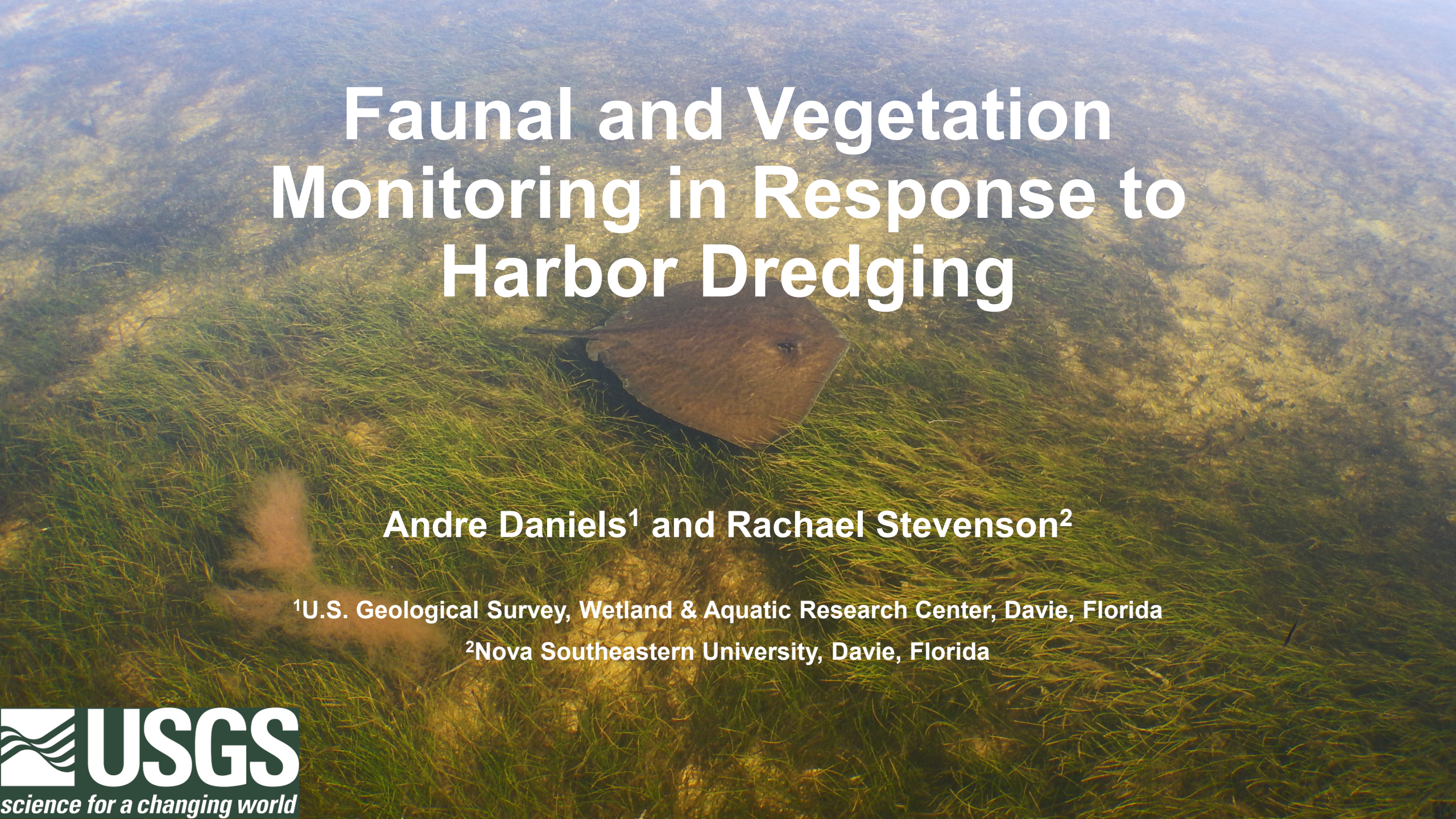


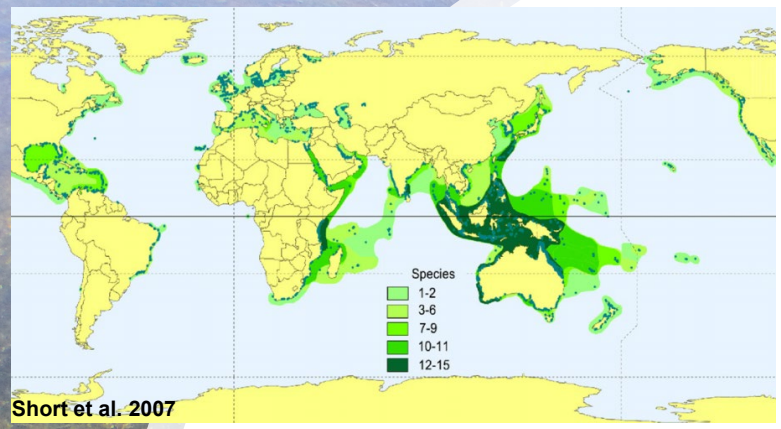
Faunal and Vegetation Monitoring in Response to Harbor Dredging

Andre Daniels[1] and Rachael Stevenson[2]

[1]U.S. Geological Survey, Wetland & Aquatic Research Center, Davie, Florida

[2]Nova Southeastern University, Davie, Florida

USGS
science for a changing world



Short et al. 2007

High primary productivity

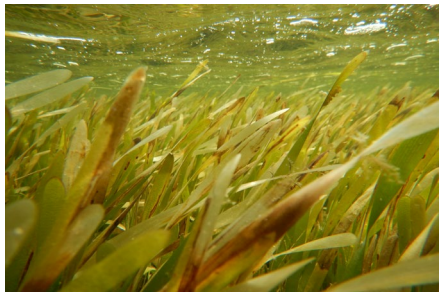

Scuba Diver Life

Supports diverse food webs

Provides nursery habitats


U.S. Fish and Wildlife Service

Maintains water quality



Sustains ecological marine resources


SeaSquared Charters

U.S. Army Corps of Engineers

Base Contract	Option A	Option B
Widen seaward portion of Cut-1 from 500 to 800 feet; deepen Cut-1 and Cut-2 from 44 to 52 feet; reef and seagrass mitigation area construction.	Cut 3 station 0 to Cut 3 station 12 and Fisherman's Channel Station 17 to Lummus Island Turning Basin end; deepen from 42 to 50 feet	Cut 3 station 12 to Fisherman's Channel station 17; Local sponsor berthing areas F.C. station 8 to 17; deepen from 42 to 50 feet

Port of Miami Deep Dredge Project

Faunal and Vegetation Monitoring in Response to Harbor Dredging (FMHD)

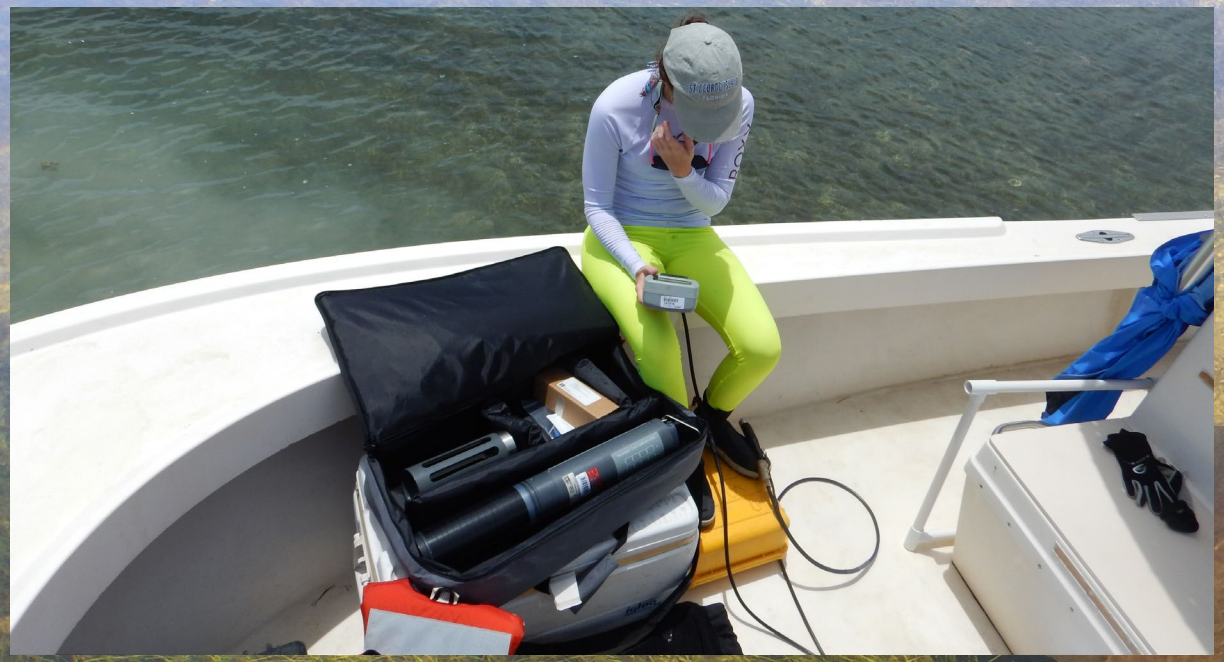
Designed to evaluate the effects of dredging in the Port of Miami by monitoring benthic vegetation, associated faunal communities, and environmental conditions between 2014-2016

Sampling Locations

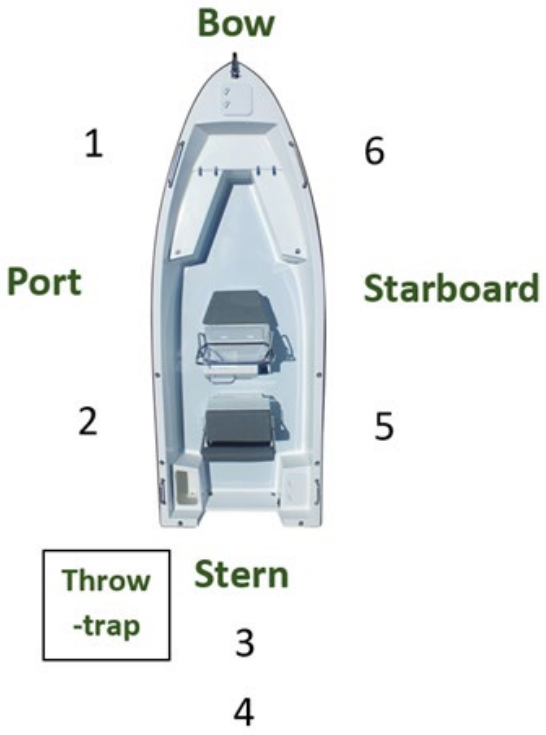
Port of Miami (POM) served as the affected basin while North Biscayne Bay (NBB) served as the control basin

Utilized a sampling grid of 30, equal-sized hexagonal cells

Sites were sampled biannually at the end of the dry and wet seasons, April and September, from 2014-2016



Environmental Sampling

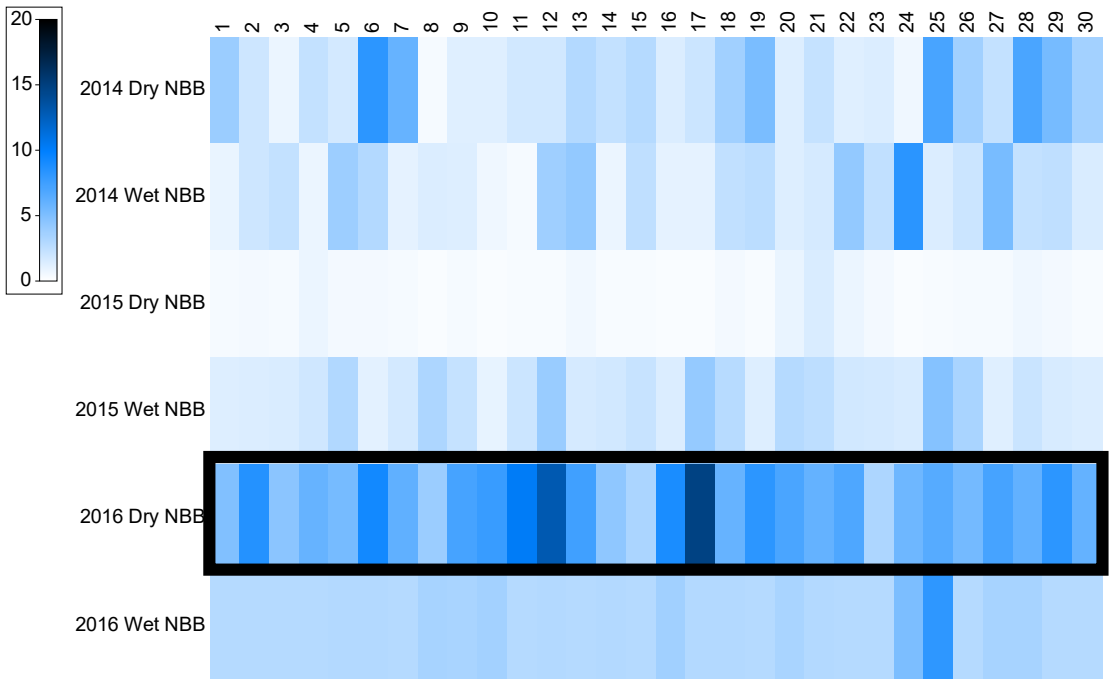


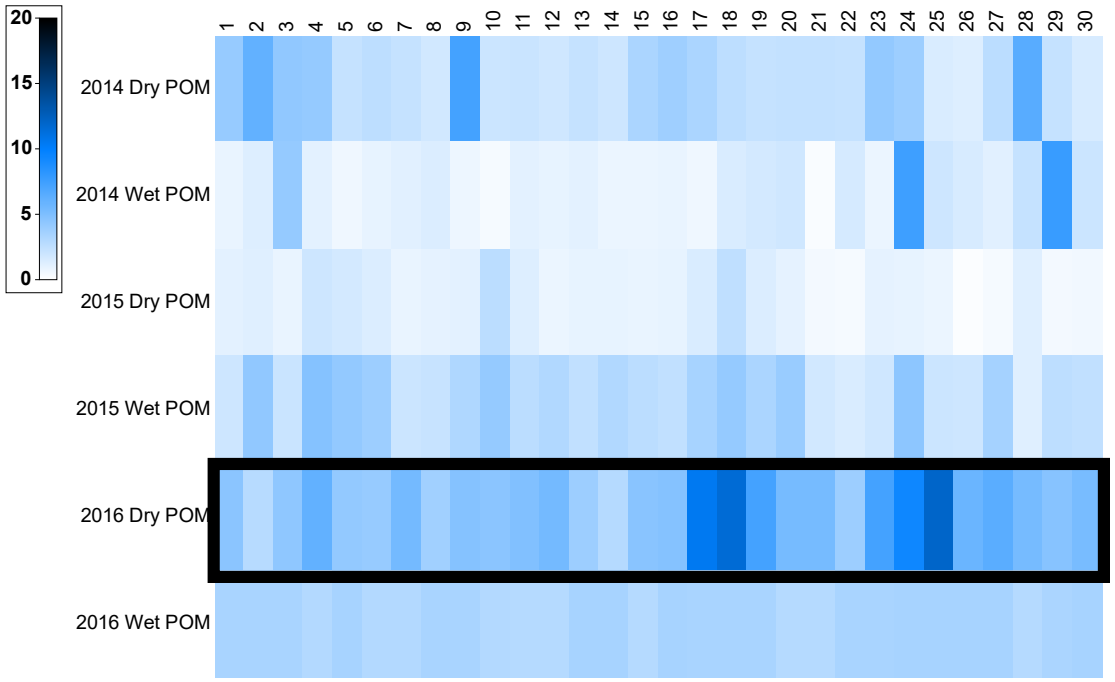
Density	*Description*
0	Absent or no measurable cover
0.1	Solitary shoot with small cover
0.5	Few shoots, but with < 5% cover
1	Numerous shoots, less than 5% cover
2	Any number of shoots but with 5% to 25% cover
3	Any number of shoots but with 25% to 50% cover
4	Any number of shoots but with 50% to 75% cover
5	Any number of shoots but with > 75% cover

Vegetation Sampling

Faunal Sampling

Turbidity

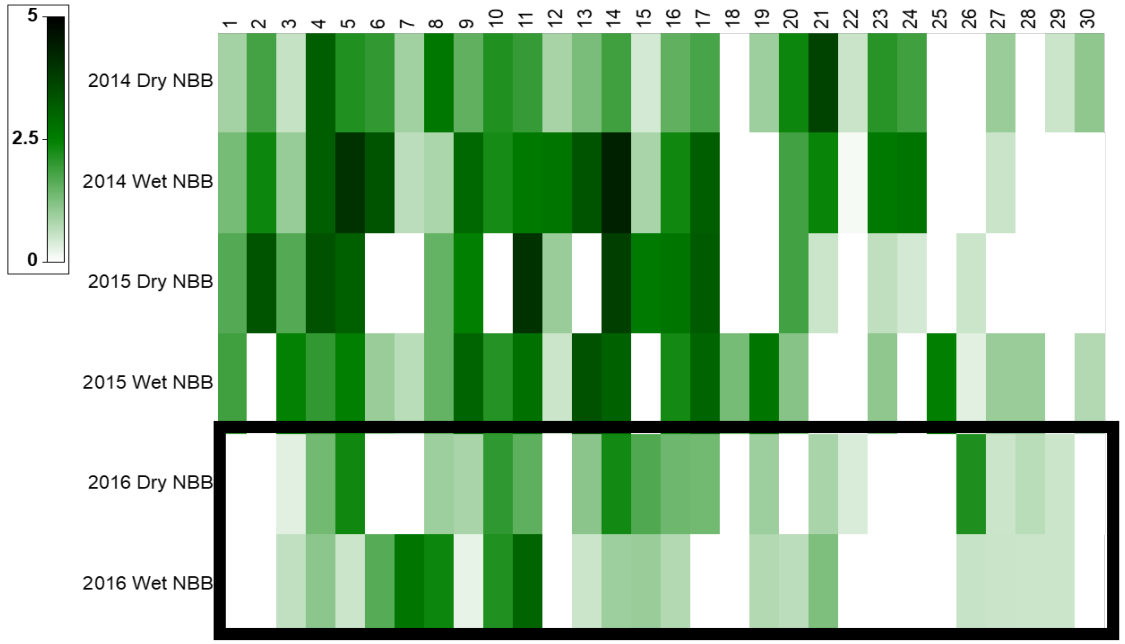


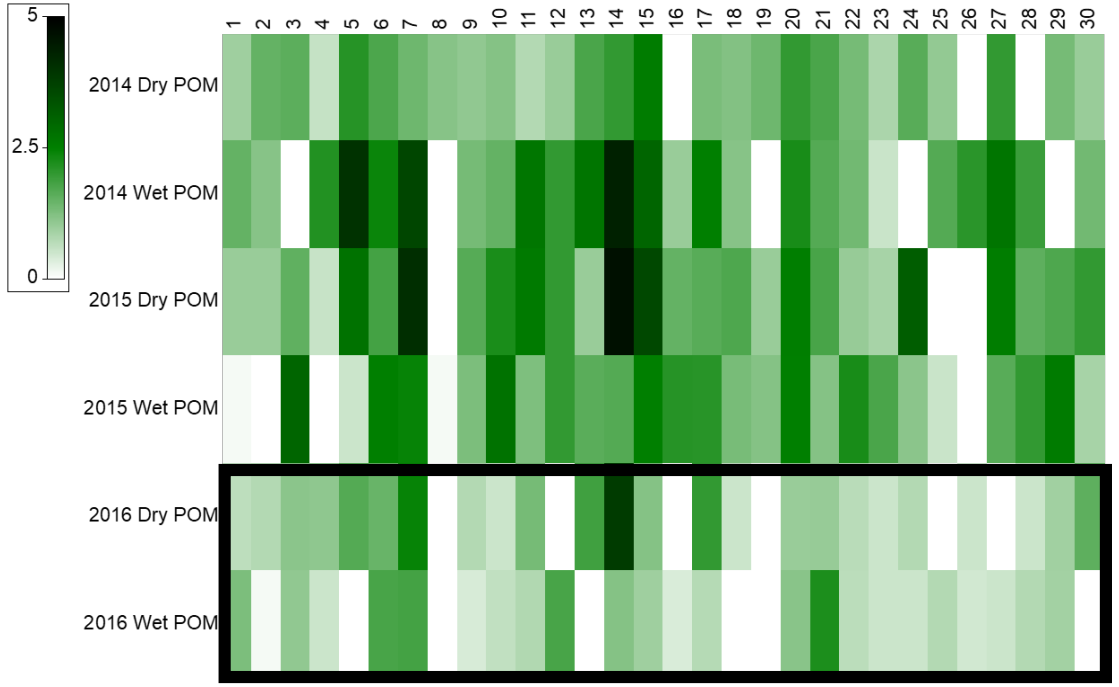


Significant increases in turbidity (NTU) occurred between 2014-2016 and 2015-2016 ($p<0.01$) at NBB and POM

Highest peak turbidity in NBB and POM occurred during the 2016 dry season, directly succeeding dredging

Seagrass Density

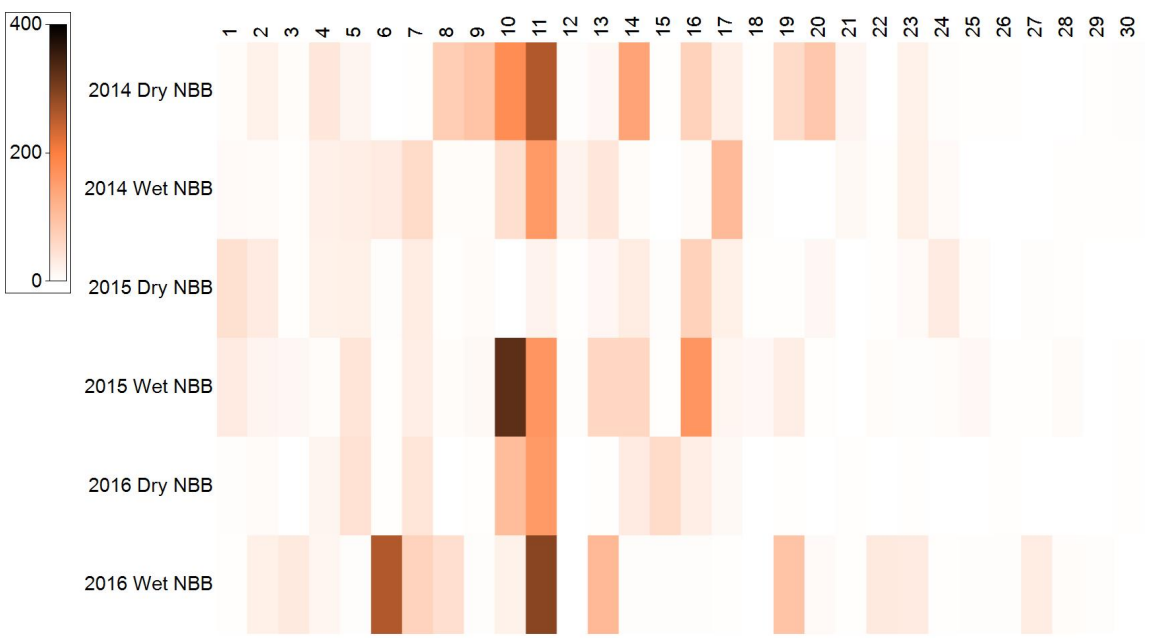


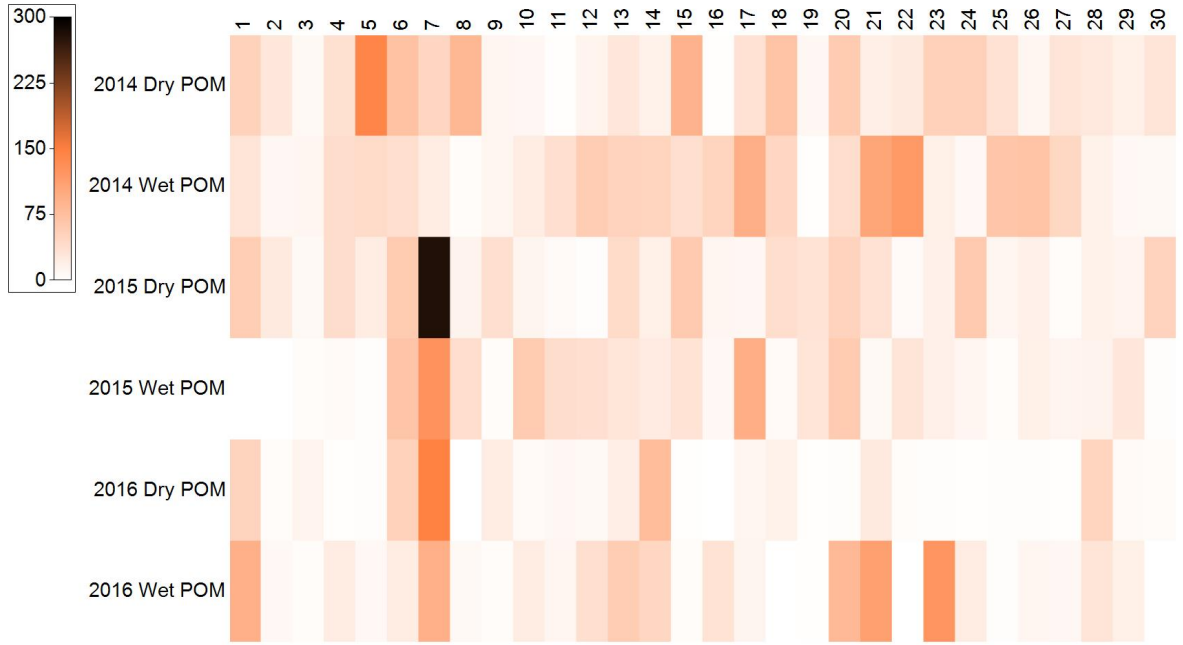


Seagrass density was negatively correlated with turbidity ($p<0.01$, $t=-0.2076391$)

Subsequent significant decreases in seagrass density between 2014-2016 ($p<0.01$) and 2015-2016 ($p<0.05$) in NBB and POM

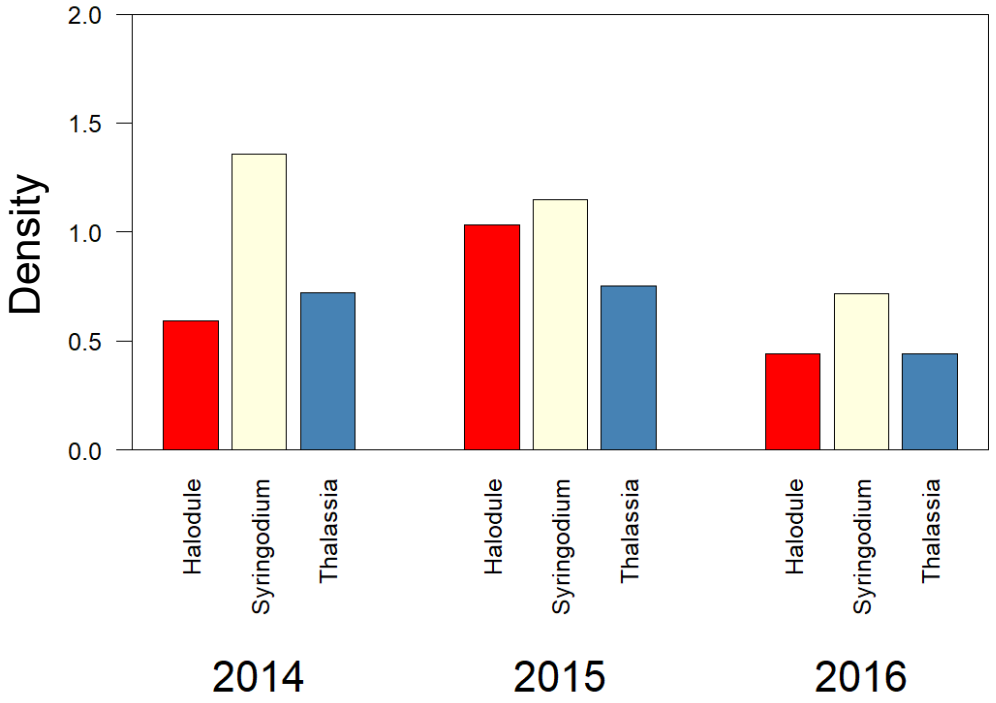
Faunal Abundance





NBB had significantly ($p<0.001$) less animals overall than POM

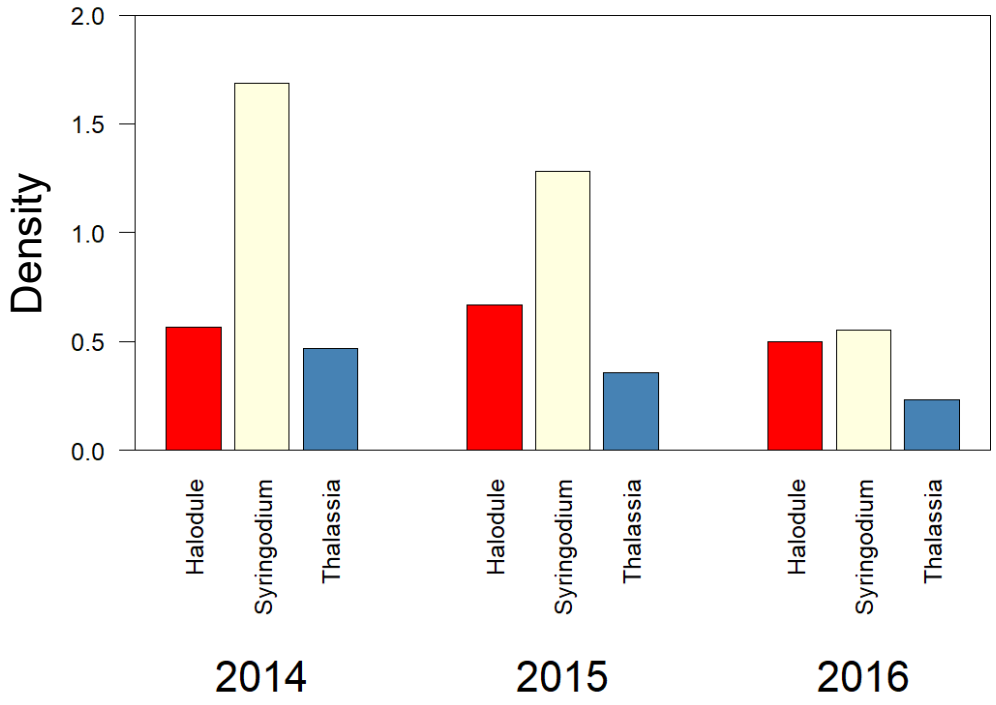
NBB and POM showed significant ($p<0.05$) decreases in caridean shrimp, penaeid shrimp, and fishes



Seagrass Community Shifts: NBB

In NBB, *Syringodium* accounted for 80% of the density loss by 2016

Combined, *Syringodium* and *Halodule* accounted for 95% density loss

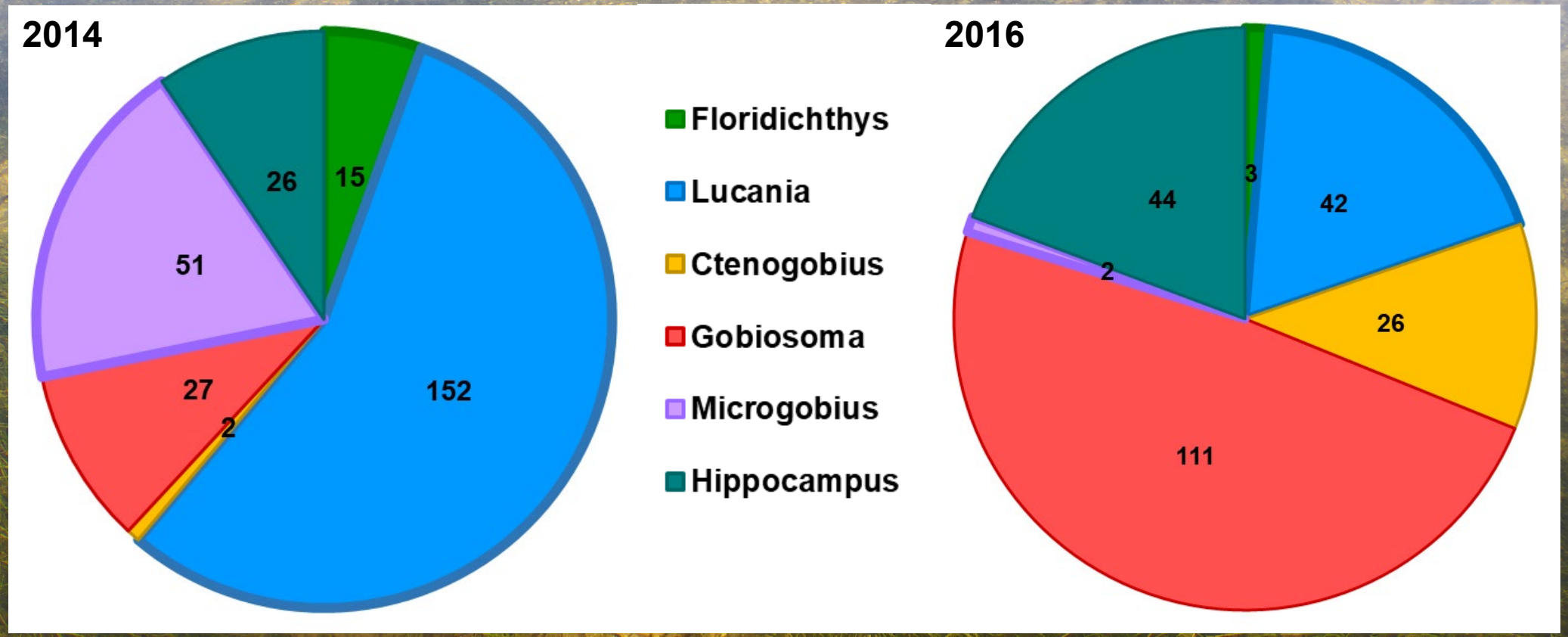


Seagrass Community Shifts: POM

In POM, *Syringodium* accounted for 70% of the density loss

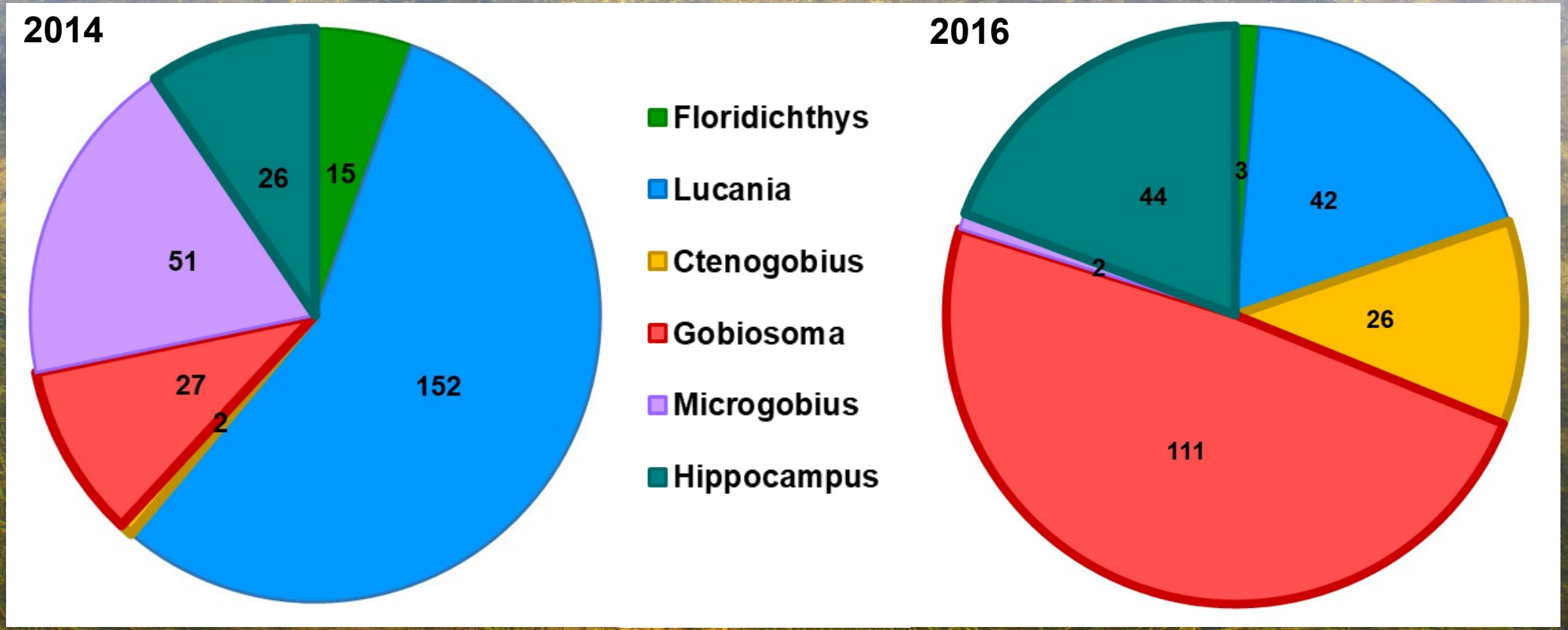
Combined with *Halodule*, accounted for 88%

Faunal Community Shifts (fishes): NBB



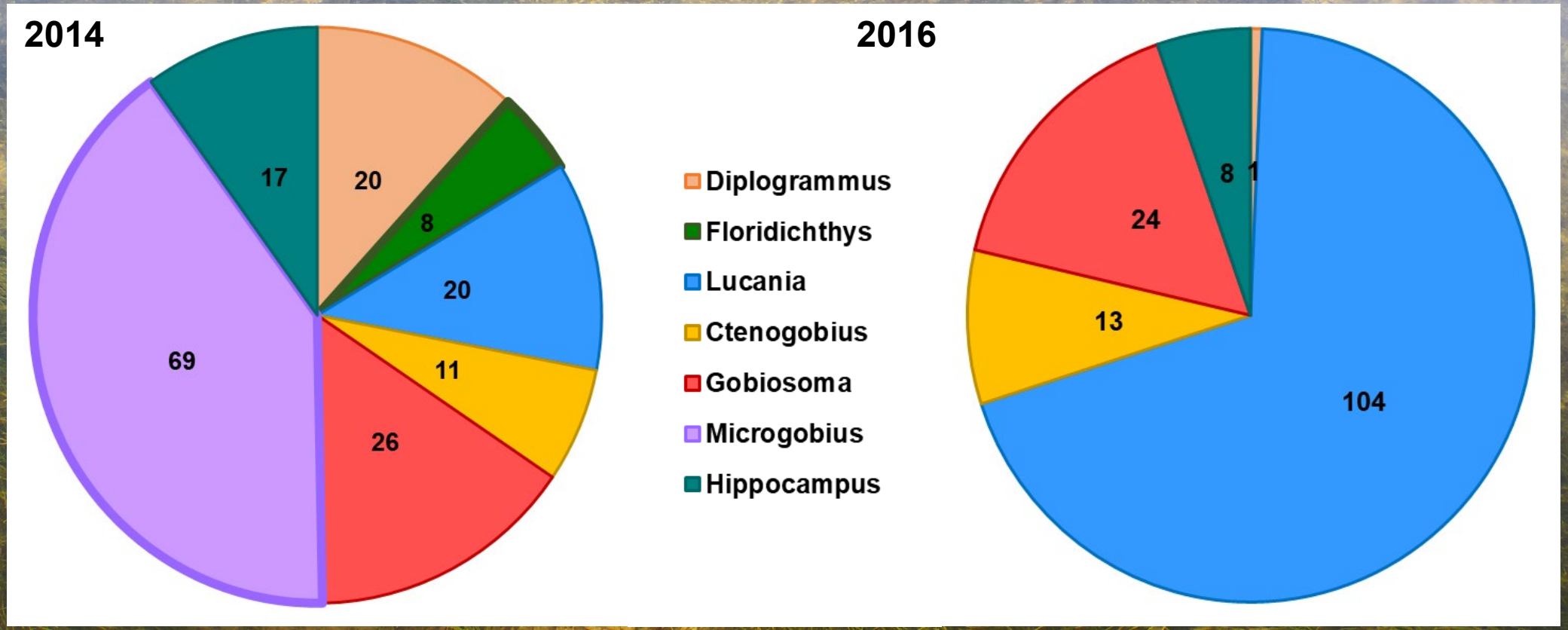
Populations of *Floridichthys* (pupfishes), *Lucania* (ray-finned killifishes), and *Microgobius* (gobies) decreased by 80, 72, and 96% from 2014-2016

Faunal Community Shifts (fishes): NBB



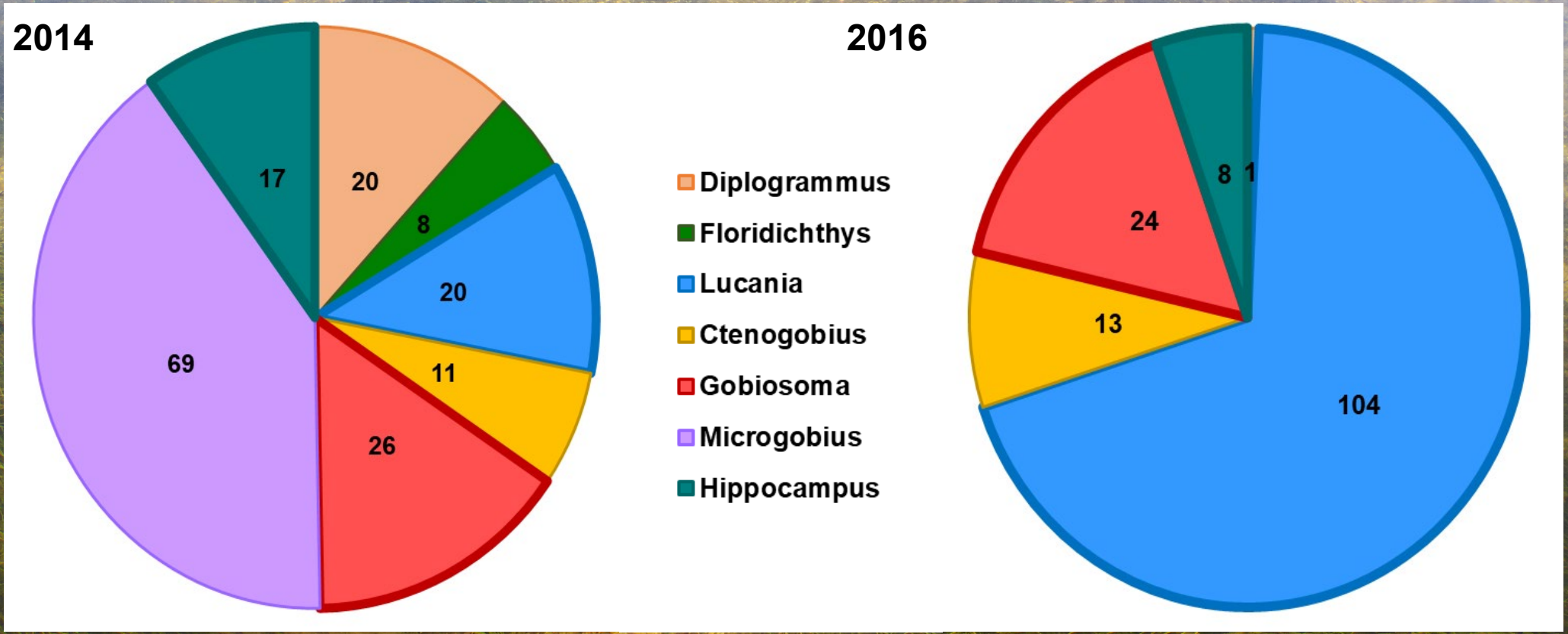
Ctenogobius, Gobiosoma **(gobies), and** ***Hippocampus*** **(pipefishes and seahorses) increased by 92, 76, and 43% throughout the project**

Faunal Community Shifts (fishes): POM



Floridichthys **and** ***Microgobius*** **substantially decreased and were no longer present in the study area by 2016**

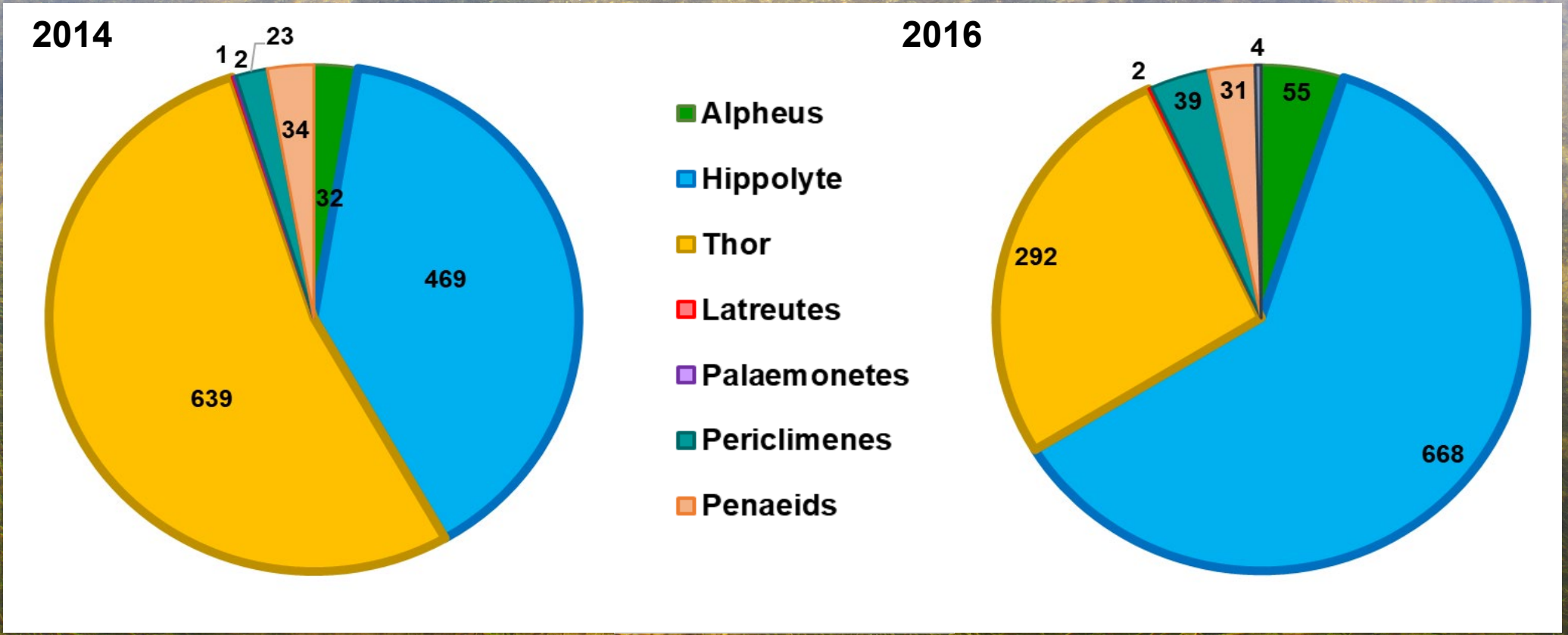
Faunal Community Shifts (fishes): POM



Populations of *Gobiosoma* and *Hippocampus* remained relatively stable

Lucania was the only genus with substantial population increases

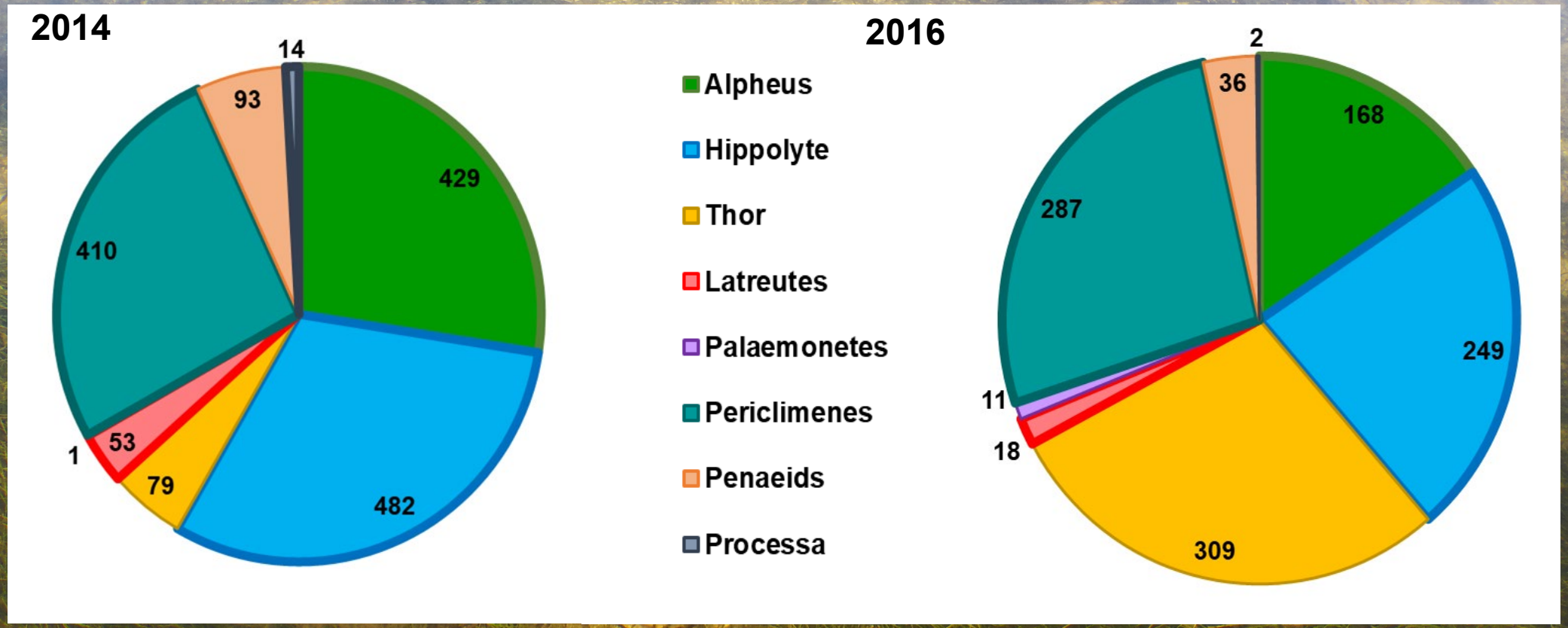
Faunal Community Shifts (shrimp): NBB



Large shift from *Thor* to *Hippolyte* (both members of Hippolytidae family) between 2014-2016

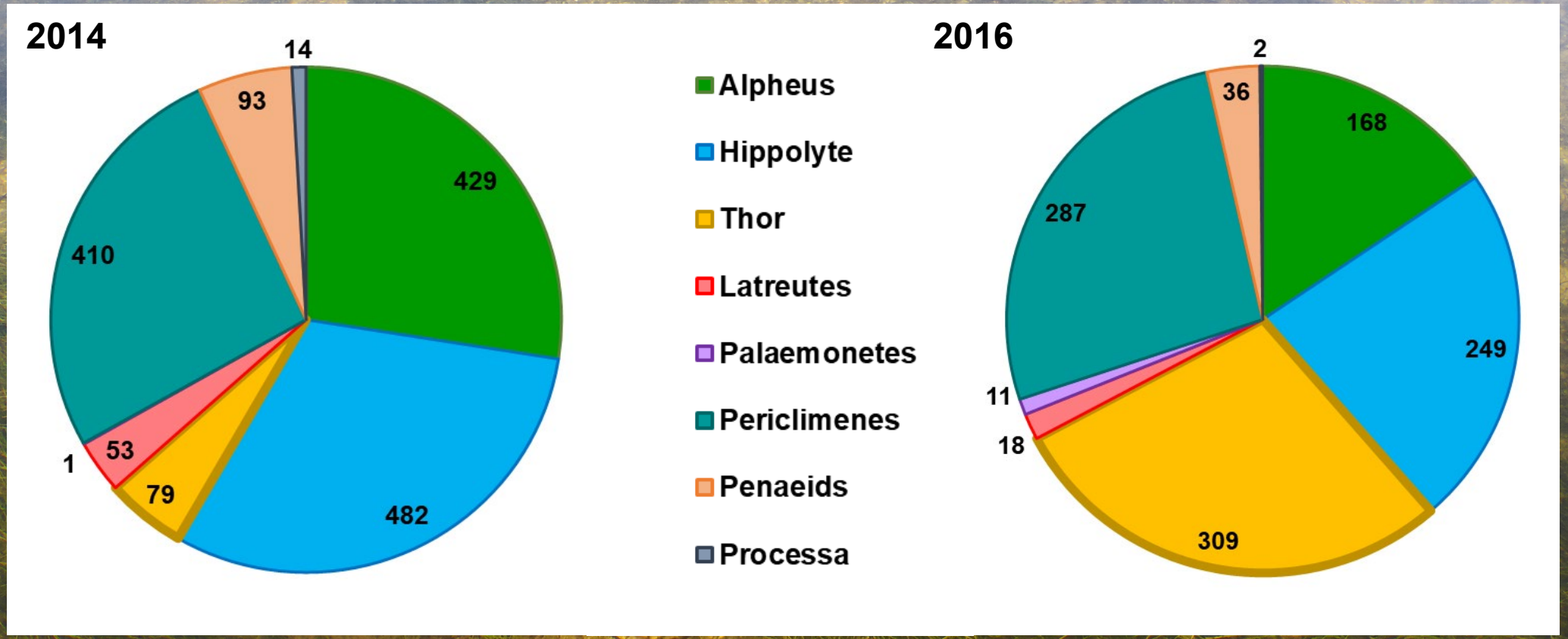
Thor populations decreased 46% by 2016

Faunal Community Shifts (shrimp): POM



Substantial decreases of 61, 48, 60, 30, and 86% occurred in *Alpheus*, *Hippolyte*, *Latreutes*, *Periclimenes*, and *Processa*

Faunal Community Shifts (shrimp): POM



Thor **was the only genus with an overall population increase of 74% between 2014-2016**

Aftermath

No collections beyond 2016

NBB experienced a separate seagrass die-off

NBB and POM suffered extensive environment-altering impacts, followed by severe impacts to South Florida by category 4 Hurricane Irma

Time

Conclusions

Was there a return-to-previous state after 2016?

Do some species show resilience to detrimental changes? Do lost species return to their environment after there is a return-to-previous state?

How long does it take for an ecosystem to rebound after anthropogenic impacts?

Integral to address long-term impacts to improve understanding of ecosystem function

Acknowledgements

Nova Southeastern University research students including Candace Grimes, Elizabeth Colhoun, David Roche, Emily Powell, Helena Fulmore, and Erin Smith

Howard Jelks, USGS; Brian Smith, Cherokee Nation Technologies; Matt Woodstock, Nova Southeastern University

Miami-Dade County Division of Environmental Resources Management (DERM)

All work was conducted under sampling permit SAL-14-1584-SR from Florida Fish and Wildlife Conservation Commission