Diet and Selectivity of the Purple Swamphen in South Florida

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Background

-Nonnative avian species in Florida

- Florida is heavily populated with nonnative avian species

- In 1992, there were 146 exotic avian species and by 2014, there are about 225

Background

-Potential Problems

- The degree to which the Purple Swamphen poses a threat to native fauna in Florida is currently unknown
- Competition
  - Aggression between Great Blue Herons and swamphens
  - Have preyed upon Black Swan eggs in Australia
  - Have been observed carrying a presumed Black-necked Stilt chick in Florida
- Altering vegetation structure and composition
  - Multiple nesting platforms
  - Large body size
- The threat largely depends on the degree of diet and habitat overlap with native species

Background
-Study Species

- Purple Swamphen (*Porphyrio porphyrio*)
- *Rallidae* family
  - secretive birds
- Closely related to
  - Purple Gallinule
  - Common Gallinule
  - American Coot

Background

-Study Species

- Large global range

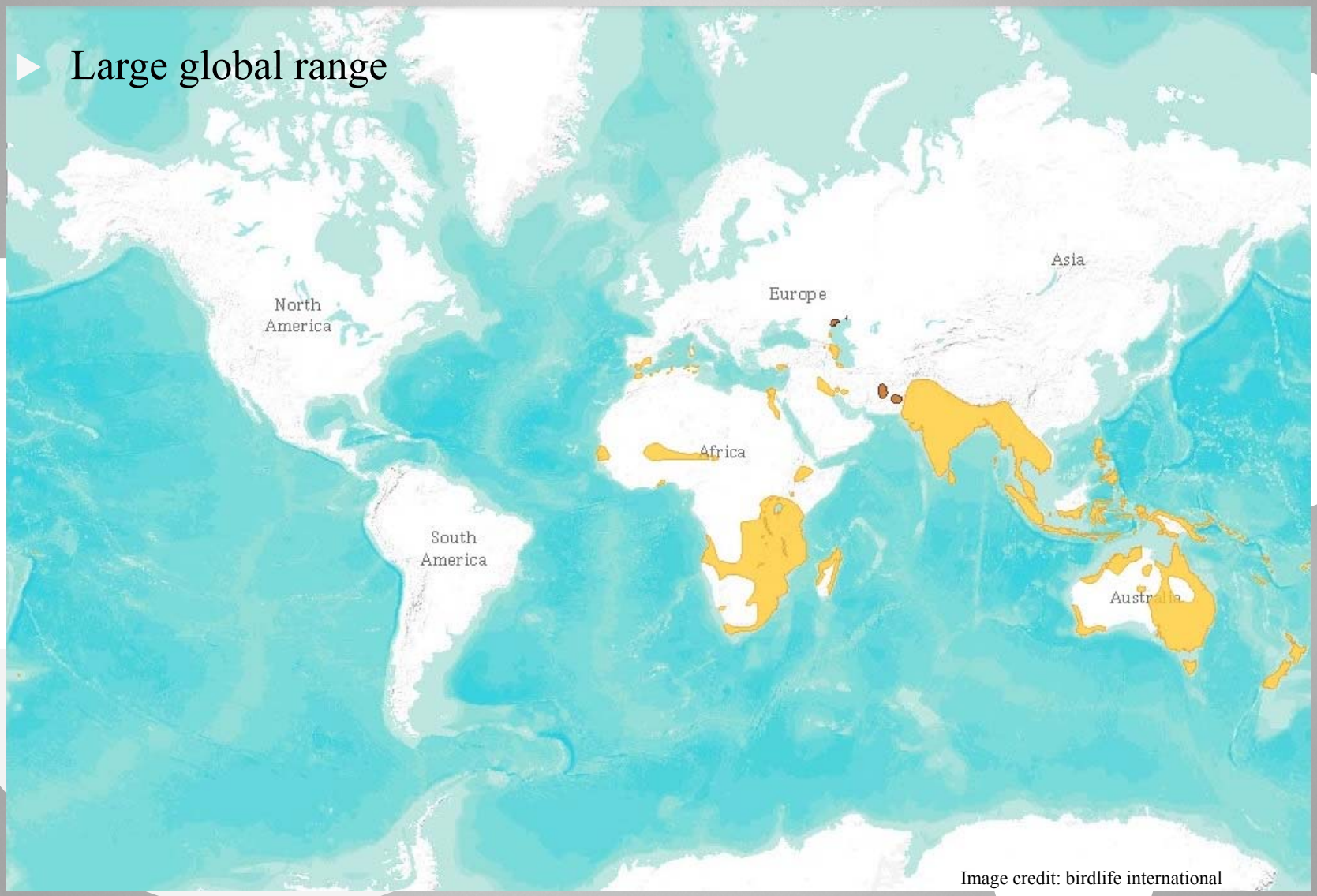


Image credit: birdlife international

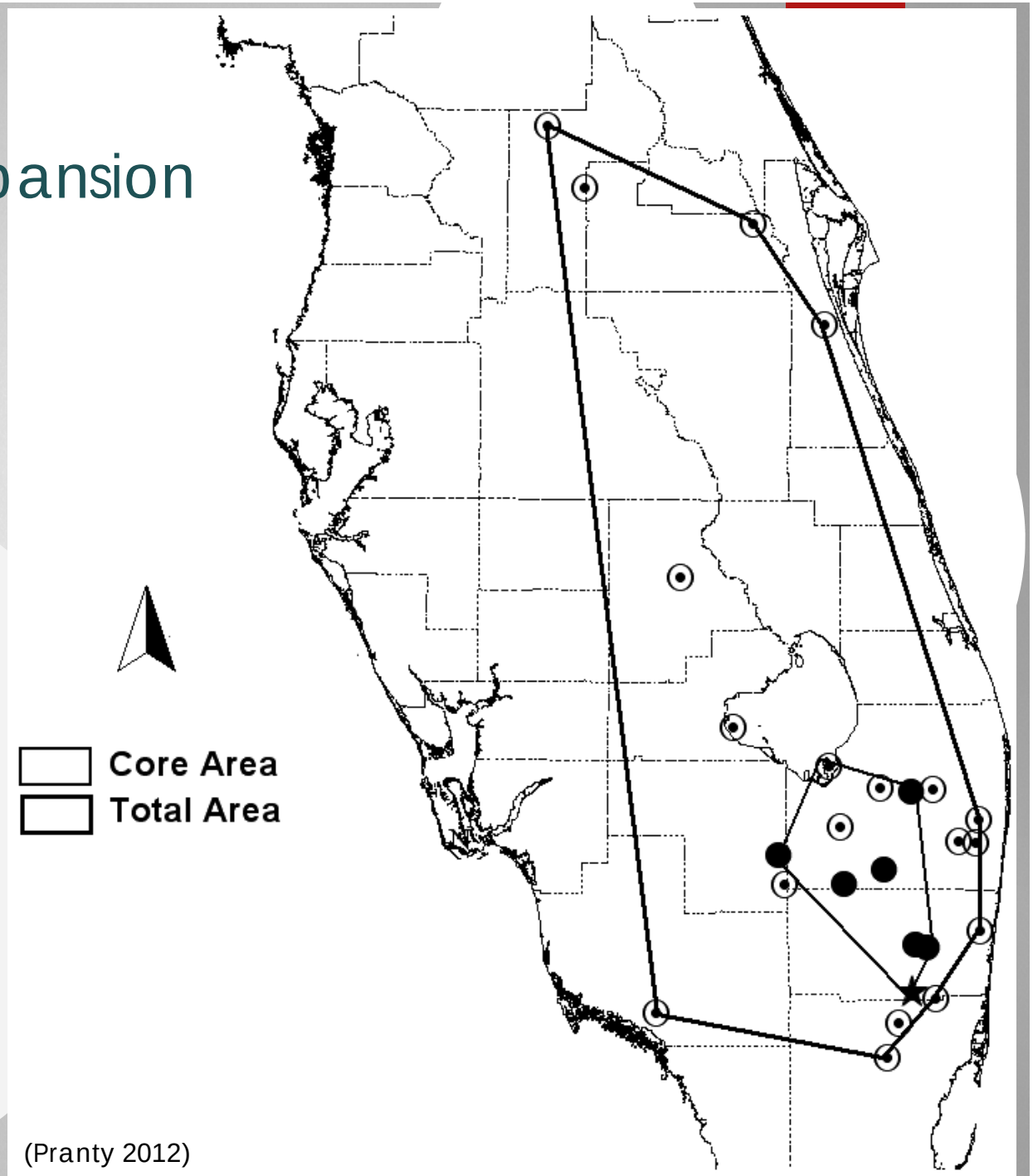
Background

-Introduction to Florida

- First discovered in South Florida in 1996
  - escaped from an aviculturist
- By 1999, 135 swamphens were counted in the vicinity of the initial discovery
- In Florida, chicks have been observed during all months except June, September, November, and December
- Swamphens can move more than 300 km to colonize new habitats
- In October 2006, an eradication program was attempted
  - over 3,100 swamphens were culled

Background

-Population expansion



(Pranty 2012)

Background

-Current diet information

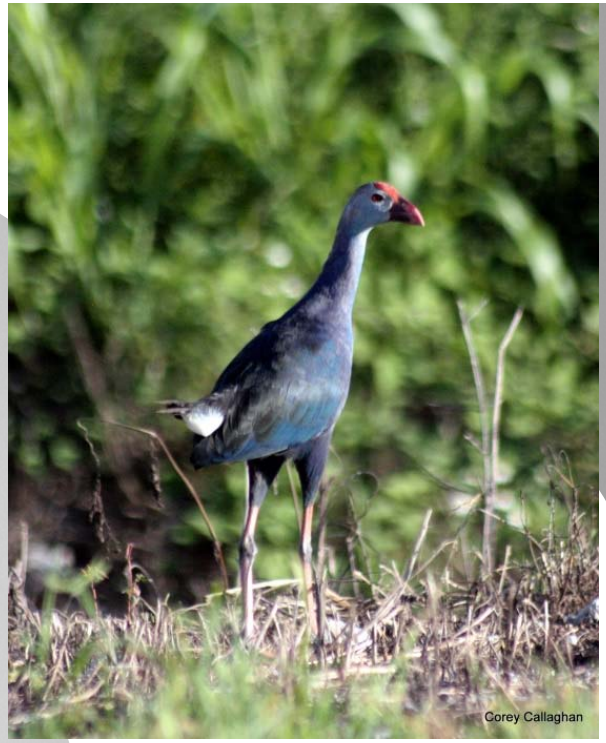
- In their native home Australia, swamphens are known to eat predominantly herbaceous materials from the families *Graminae* (59%), *Cyperaceae* (17%), and *Hydrocharitaceae* (11%)

- Predominantly herbivores, but individuals may feed on small animal prey such as: mollusks, leeches, crabs, fish, frogs, birds and their eggs, and rodents

- Little is known about the diet of Purple Swamphens in Florida
  - swamphens' stomachs in the STAs were bursting with rice grains

Objectives

- (1): Quantify the diet of the Purple Swamphen (*Porphyrio porphyrio)*
- (2): Identify any selectivity the swamphens may demonstrate
- (3): Compare morphological measurements of the swamphens among three study sites



Hypotheses

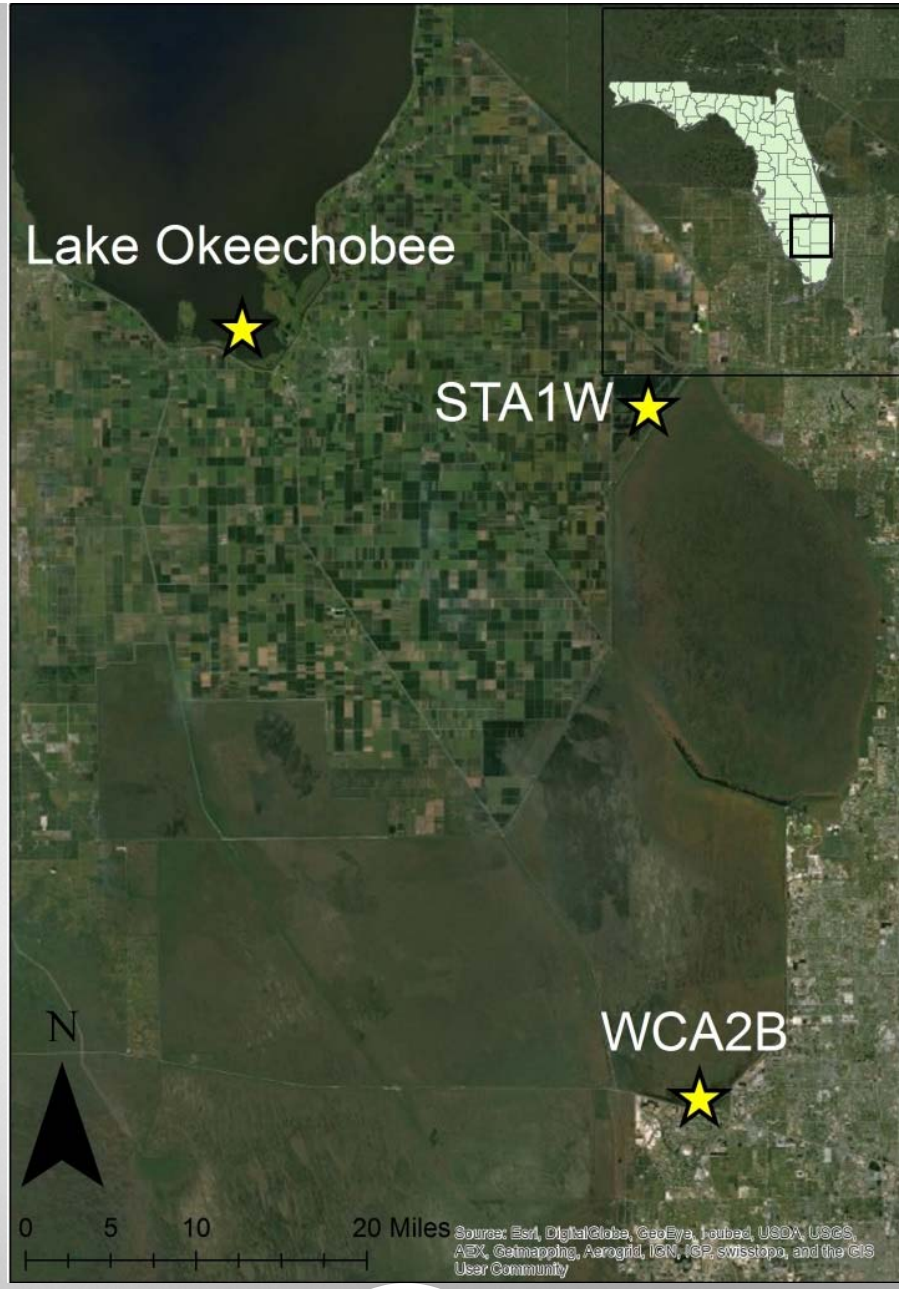
- (1): Swamphens will predominantly be herbivorous as they are throughout most of their range
- (2): Swamphens select for *Eleocharis spp*.

Image credit: Tyler Beck

Methodology

-Collection

- Three study sites
- Sample size
  - WCA2B: 32
  - STA1W: 27
  - Lake Okeechobee: 24



Methodology

-Objective (1): Diet

- Contents removed from proventriculus, gizzard, and crop
  - Stored in 70% ethanol
- A macroscopic and microscopic level of sorting and identification
- Reference collection utilized
- Stepwise process
  - Macroscopic sorting
  - Random sampling and identification of the remaining contents (homogenate)
  - Dry weight of the items

Methodology

-Objective (1): Diet

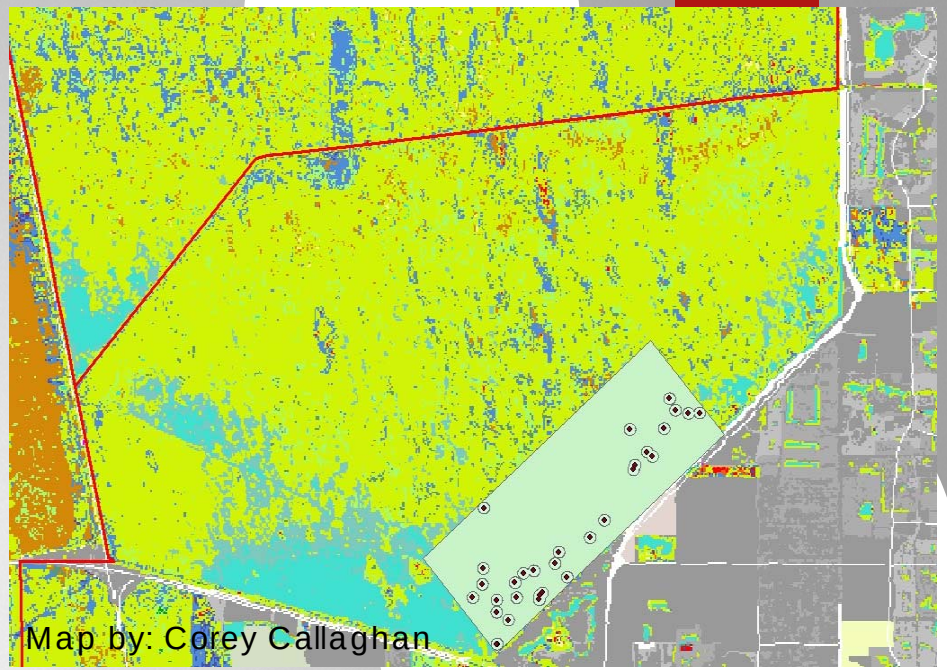
- Statistical Analysis: MDS and ANOSIM using PRIMER
  - Multi-dimensional Scaling
    - Visualization of similarity/dissimilarity
  - Analysis of Similarity
    - Compares variation and composition among sites

Methodology

-Objective (2): Selectivity

- Vegetation sampling area was defined
- Nested plot design at random points in which each point represents the Northeast corner a priori
  - 5m x 5m, 3m x 3m, and 1m x 1m
- Utilized a modified Braun-Blanquet scale to estimate the percent cover at each point

Braun-Blanquet scale	Range of cover (%)
5	75-100
4	50-75
3	25-50
2	5-25
1	<5



Methodology

-Objective (2): Selectivity

- Chesson's Index: $\alpha_i = \frac{r_i/p_i}{\sum r_i/p_i}, \quad _i = 1, \ldots, m$
  - α_i is the selectivity index for prey type *i*
  - r_i is the relative abundance of prey type *i* in the swamphen's stomach
  - p_i is the percent of prey type *i* in the environment calculated from the vegetation surveys
  - *m* is the number of prey types available in the environment
- Chesson's index is interpreted by relating α_i to 1/m
  - Random feeding: 1/m = α_i
  - Selection: α_i > 1/m
  - Avoidance: α_i < 1/m
- Assumptions
  - Prey abundance is large
  - Ability to consume a species is equal
  - Plants detected by us are also detected by swamphens

Methodology

-Objective (3): Morphology

- Morphological measurements taken before dissection:
  - Body mass
  - Bill length to gape
  - Exposed culmen
  - Bill width
  - Bill depth
  - Tarsus length
  - Wing chord
  - Tail length
  - Pectoral score
- Statistical Analysis: MDS and ANOSIM using PRIMER

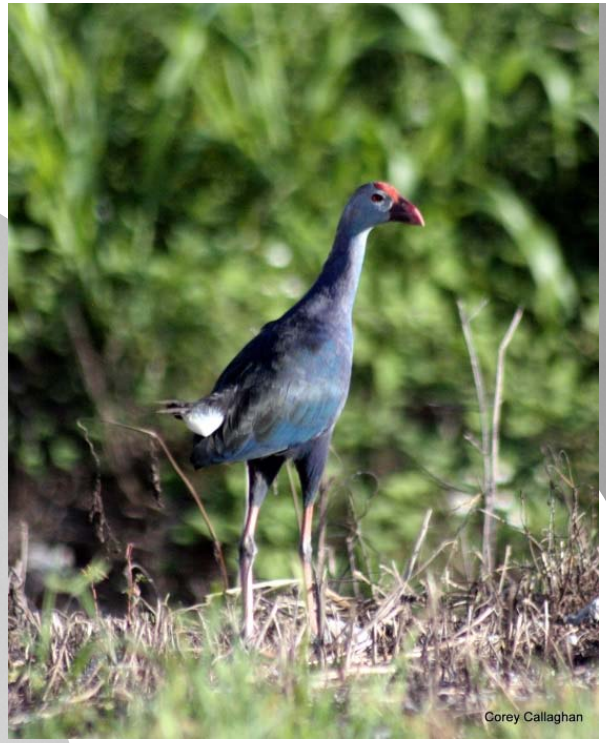
Image Credit: Jennifer Chastant

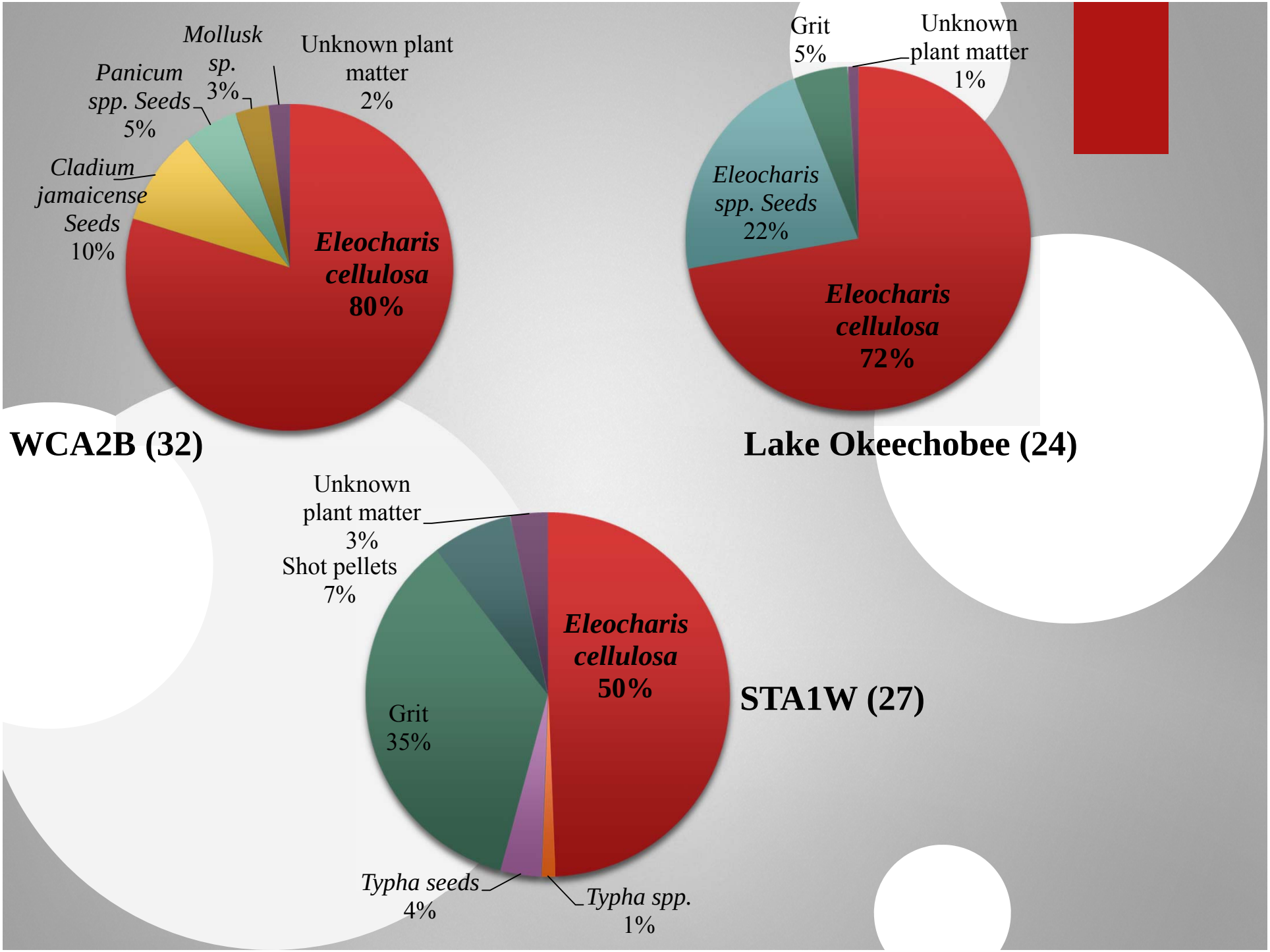
Findings

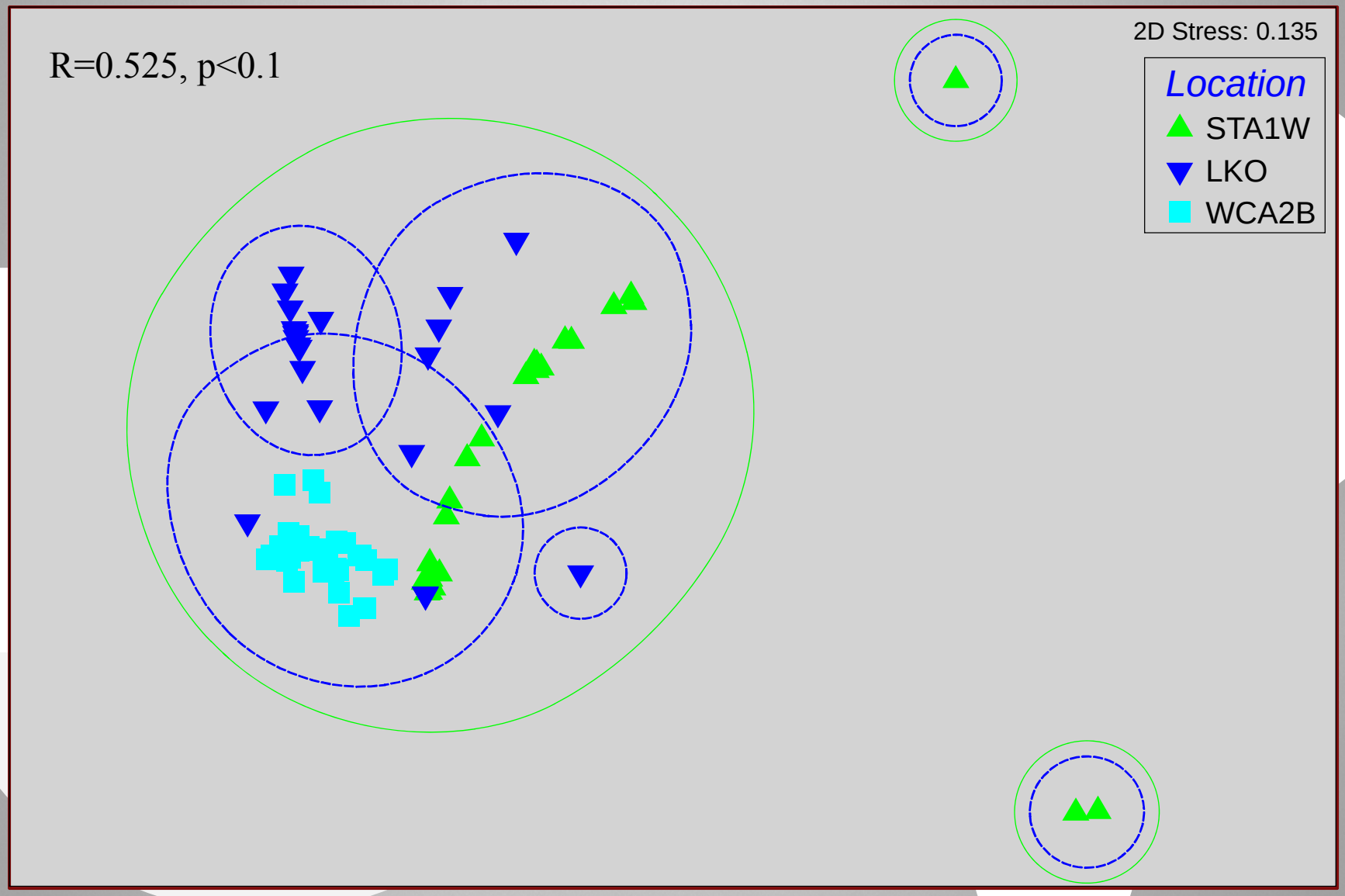
- **(1): Quantify the diet of the Purple Swamphen (*Porphyrio porphyrio)***

- (2): Identify any selectivity the swamphens may demonstrate

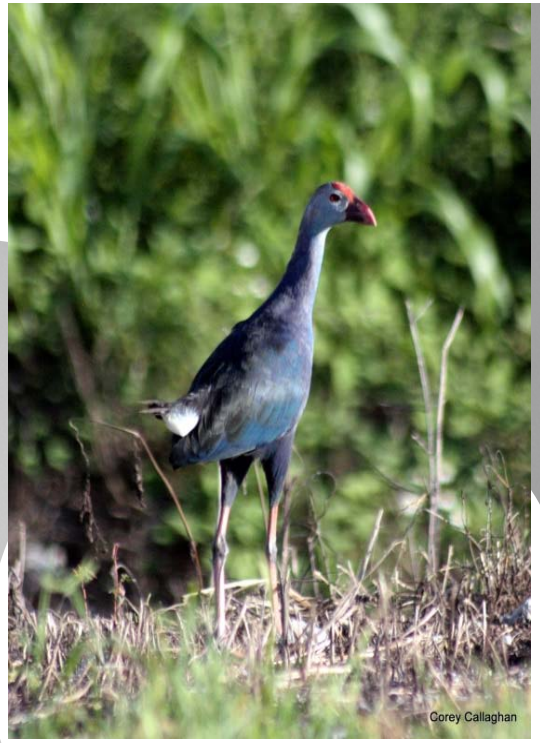
- (3): Compare morphological measurements of the swamphens among three study sites




Mollusk sp. 3%
Unknown plant matter 2%
Panicum spp. Seeds 5%
Cladium jamaicense Seeds 10%
Eleocharis cellulosa 80%
WCA2B (32)
Grit 5%
Unknown plant matter 1%
Eleocharis spp. Seeds 22%
Eleocharis cellulosa 72%
Lake Okeechobee (24)
Unknown plant matter 3%
Shot pellets 7%
Eleocharis cellulosa 50%
Grit 35%
Typha seeds 4%
Typha spp. 1%
STA1W (27)


R=0.525, p<0.1
2D Stress: 0.135
Location
STA1W
LKO
WCA2B

Findings



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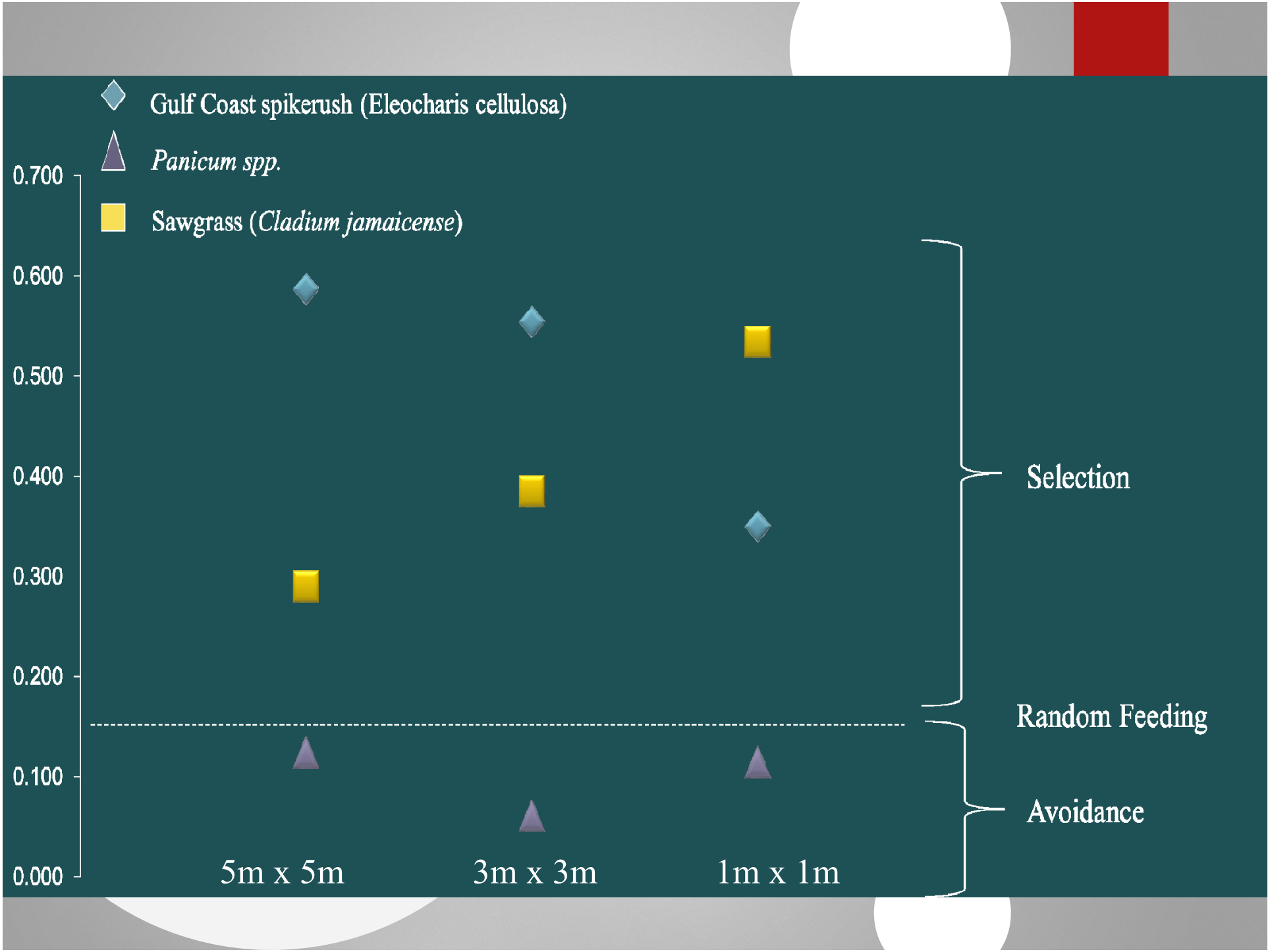
Gulf Coast spikerush (Eleocharis cellulosa)
Panicum spp.
Sawgrass (Cladium jamaicense)
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
5m x 5m
3m x 3m
1m x 1m
Selection
Random Feeding
Avoidance

Findings

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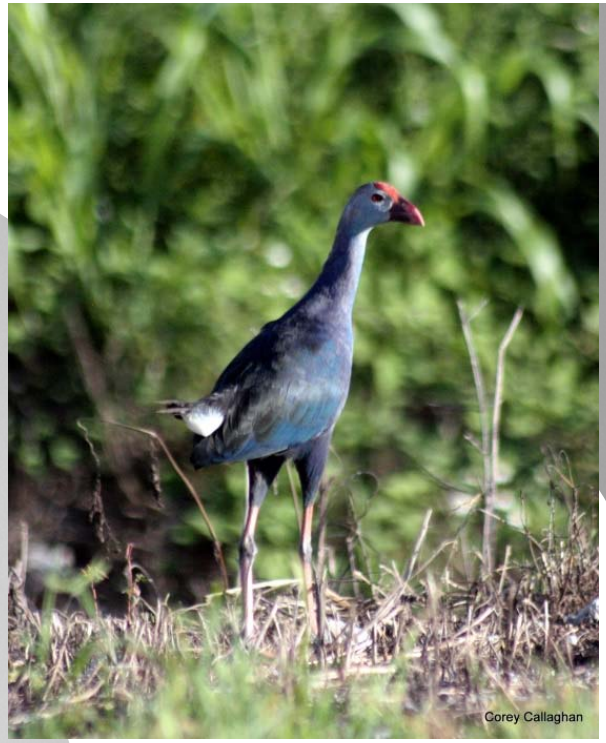
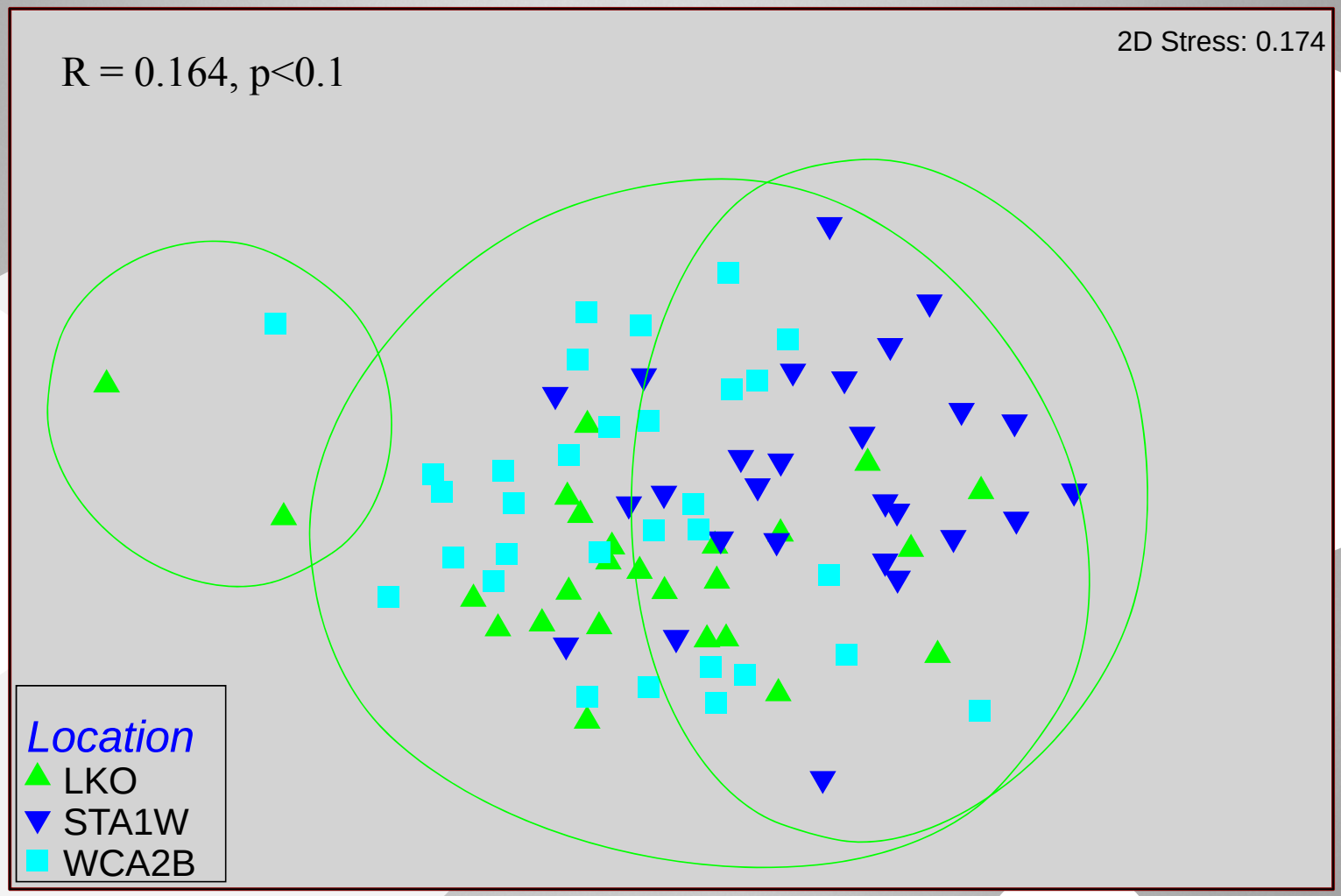
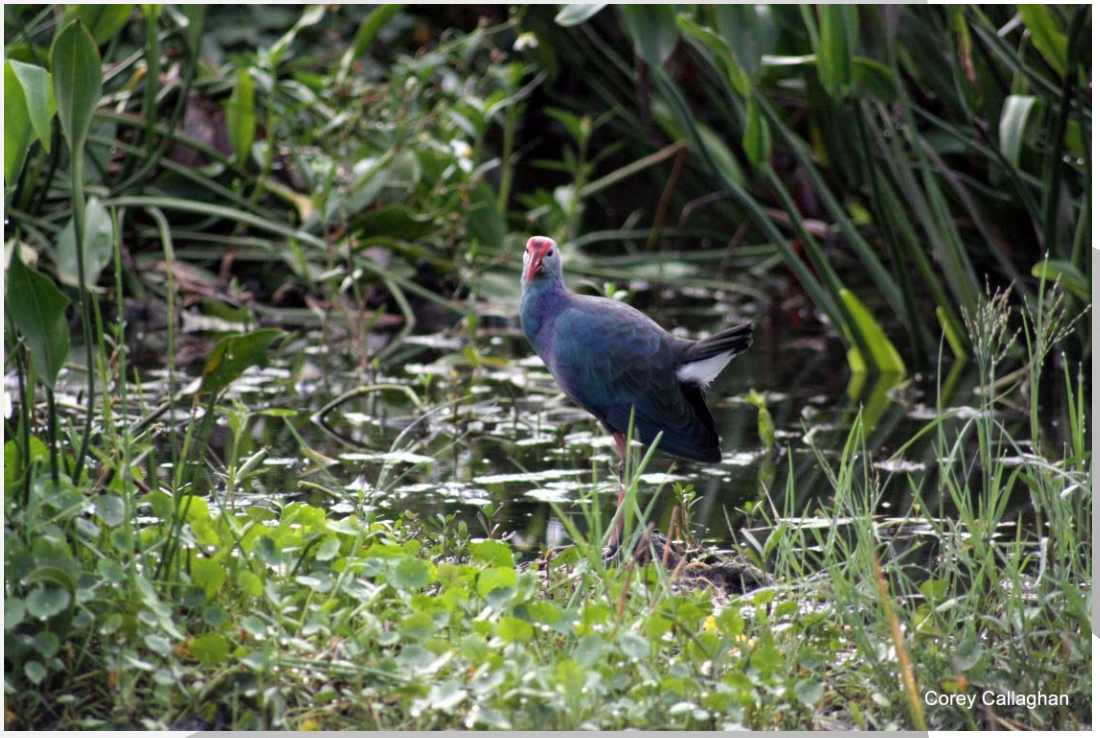



2D Stress: 0.174
R = 0.164, p<0.1
Location
LKO
STA1W
WCA2B

Conclusions

- Objective (1): Swamphens are mainly herbivores and eat predominantly Gulf Coast spikerush
- Objective (2): They show a strong preference for Gulf Coast spikerush in WCA2B
- Objective (3): The largest birds were collected from STA1W



Implications

- Swamphen diets were predominantly herbivorous and were more specialized than the literature suggested because of a strong preference for spikerush
  - Adaptive flexibility hypothesis
- Potential impacts to native species likely depends on the degree to which they are dependent on spikerush and the degree of selection of spikerush by swamphens
- High selectivity is not likely to limit the expansion of swamphens, because of the plant's prevalence throughout Florida and the southeastern U.S.

Acknowledgements

- Florida Fish and Wildlife Commission provided the funding and collaboration of this work

- Lab-mates and technicians in the Gawlik Lab


Questions?