Trends in Alligator Body Condition in Relation to Hydrology in Arthur R. Marshall Loxahatchee National Wildlife Refuge, Florida USA.

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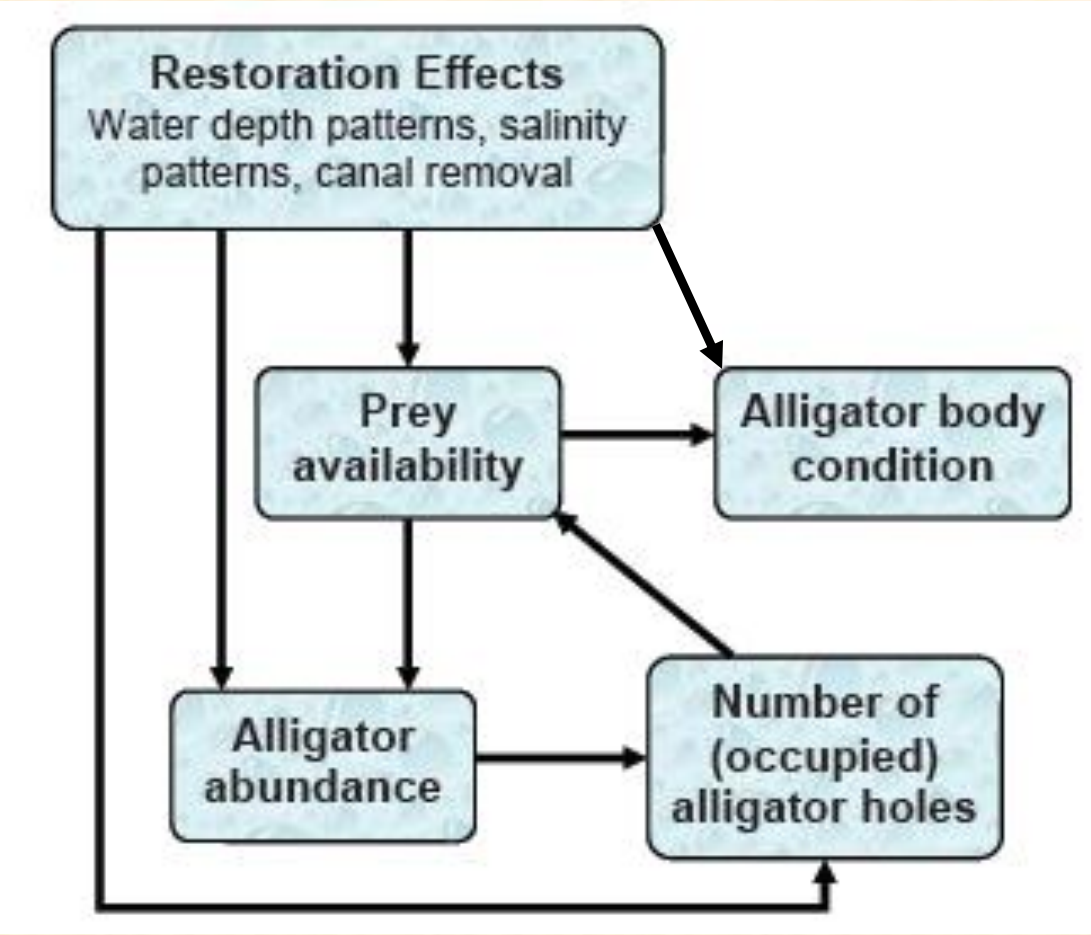
- Alligators as indicators
- Comprehensive Everglades Restoration (CERP) Monitoring and Assessment Plan (MAP)
  - Hypotheses
- Status and trends in Arthur R. Marshall Loxahatchee National Wildlife Refuge (LNWR)

The alligator, like the buffalo of the plains, dominated the ecology of the Everglades Swamps – Craighead (1968)

Alligators: Keystone Species Hypothesis



Monitoring and Assessment Plan (MAP)

- Establish pre-Comprehensive Everglades Restoration Plan (CERP) reference state including variability
- Determine status and trends
- Detect unexpected responses
- Increase ecosystem understanding

MAP

- Density and body condition of the American alligator in remaining Everglades wetlands are currently suppressed due to altered water depth patterns, salinity distributions and prey abundance

- Restoration of sheet flow and related water depth patterns consistent with the understanding of pre-drainage condition, in combination with the removal of canals, will result in a widespread increase in alligator density and body condition in the Everglades

A.R.M. Loxahatchee NWR

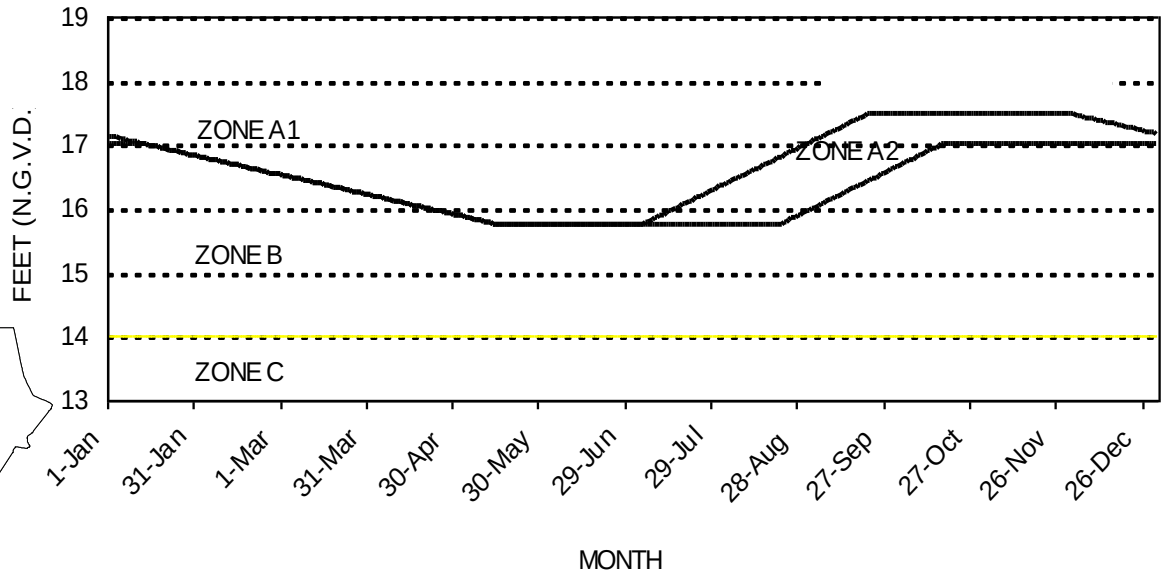
WCA 2

Big Cypress National Preserve

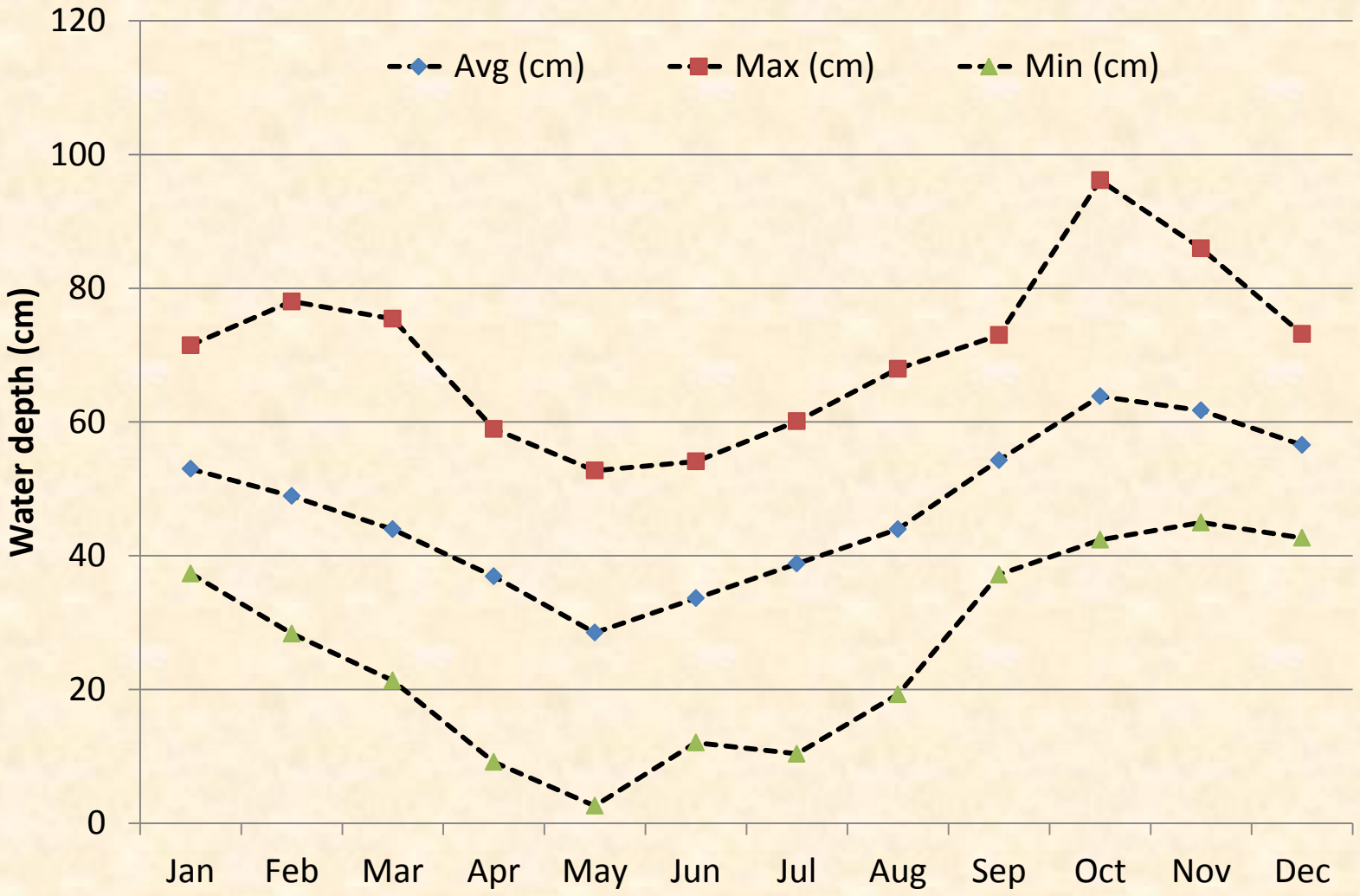
WCA 3

Everglades National Park

WCA 1 WATER REGULATION SCHEDULE



Average of gauges 1-7 and 1-9 1998-2010



Methods

- Captured 15 animals >=1.25m each season
  - Fall (Sep-Nov)
  - Spring (Mar-May)
- Fall 1999 – Fall 2010
- Weighed, measured, sexed, marked, released

Body Condition

- Fulton's K

$$K = \frac{M}{SVL^3} \times 10^5$$

- Values range from 0.85 - 4.27

Questions

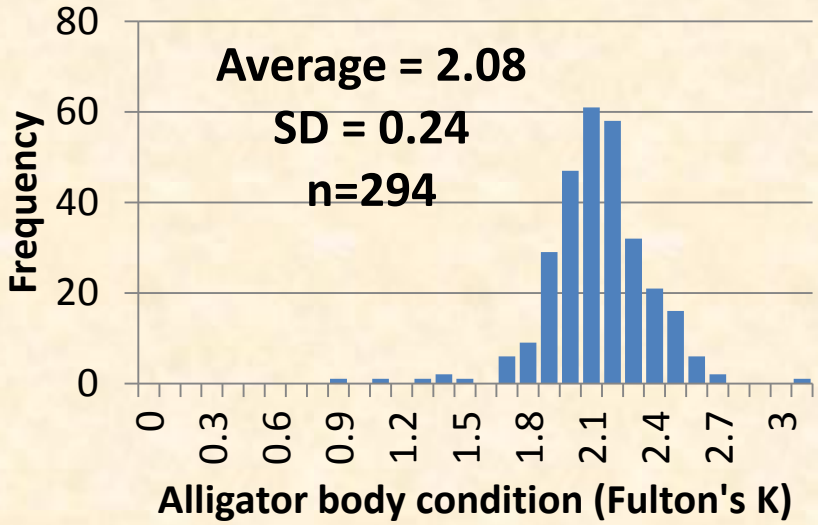
- What are the characteristics of alligator body condition?
- Over the period of record, has there been a trend in alligator body condition?
- Do we see trends on 3 year time steps?
- Are there break points in the data?
- How is body condition related to hydrology?

Analysis

- Summary of patterns- Spring vs Fall, Female vs Males
- Linear trends
  - Condition~SampleNo+CLASS+SEX+SEASON
  - Entire period of record and 3 year increments
- Change point analyzer (Gavit et al 2009)
- Correlation of alligator body condition, water depth and water depth amplitude using Everglades Depth Estimation Network (EDEN) data
  - Short (<90 days)
  - Long (>270 days)

Results

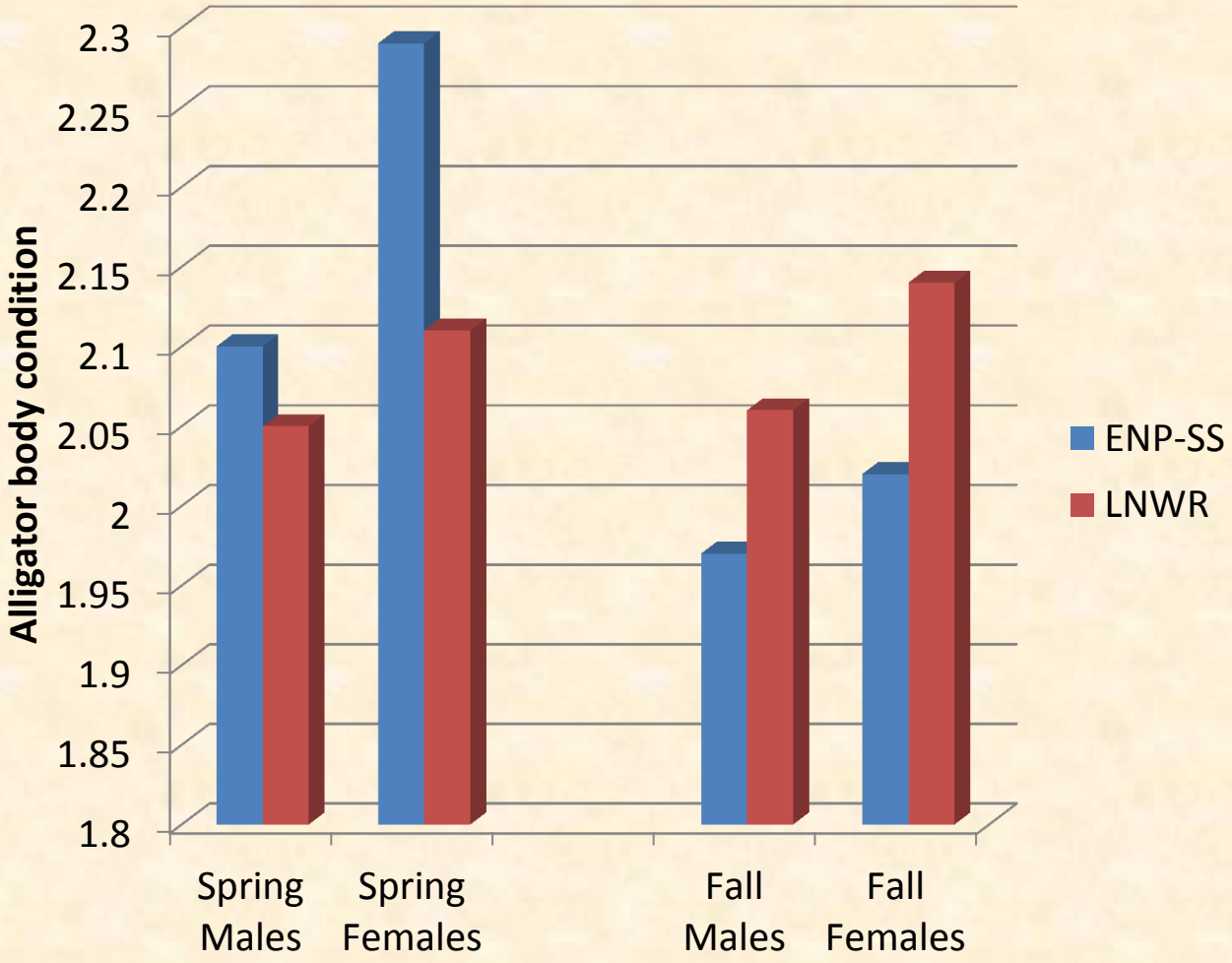
- 294 alligators
  - 142 Spring, 152 Fall
  - 141 Female, 144 Male



- No significant difference in Spring and Fall – all animals (Average body condition 2.09 and 2.07, respectively)

- Females significantly greater condition than males overall (2.11 compared to 2.03- 4% difference)

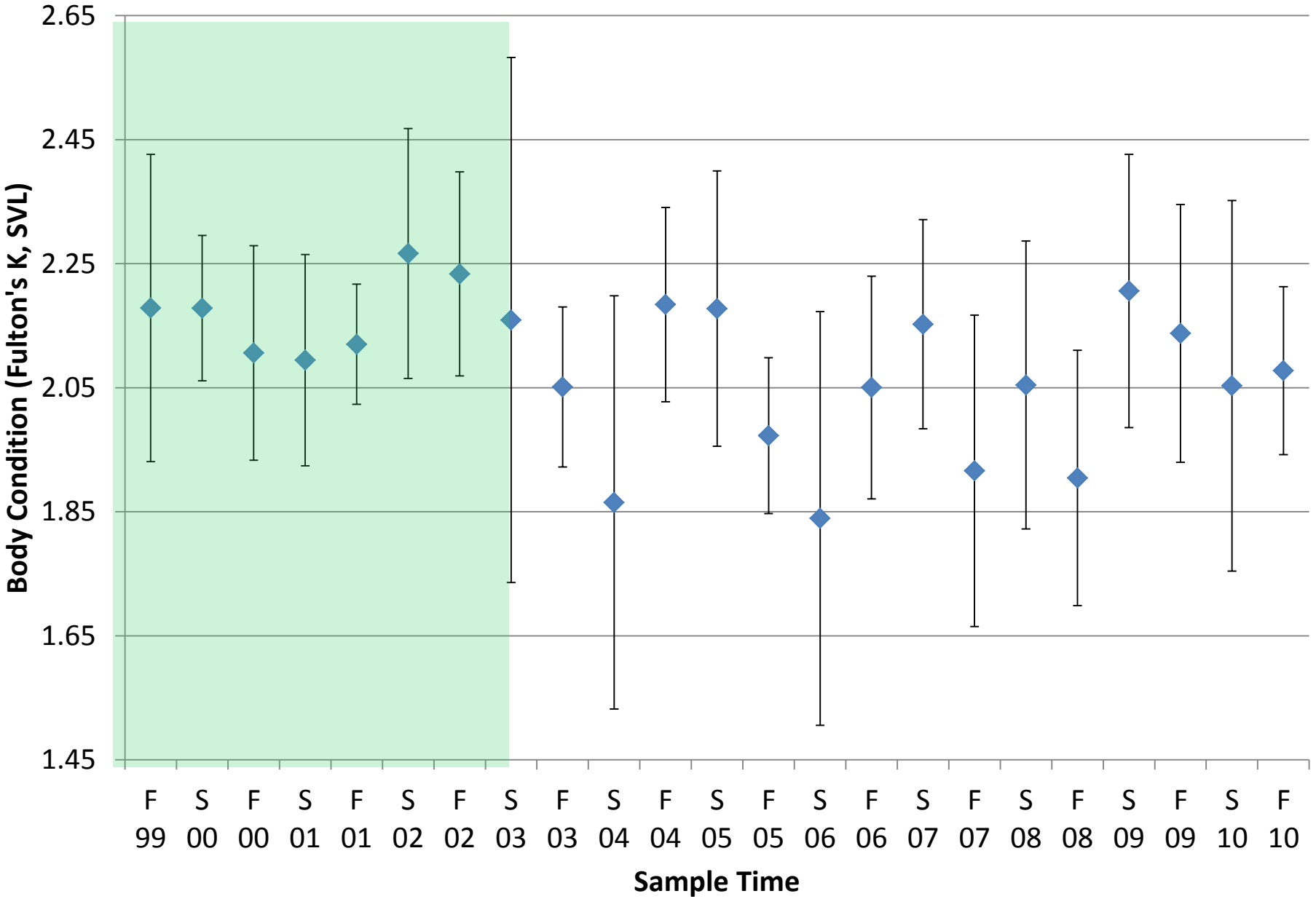
Comparison to Everglades National Park-Shark Slough



2000-2006 data

Trends

- Negative trends
  - Fall 1999-Fall 2010 ($p<0.05$)
  - Fall 2001-Fall 2004 ($p<0.05$)
  - Fall 2004-Fall 2007 ($p<0.10$)
- Positive trend
  - Fall 2007-Fall 2010 ($p<0.10$)

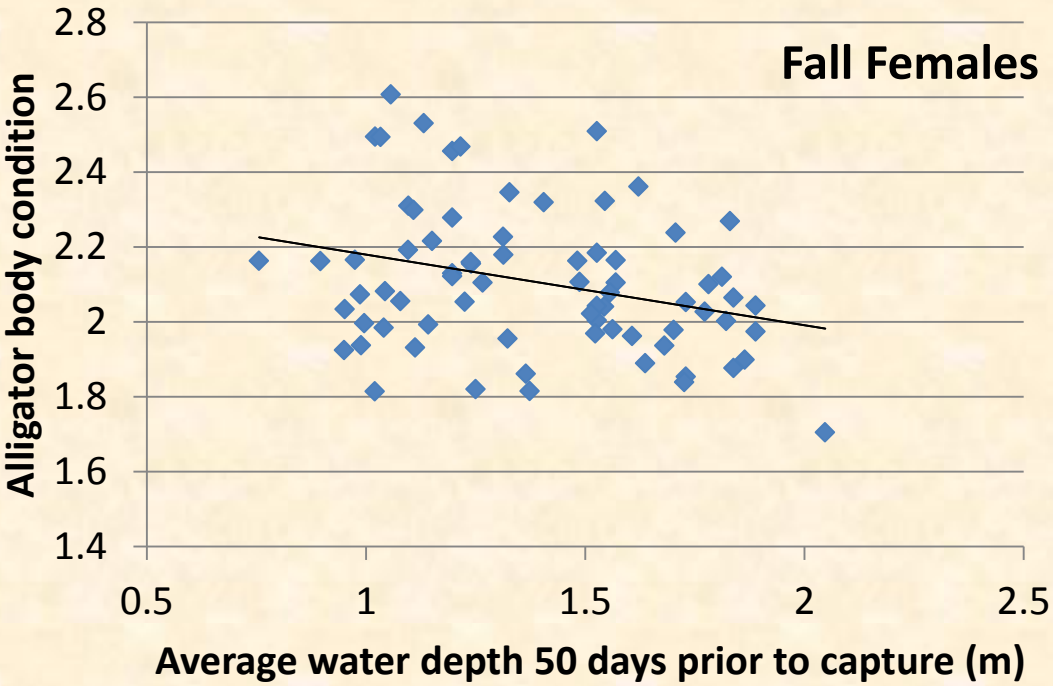


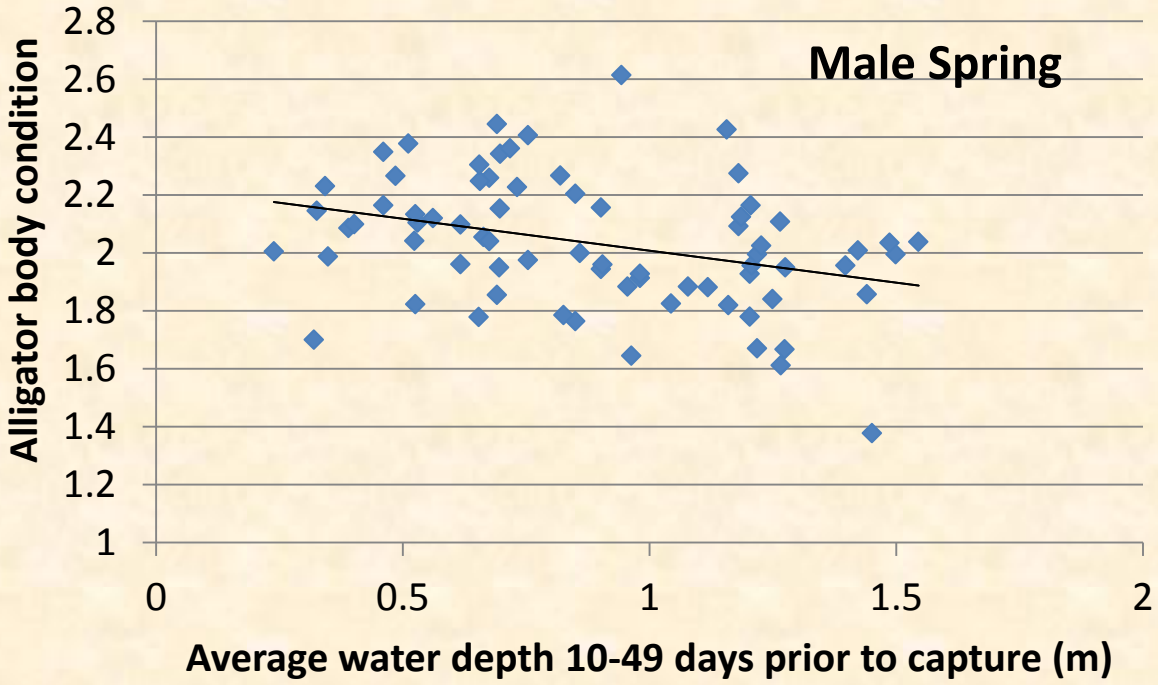
Mean condition=2.17
Mean amplitude 360=0.68 m (2.24 ft)
Mean days since dry=1629

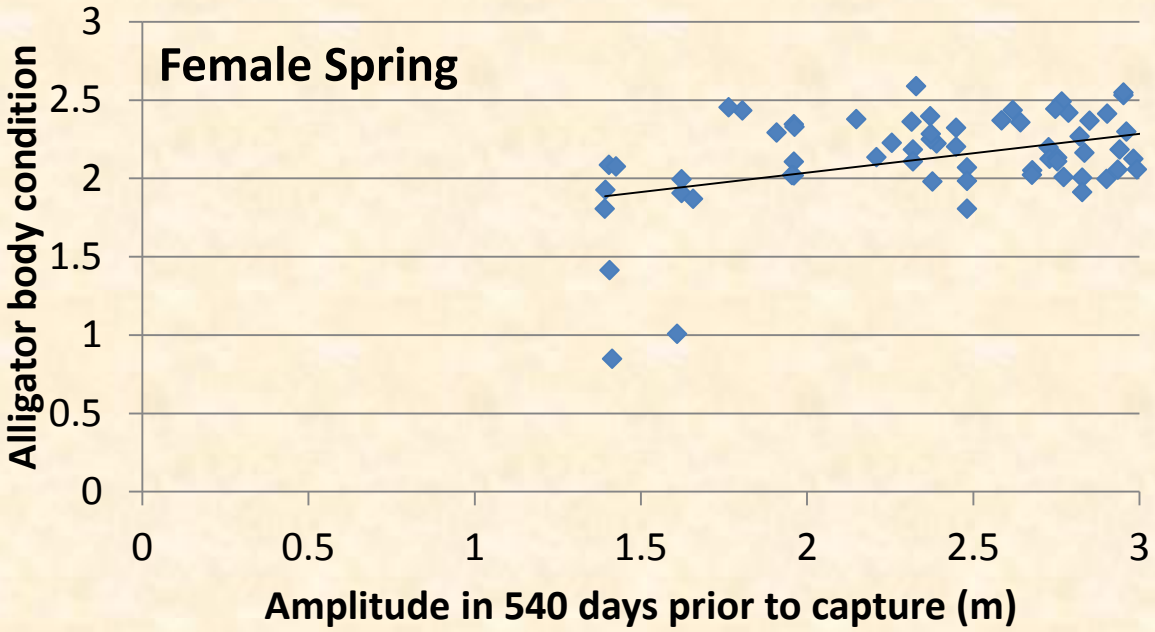
Mean condition=2.04
Mean amplitude 360=0.46 m (1.52 ft)
Mean days since dry=519

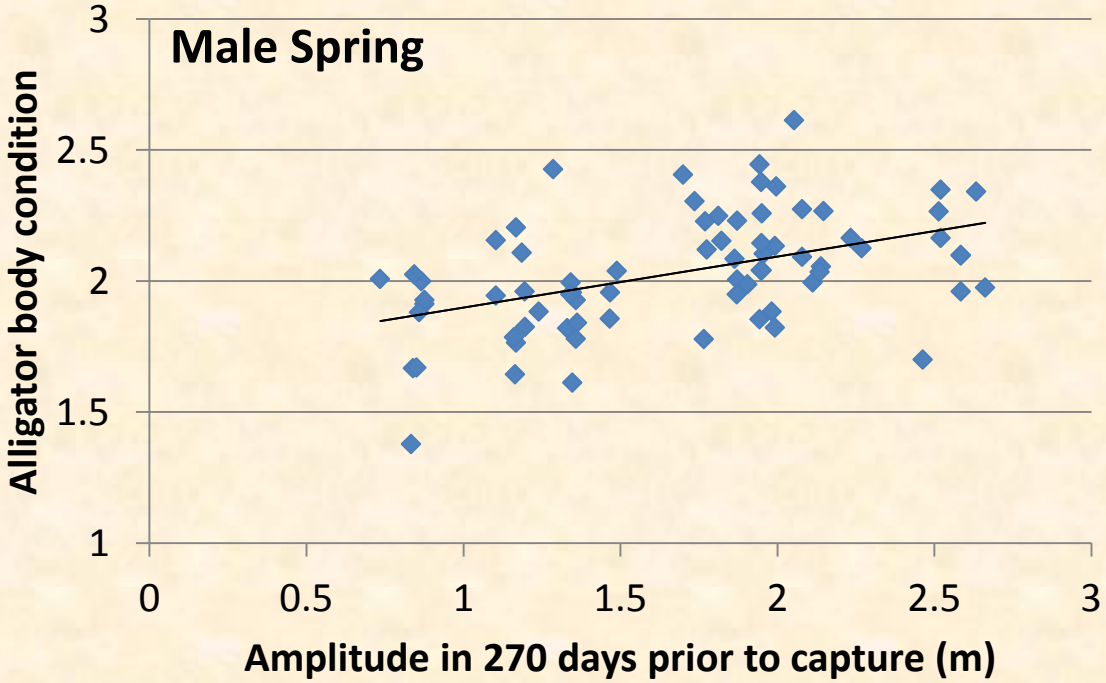
Correlations using EDEN

- Both seasons males and females
  - Water depth 70 days prior to capture (r=-0.15)
  - Amplitude 360 days prior to capture (r=0.19)
- Males
  - Water depth 10-49 days prior to capture in spring (r=-0.24)
  - Amplitude 270 days prior to capture in spring (r=0.30)
- Females
  - Water depth 50 days prior to capture in fall (r=-0.30)
  - Amplitude 540 days prior to capture in spring (r=0.43)


Fall Females
Alligator body condition
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
0.5
1
1.5
2
2.5
Average water depth 50 days prior to capture (m)


Male Spring
Alligator body condition
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0
0.5
1
1.5
2
Average water depth 10-49 days prior to capture (m)


Female Spring
Alligator body condition
Amplitude in 540 days prior to capture (m)
0
0.5
1
1.5
2
2.5
3

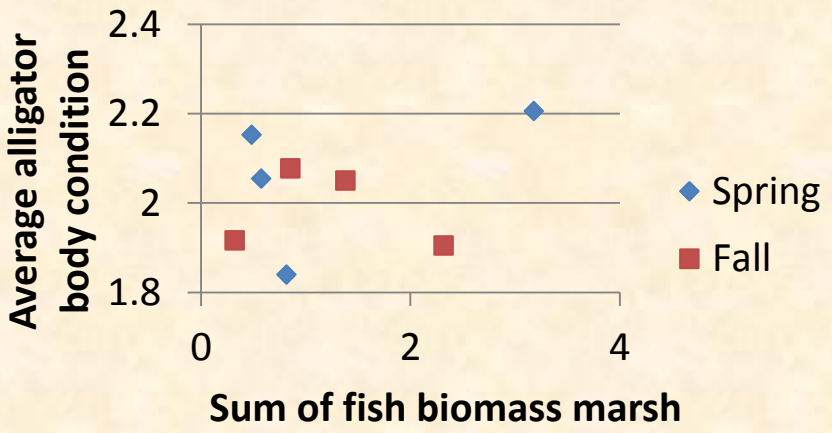

Male Spring
Alligator body condition
Amplitude in 270 days prior to capture (m)
1
1.5
2
2.5
3
0
0.5
1
1.5
2
2.5
3

Summary

- There are both trends and a break point in alligator body condition data in LNWR 1999-2010
- Alligator body condition is negatively correlated with water depth prior to capture
- Body condition is positively correlated with water depth amplitude 0.75-1.5 years prior to capture
- Male and female alligator body condition show different patterns
- Alligator body condition is a useful indicator for following trends and helping us to understand ecosystem dynamics and define future desired conditions for LNWR

Next Steps

- Additional hydrological variables
- Examine spatial patterns within LNWR
- Comparison with other areas
- Link with fish biomass data



Data from Joel Trexler