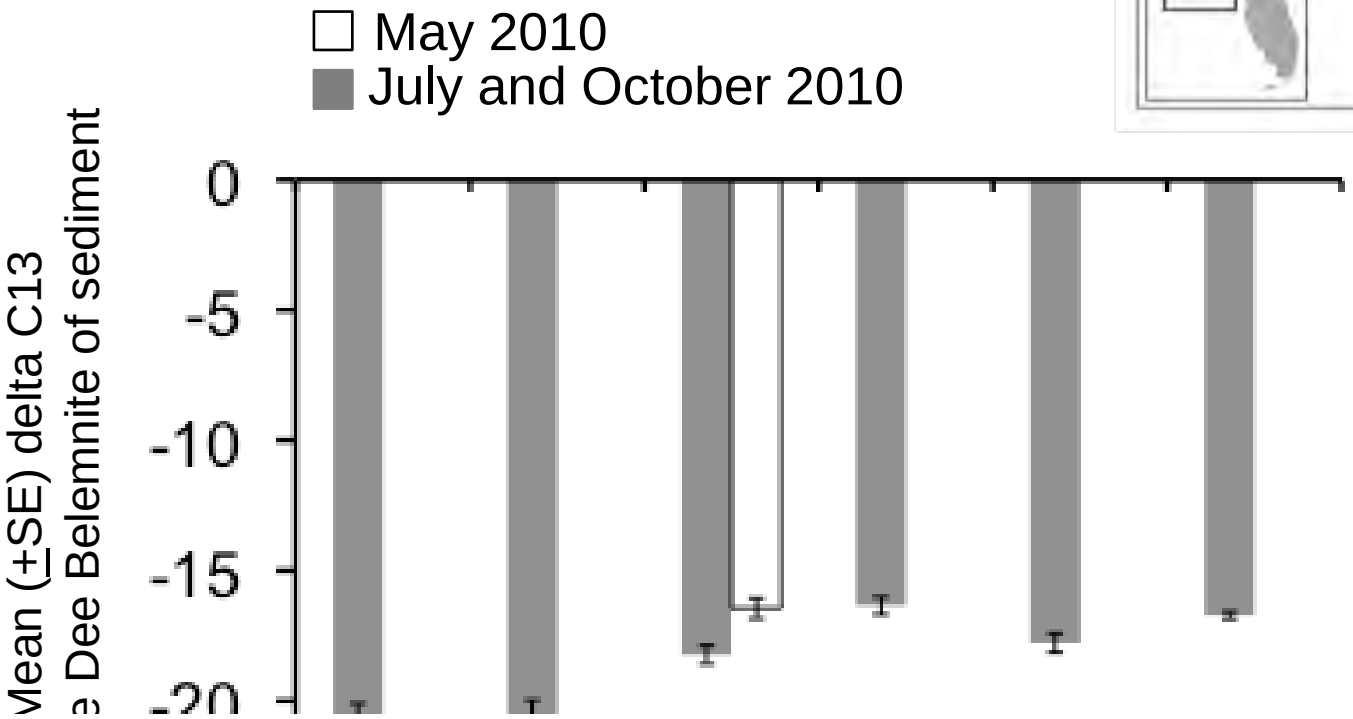
CHANGES IN CARBON ISOTOPIC SIGNATURE OF MARSH SEDIMENTS ACROSS PANHANDLE & BIG BEND OF FLORIDA

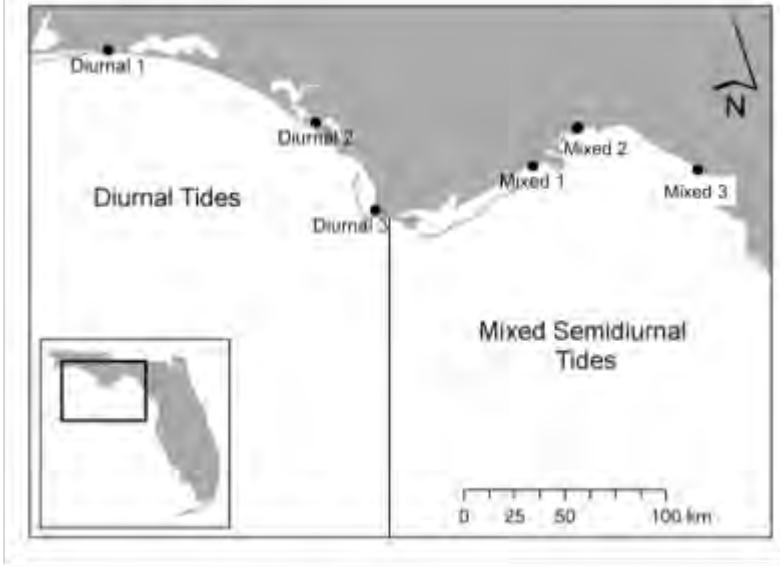




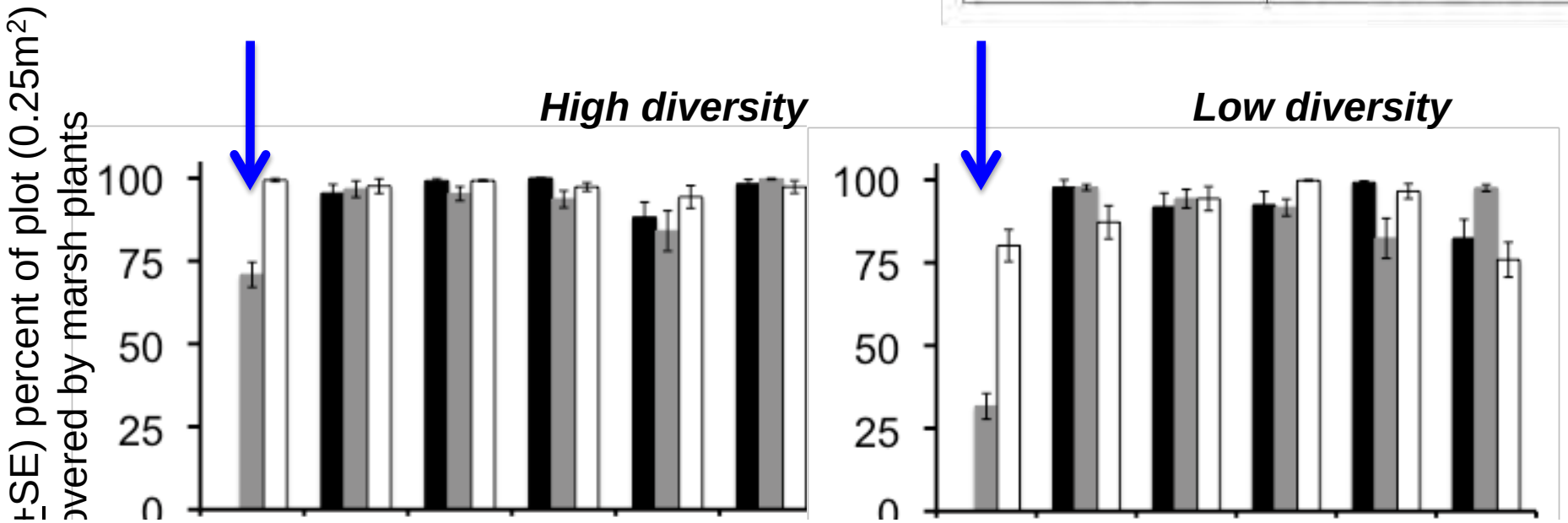
SIGNIFICANT CHANGE BETWEEN PRE- AND POST DWH

OBJECTIVE 1

DIVERSITY OF MARSH PLANTS IN PANHANDLE & BIG BEND OF FLORIDA



- JULY 2010
- OCTOBER 2010
- MARCH 2011

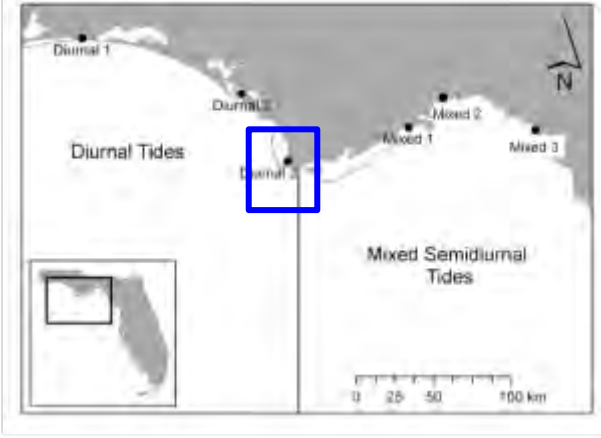


SUGGESTS POTENTIAL DIVERSITY-RESISTANCE EFFECT

OBJECTIVE 2

DIVERSITY AND OIL-IMPACT EXPERIMENT (JULY 2010-ONGOING)

Percent cover of marsh quantified seasonally



5 Monoculture treatments (n =5)

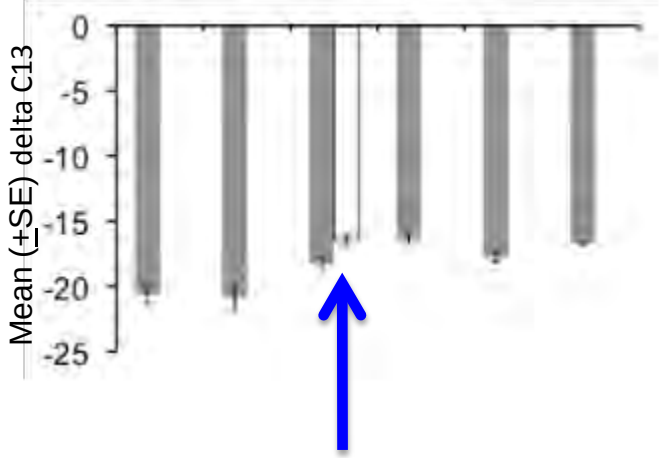
JUNCUS **ONLY**

SPARTINA **ONLY**

POLYCULTURE 5 TREATMENTS N=5

OBJECTIVE 2

DIVERSITY AND OIL-IMPACT EXPERIMENT (JULY 2010-ONGOING)

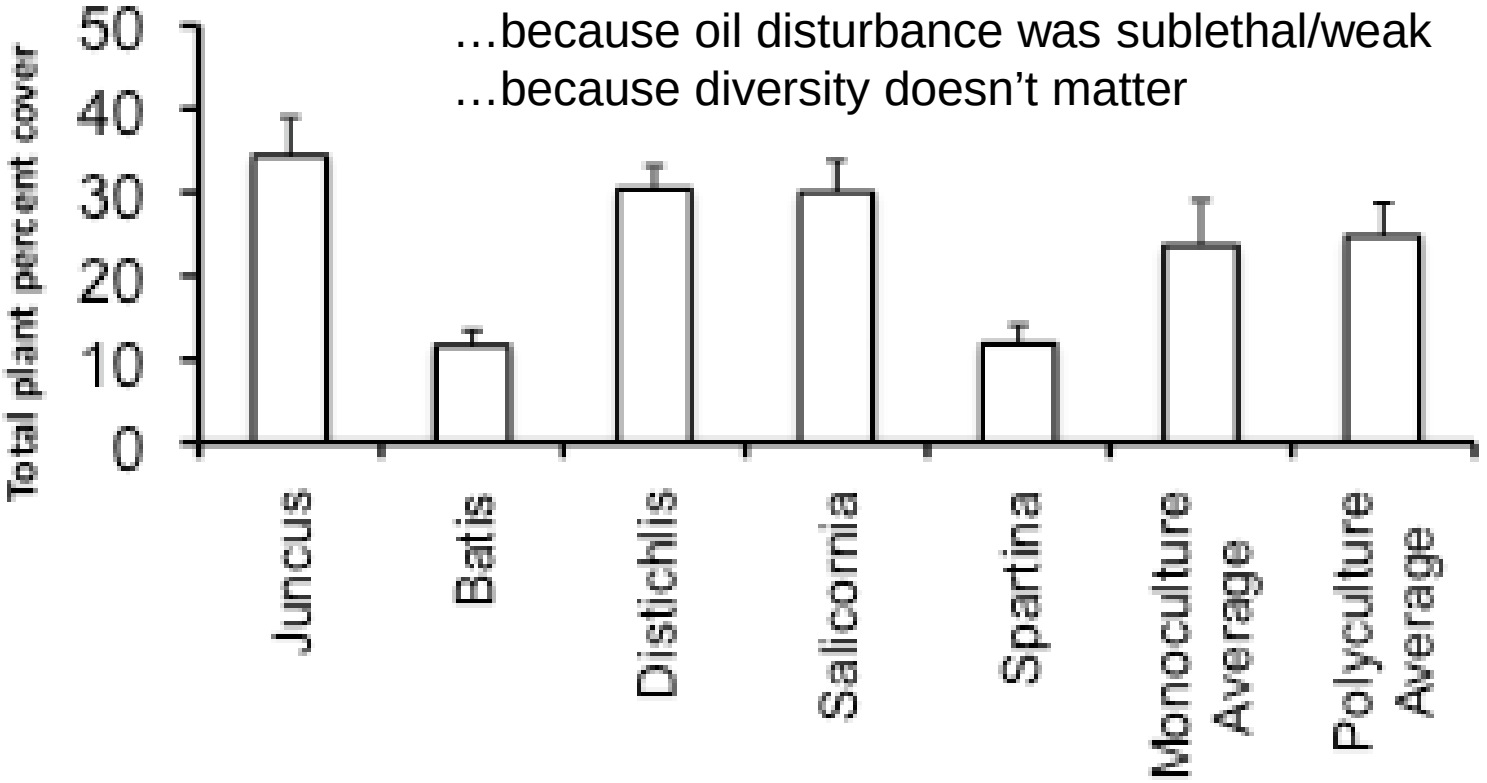


Diversity F = 0.14, P = 0.70

…because of no oil **X**

…because oil disturbance was sublethal/weak

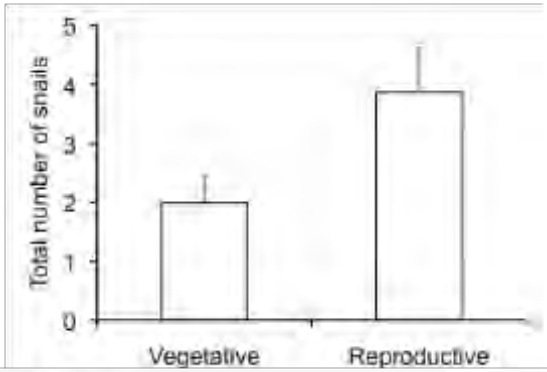
…because diversity doesn't matter



OBJECTIVE 3

NUTRIENT ADDITION & OVER-GRAZING OF MARSH

WHAT ABOUT OTHER FACTORS?



HOW DO PREDATION, PLANT HEIGHT, AND FERTILIZATION INTERACTIVELY IMPACT SNAIL BEHAVIOR?

OBJECTIVE 3 EXPERIMENT

Plant Height (Tall/Short) X Nutrients (Present/Absent) X Predator (Present/Absent)

Focal tall

Focal same ht.

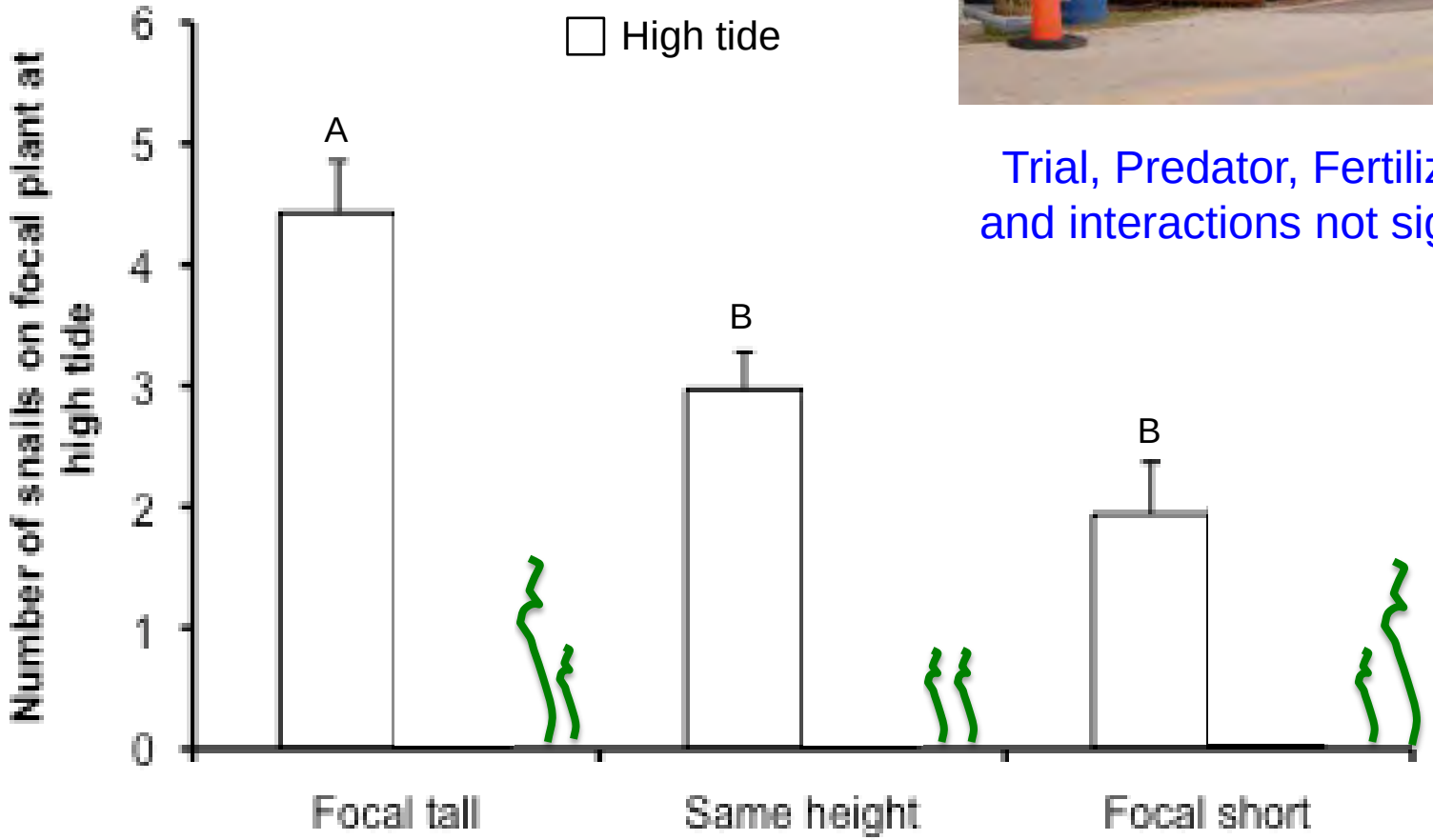
Focal short

Objective 3

Nutrient Addition & Snail Grazing Experiment

(July 2010-September 2010)

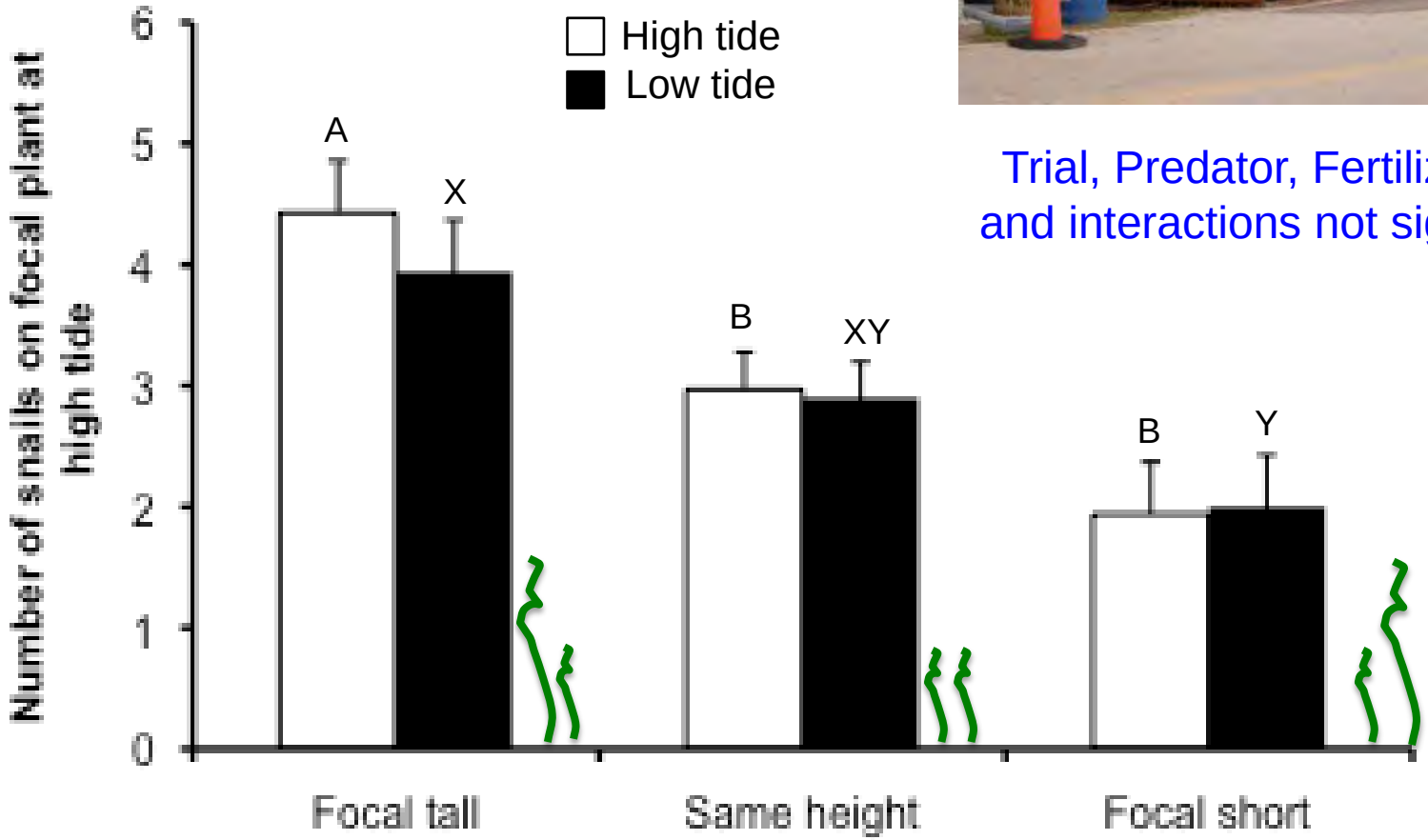
Trial, Predator, Fertilization, and interactions not significant



OBJECTIVE 3

NUTRIENT ADDITION & SNAIL GRAZING EXPERIMENT

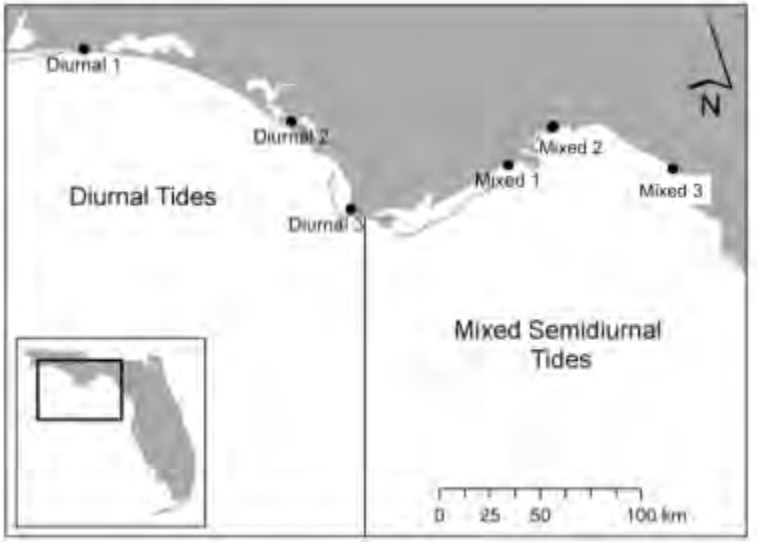
(JULY 2010-SEPTEMBER 2010)



Trial, Predator, Fertilization, and interactions not significant

PLANT HEIGHT ATTRACTS SNAILS MORE THAN DOES FERTILIZATION

CONCLUSIONS



(1) The range of plant species diversity varies across the Panhandle and Big Bend

(2) The stable isotopic signature (C13) of marsh sediments suggests DwH oil may have reached Panhandle marshes

(3) Surveys suggest more diverse marshes may have reduced the impact of DwH oil on marsh loss (percent cover)

(4) But an experiment produced no evidence that diversity reduced the impact of oil

(5) The degree to which targeted nutrient additions increase snail grazing on marsh plants may be minimized by plant height and the threat of predation

Acknowledgements

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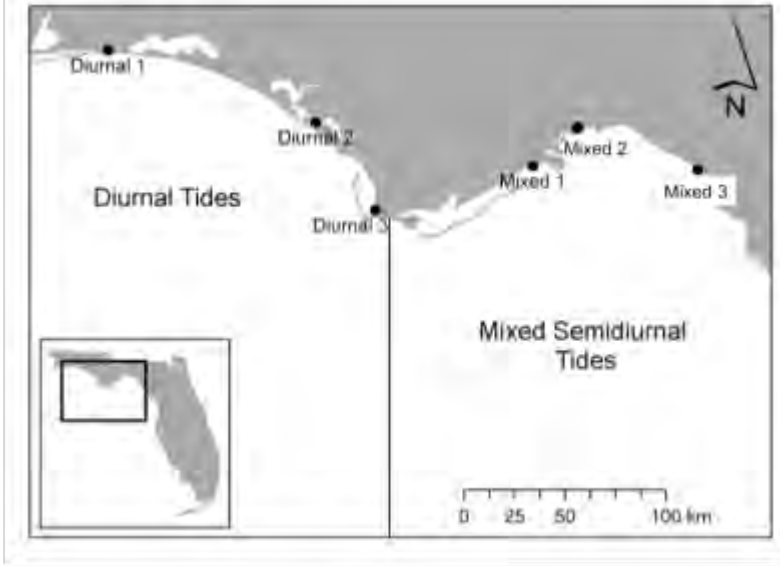
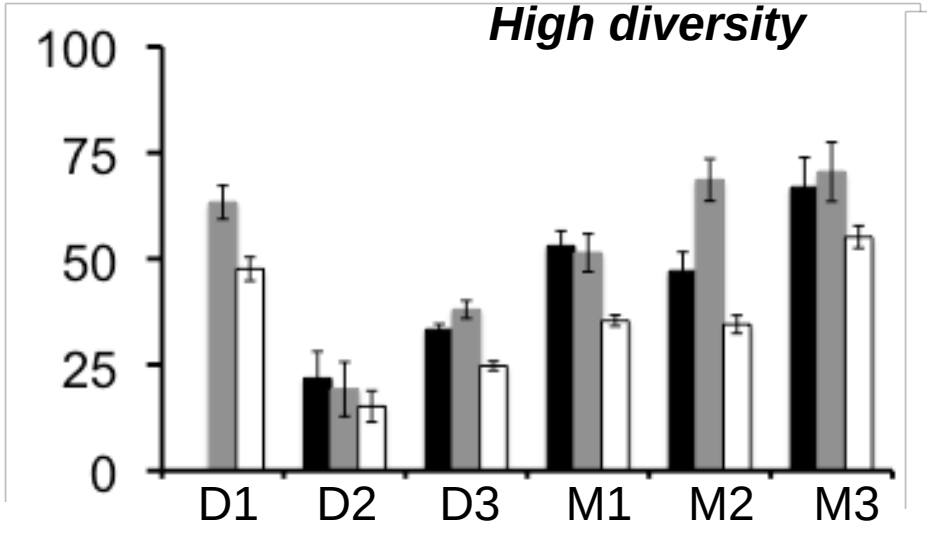
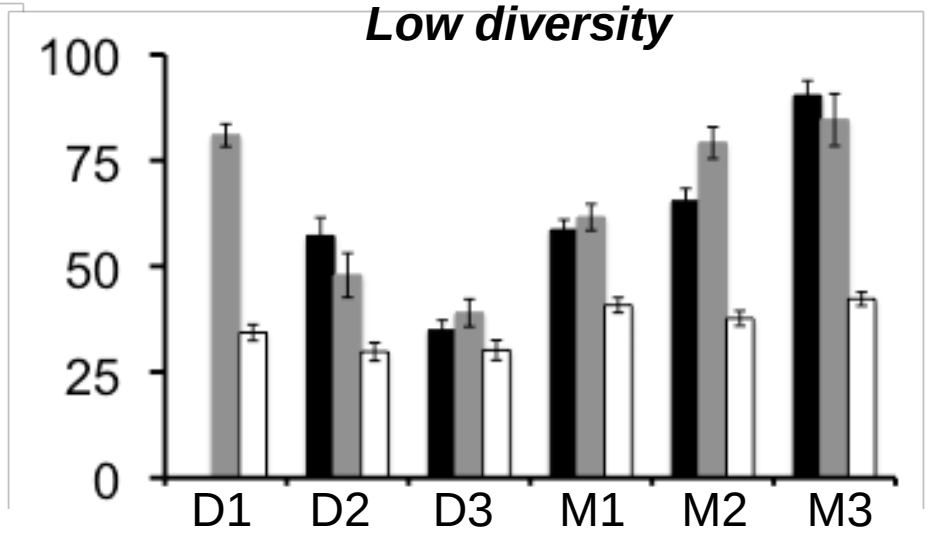
Liz Hibner, Robyn Zerbecki, Emily Field

High Spatial and Temporal Variation in Height of *Spartina*



- July 2010
- October 2010
- March 2011





Best Mixed Model: avg.ht ~ diversity * overall.site * month.post.oil + (1 | Plot)

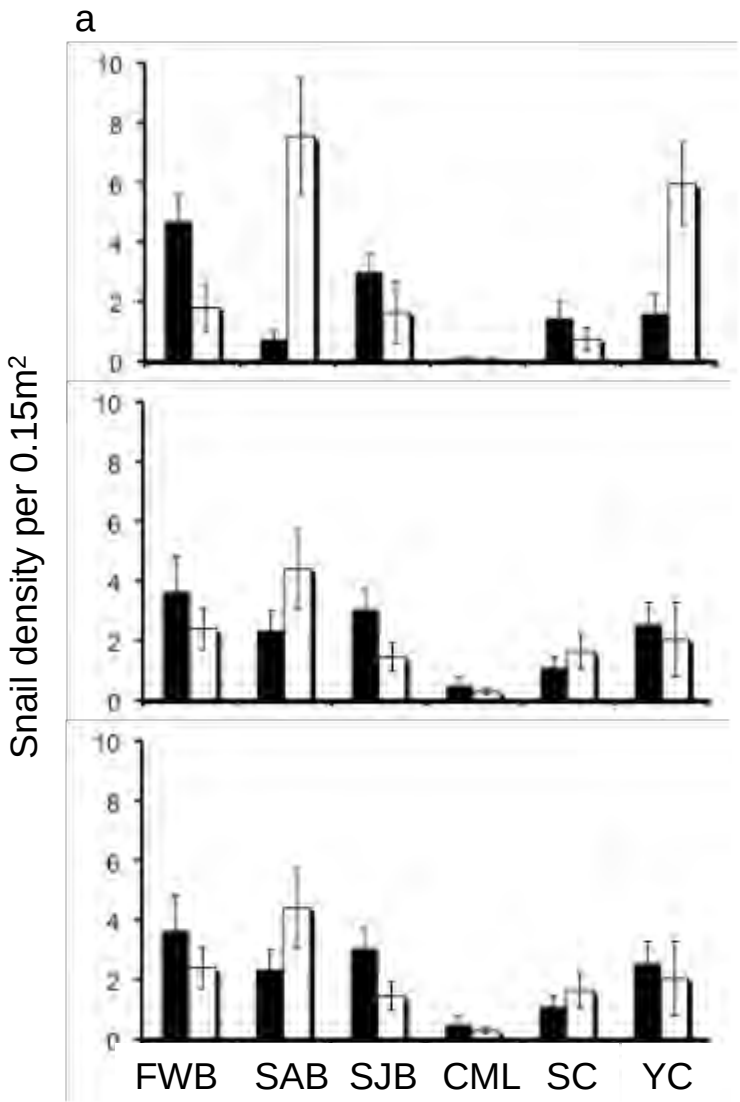
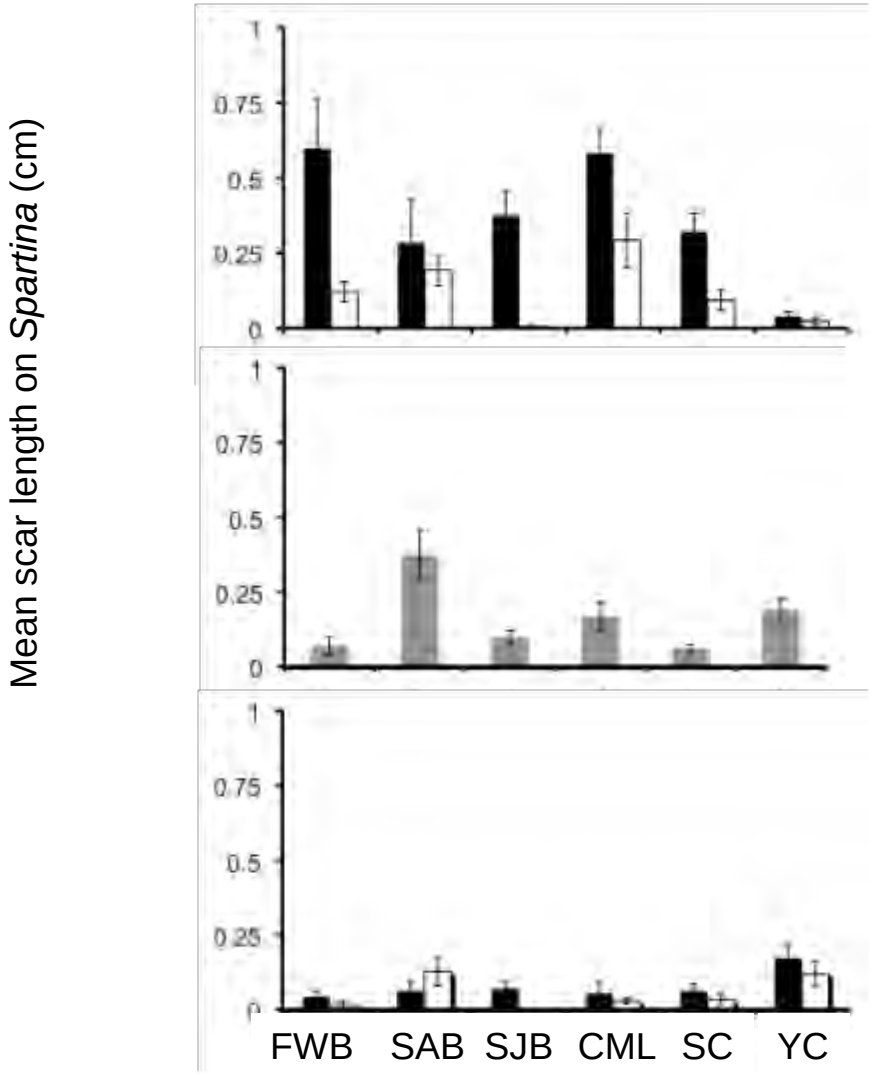


Figure 6. Mean density of snails in (a) July 2010 and (b) October 2010, and (c) March 2011. Snail density varied by plant diversity and site in July. Black bars are diverse blocks; open bars are *Spartina*-dominated blocks.

Figure 7. Mean scar length caused by snail grazing in July 2010. Scar intensity varied by plant diversity and site. Black bars are diverse blocks; open bars are *Spartina*-dominated blocks.



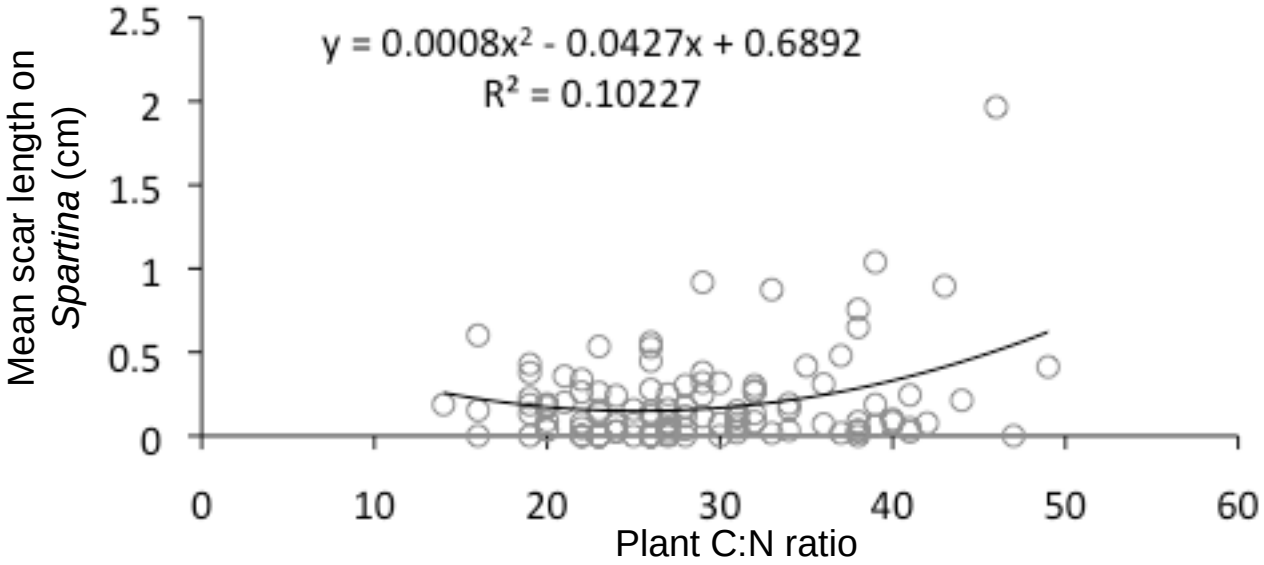


Figure 8. Relationship between *Spartina* carbon:nitrogen ratio and mean scar length caused by snail grazing in October 2010.

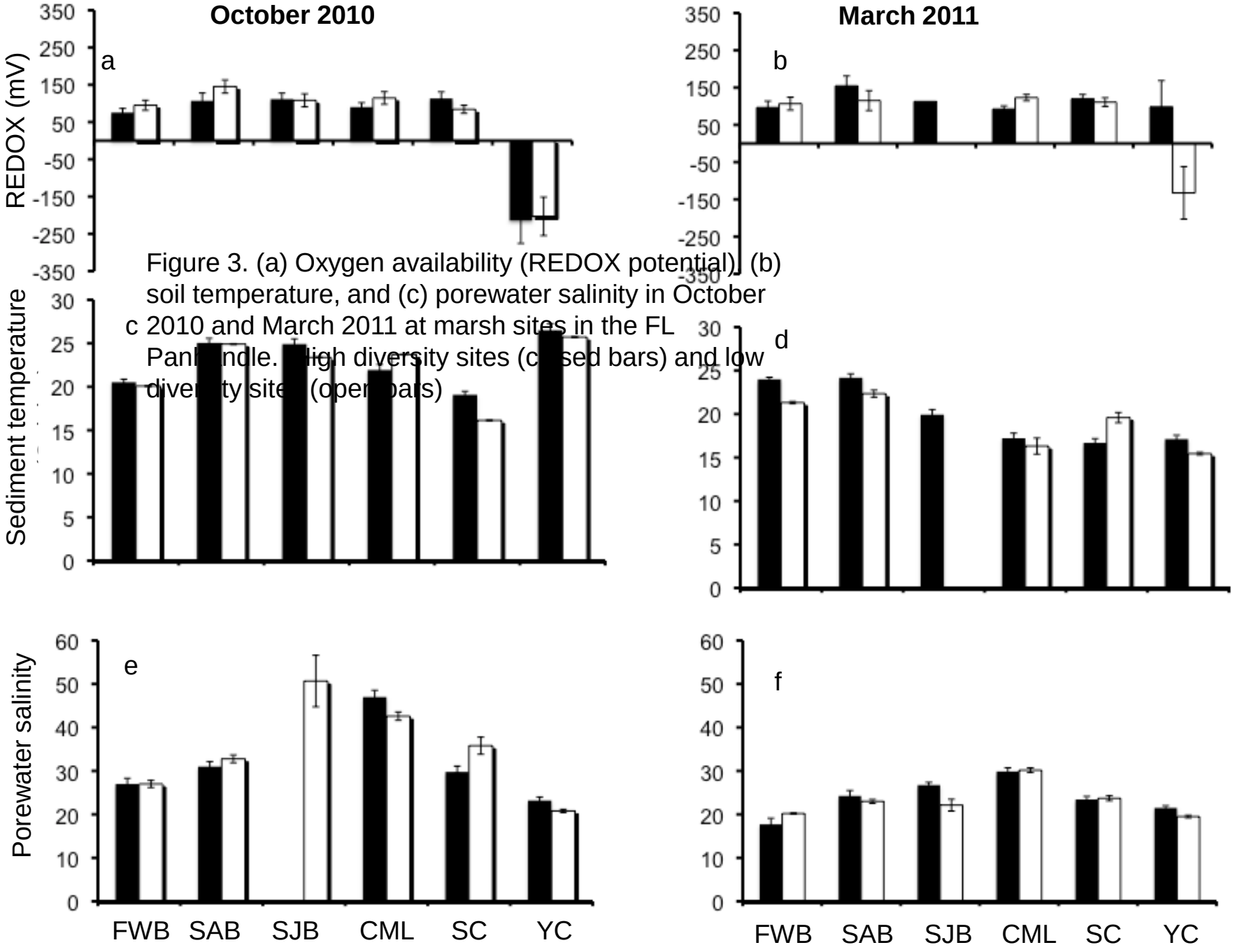


Figure 3. (a) Oxygen availability (REDOX potential), (b) soil temperature, and (c) porewater salinity in October 2010 and March 2011 at marsh sites in the FL Panhandle. High diversity sites (closed bars) and low diversity sites (open bars)