

**U.S. Geological Survey, South Florida Invasive Species Research  
Fort Collins Science Center – South Florida Field Station  
& Wetland and Aquatic Research Center – Davie**

Presented by Andrea Currylow



**Primary Collaborators:** National Park Service Everglades National Park & Big Cypress National Preserve, University of Florida, Zoo Miami, The Conservancy of Southwest Florida, U.S. Fish and Wildlife Service Crocodile Lake National Wildlife Refuge.

**Primary Funders:** National Park Service, the USGS Greater Everglades Priority Ecosystem Science Program, and Biological Threats and Invasive Species Research Program.

*This information is preliminary and is subject to revision. It is being provided to meet the need for timely best science. The information is provided on the condition that neither the U.S. Geological Survey nor the U.S. Government shall be held liable for any damages resulting from the authorized or unauthorized use of the information.*

# Ongoing Collaborative Projects

- Specimen Management & Data Summaries
- Diet Analyses
- Tegu Surveillance
- Scout Python Collaborative
- Python External Mark Evaluation
- Stress & Reproductive Hormones
- Hatchling/Juvenile Python Survival

 USGS

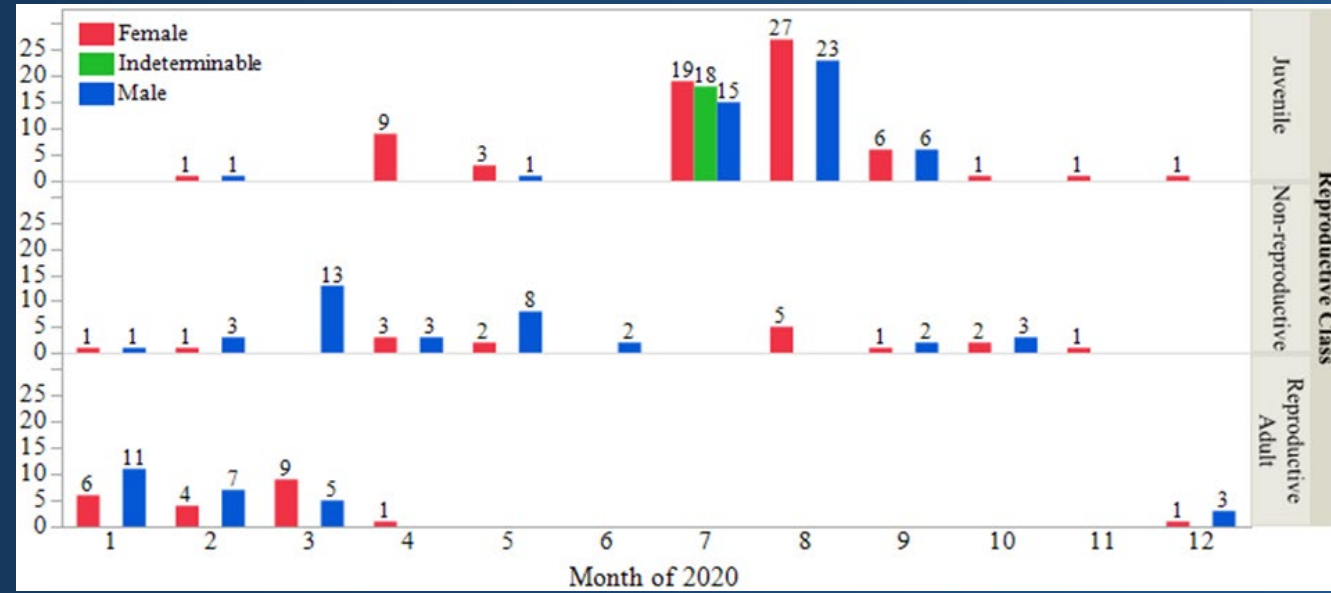


**Everglades Cooperative Invasive Species Management Area**

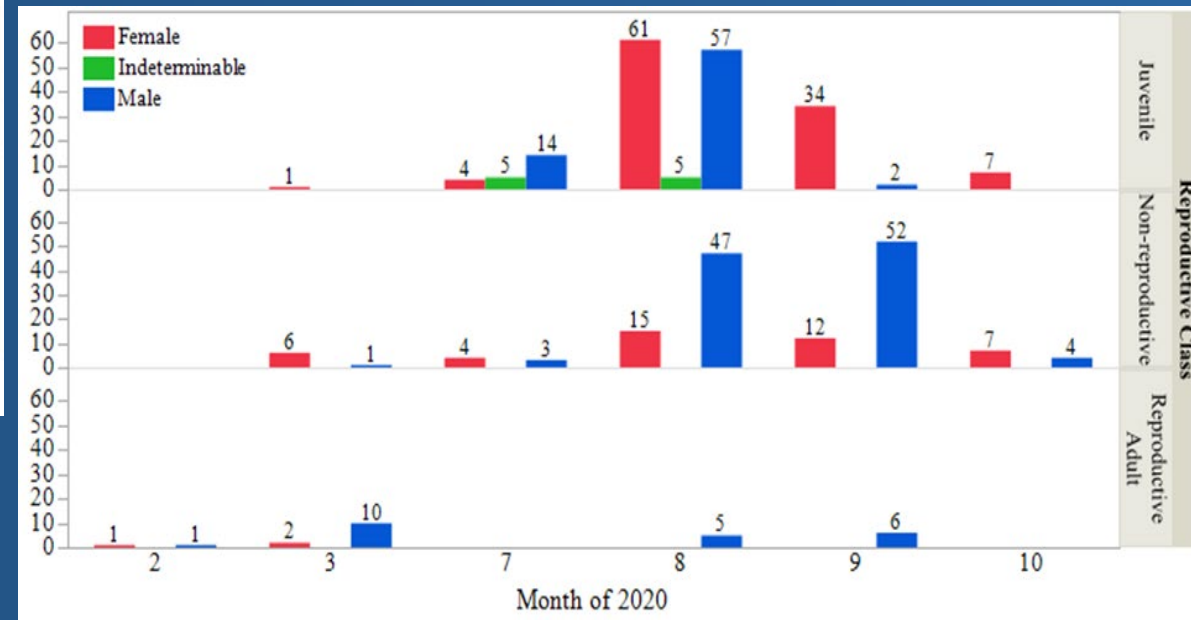


# Pythons

Preliminary Information-Subject to Revision. Not for Citation or Distribution



# Tegus



Necropsies yield valuable demographic & ecological data

- Reproduction
- Diet
- Temporal Patterns
- Genetics
- Disease/parasite spread

Everglades Cooperative Invasive Species Management Area

# Dietary collection & analysis

- 81 pythons and 503(!) tegu diet samples since July 2020
- Thus far, python samples yielded > 60 prey species
- Masters study on tegu dietary preferences by sex, season, and habitat.

**UF** UNIVERSITY of FLORIDA

**USGS**

**CISMA**



Preliminary Information-Subject to Revision. Not for Citation or Distribution

**Everglades Cooperative Invasive Species Management Area**

## Tegu Photographed

- No
- Yes
- Major Roads
- ▭ ENP Boundary



# Tegu Surveillance & EDRR

- 23 cameras deployed: 6 Long Term, 17 EDRR
- 3 tegus seen in May at 1 Long Term camera along the C-111N outside EVER
- None seen on cams in EVER so far this year



Everglades Cooperative Invasive Species Management Area



# Scout Python Collaboration

- Standardizing data collection
- Expanding partnerships
- Layering research

Preliminary Information-Subject to Revision.  
 Not for Citation or Distribution

Everglades Cooperative Invasive Species Management Area





# Scout Python External Marking



# Reproductive Patterns in Hormone Concentrations



- Define reproductive timing & tempo
- Predict reproductive status
- Understand reproductive signaling year-round



# Juvenile Python Survival and Dispersal in Big Cypress National Preserve



Preliminary Information-Subject to Revision. Not for Citation or Distribution

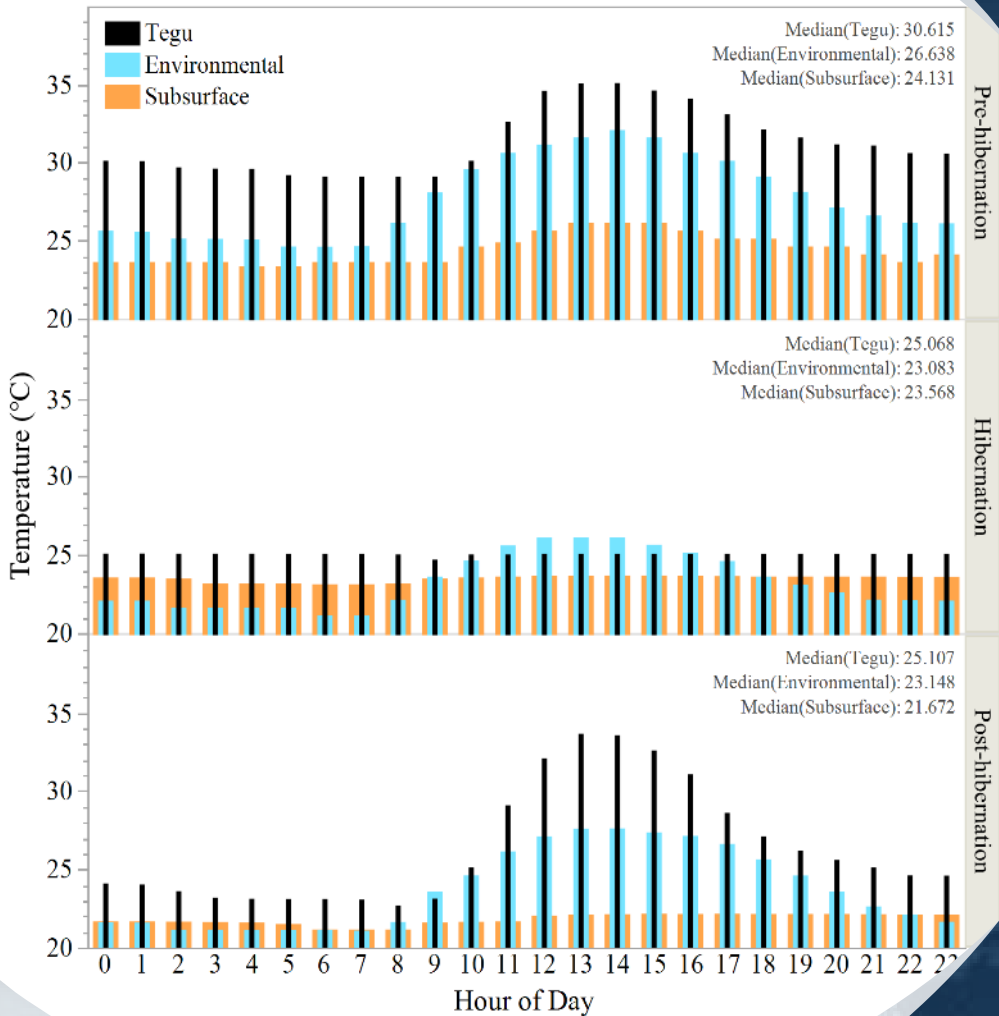
Everglades Cooperative Invasive Species Management Area



# Recent Products from Collaborative Research

- Tegu thermal biology
- Tegu establishment in GA
- Tegu overwinter survival in AL
- Y-maze use with large invasive reptiles
- Python Accelerometry
- Python range use in SW FL
- Mammalian predation on adult pythons
- Python hatchling growth
- Scientific word choice
- Python egg retention
- Python predation by native snakes

Everglades Cooperative Invasive Species Management Area



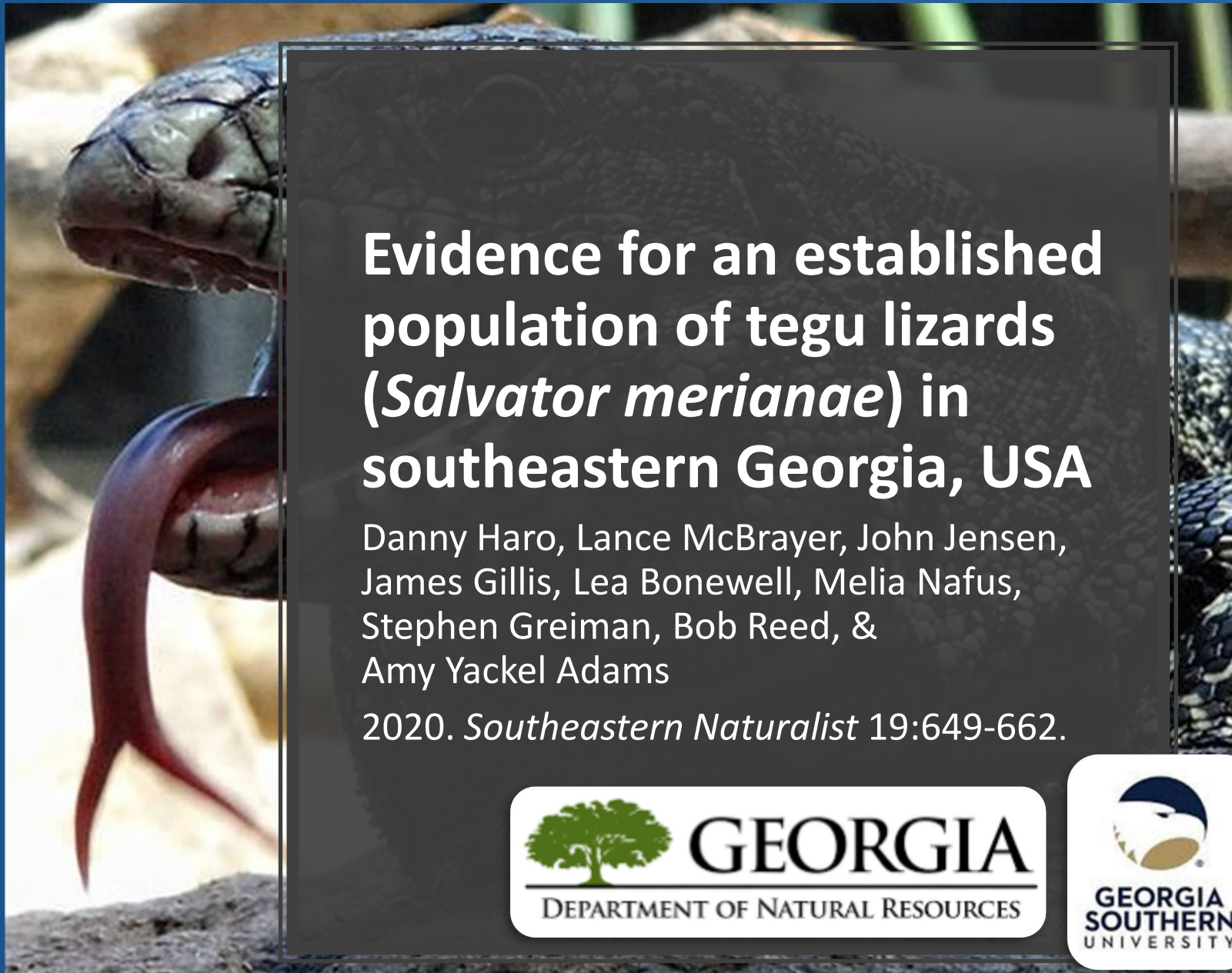
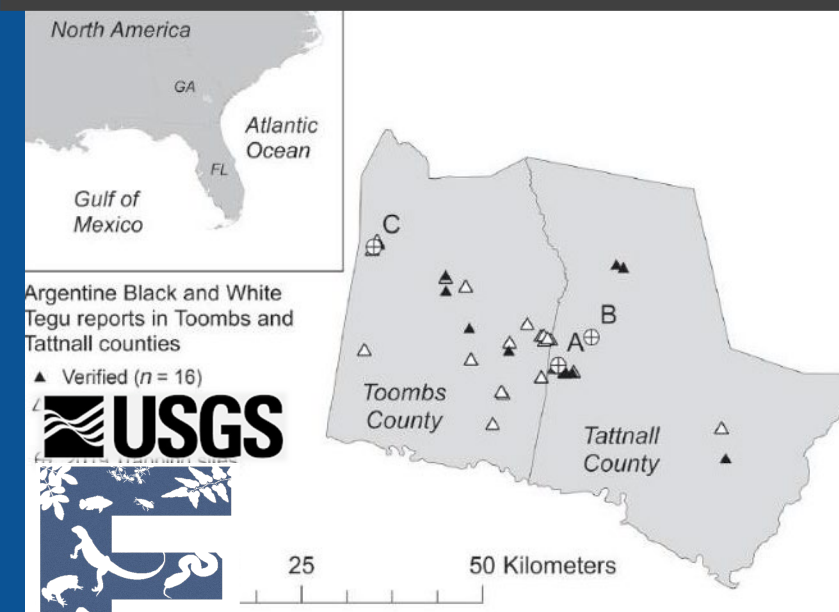
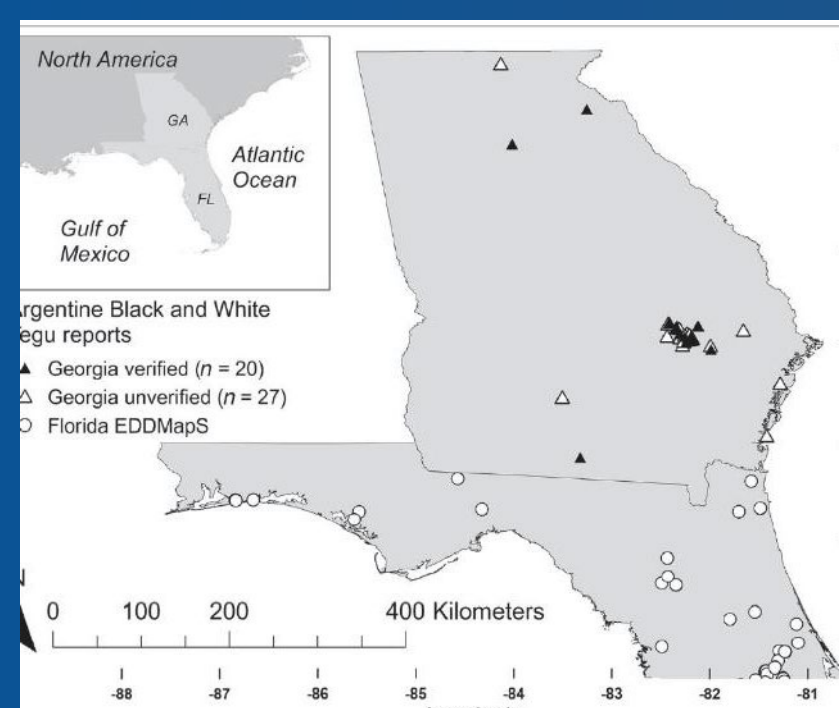
# Thermal stability of an adaptable, invasive ectotherm — Argentine giant tegus in the Greater Everglades Ecosystem, USA

Andrea Currylow, Michelle Collier, Emma Hanslowe, Bryan Falk, Brian Cade, Sara Moy, Alejandro Grajal-Puche, Frank Ridgley, Bob Reed, & Amy Yackel Adams

2021. *Ecosphere*.

Everglades Cooperative Invasive Species Management Area





# Evidence for an established population of tegu lizards (*Salvator merianae*) in southeastern Georgia, USA

Danny Haro, Lance McBrayer, John Jensen, James Gillis, Lea Bonewell, Melia Nafus, Stephen Greiman, Bob Reed, & Amy Yackel Adams

2020. *Southeastern Naturalist* 19:649-662.



Argentine Black and White  
Tegu (*Salvator merianae*)  
can survive the winter under  
semi-natural conditions well  
beyond their current  
invasive range

Scott Goetz, Dave Steen, Melissa Miller,  
Craig Guyer, Jack Kottwitz, John Roberts,  
Emmitt Blankenship, Philip Pearson,  
Daniel Warner, & Bob Reed

2021. *PLoS ONE* 16:e0245877

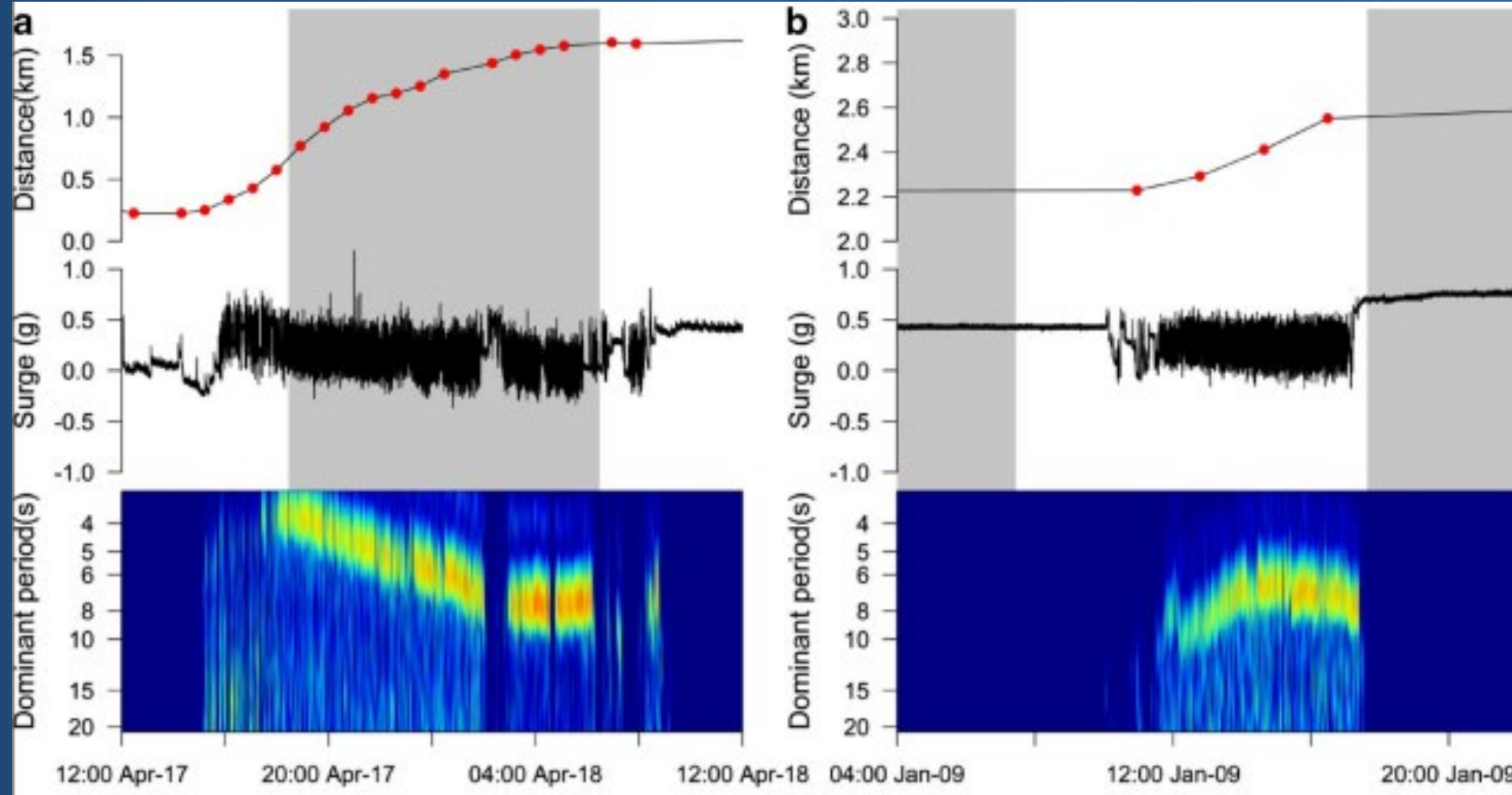


Everglades Cooperative Invasive Species Management Area

# Accelerometry to study fine-scale activity of invasive Burmese pythons (*Python bivittatus*) in the wild



Nicholas Whitney,  
Connor White,  
Brian Smith,  
Mike Cherkiss,  
Frank Mazzotti, &  
Kristen Hart. 2021.  
*Animal Biotelemetry* 9:2



Everglades Cooperative Invasive Species Management Area

**JMU**

**JAMES MADISON  
UNIVERSITY**



**NATIONAL  
PARK  
SERVICE**

**USDA**

# Using Y-mazes to assess chemosensory behavior in reptiles

Rocky Parker, Andrea Currylow, Eric Tillman,  
Charlotte Robinson, Jillian Josimovich,  
Isabella Bukovich, Lauren Nazarian,  
Melia Nafus, Bryan Kluever, &  
Amy Yackel Adams

2021. *Journal of Visualized  
Experiments*

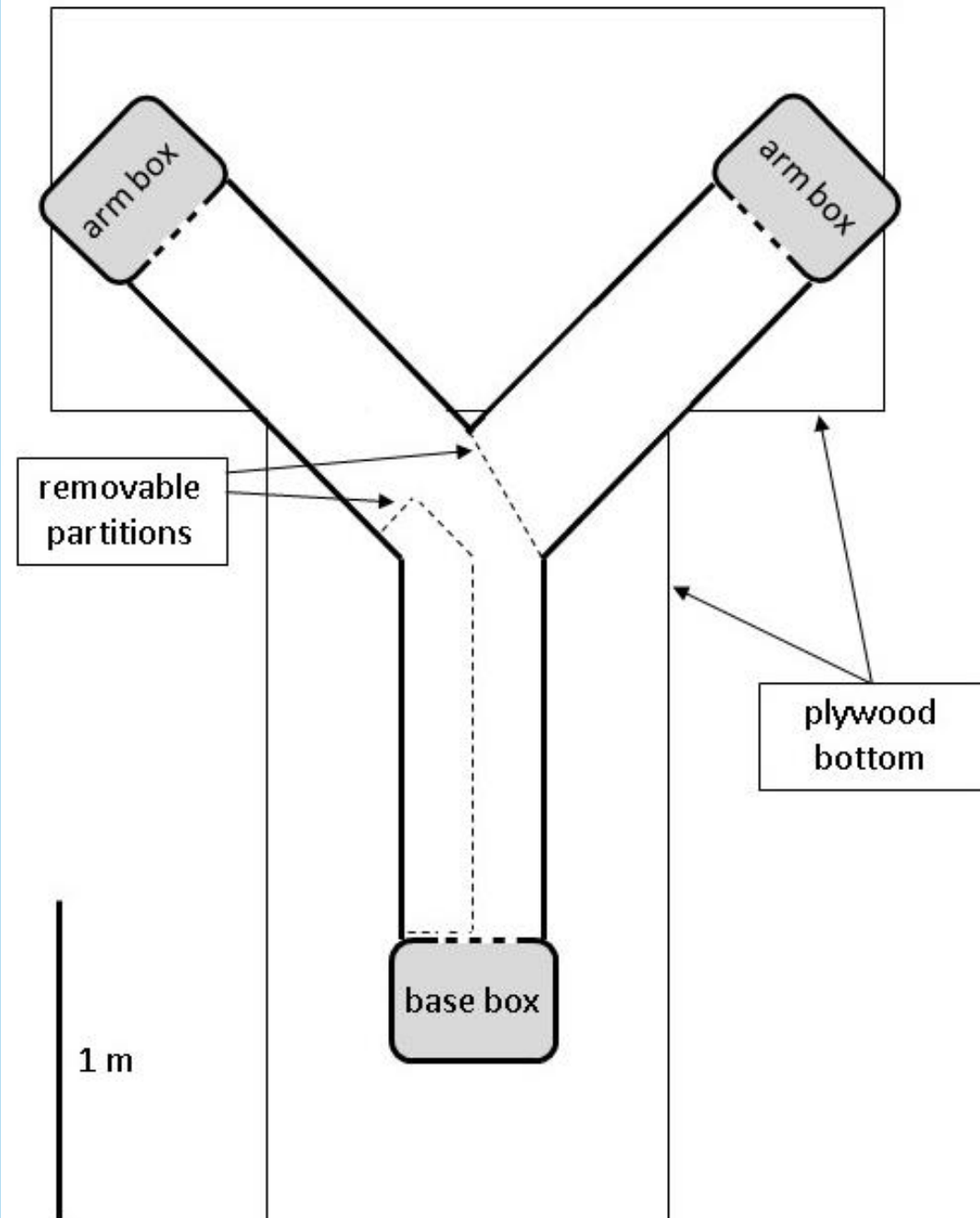
e61858

**USGS**



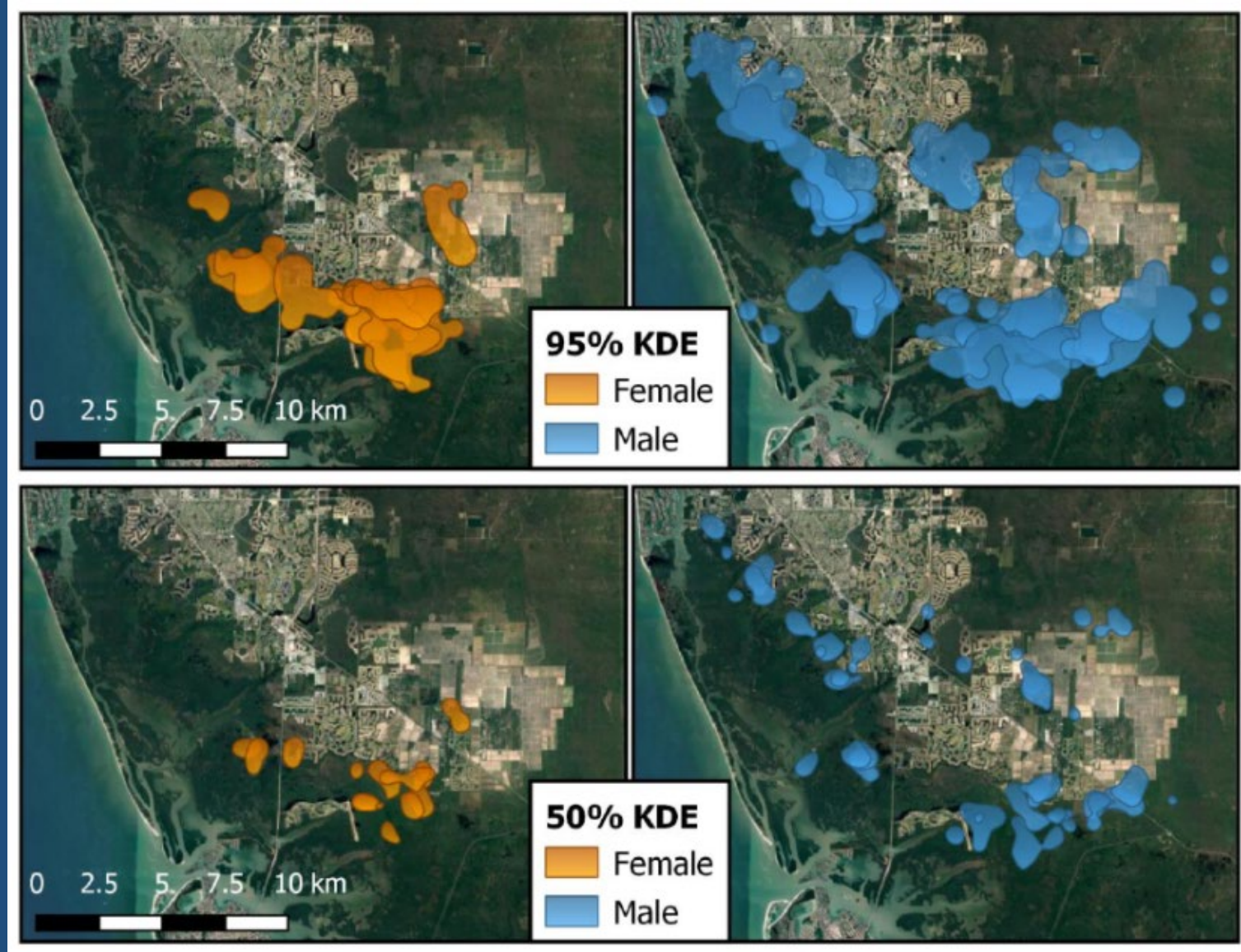
**CISMA**

**Everglades Cooperative Invasive Species Management Area**

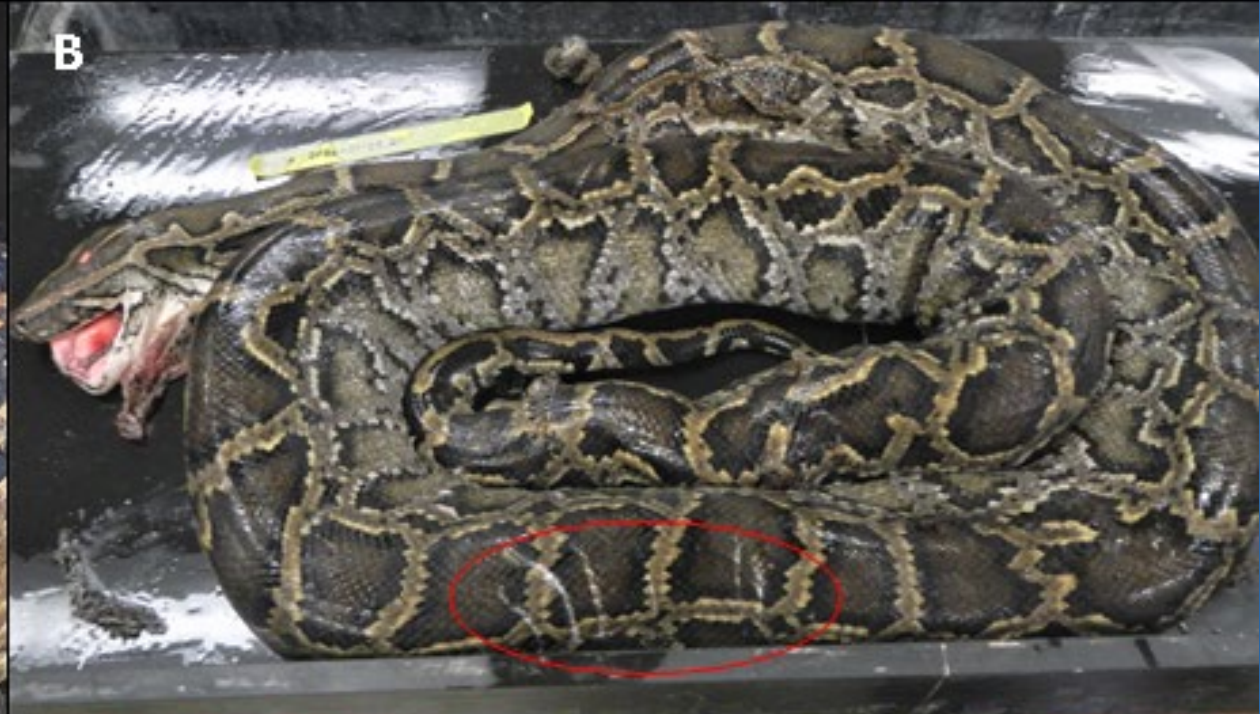


Ian Bartoszek, Brian Smith,  
Bob Reed, & Kristen Hart  
2021. *Ecosphere* 12(6):e03564.

# Spatial ecology of invasive Burmese pythons in southwest Florida



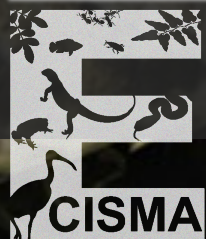
Everglades Cooperative Invasive Species Management Area



# Native mammalian predators can predate adult Burmese pythons in Florida

Matthew McCollister, Jillian Josimovich, Austin Fitzgerald, Deb Jansen, & Andrea Currylow

2021. *Southeastern Naturalist* 20:N55-N59.



Everglades Cooperative Invasive Species Management Area



**CONSERVANCY**  
of Southwest Florida  
OUR WATER, LAND, WILDLIFE, FUTURE.

# Clutch predicts growth of hatchling Burmese pythons better than food availability or sex

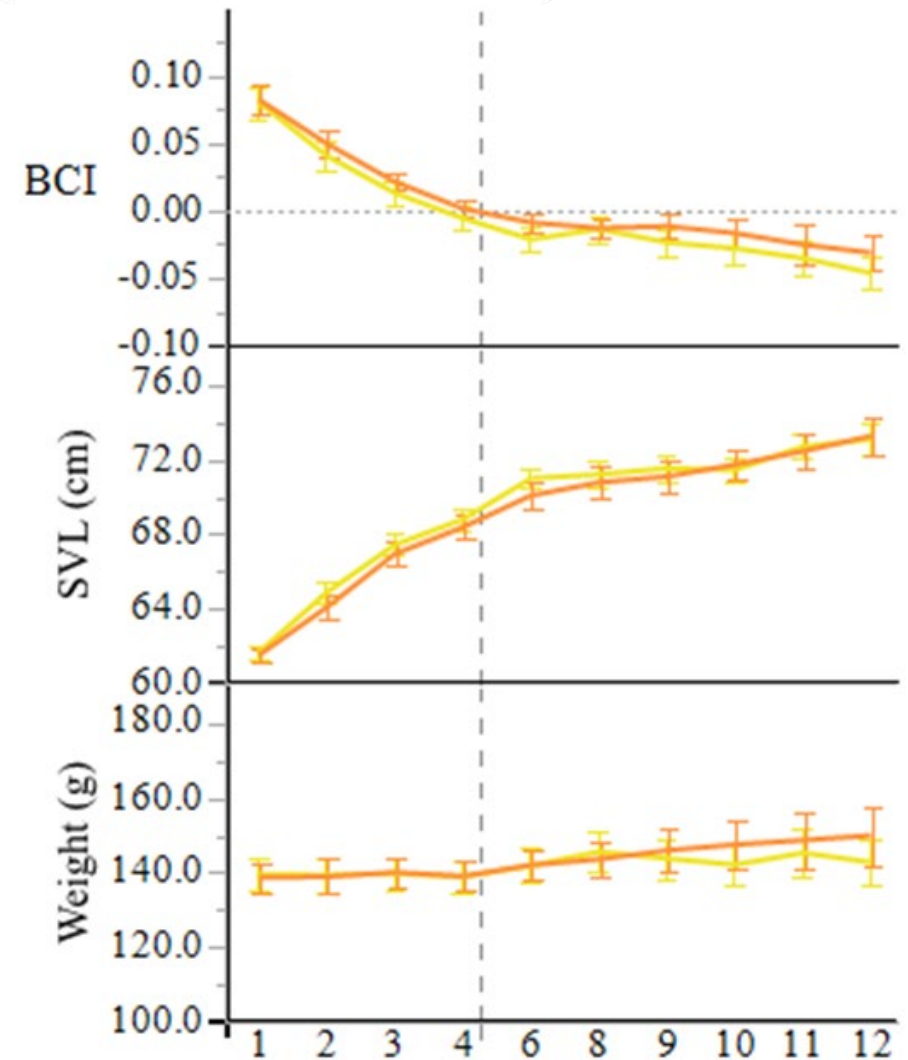
Jillian Josimovich, Bryan Falk,  
Alejandro Grajal-Puche,  
Emma Hanslowe, Ian Bartoszek,  
Bob Reed, & Andrea Currylow

*In review*



High = Weekly

Low = 3 Weeks



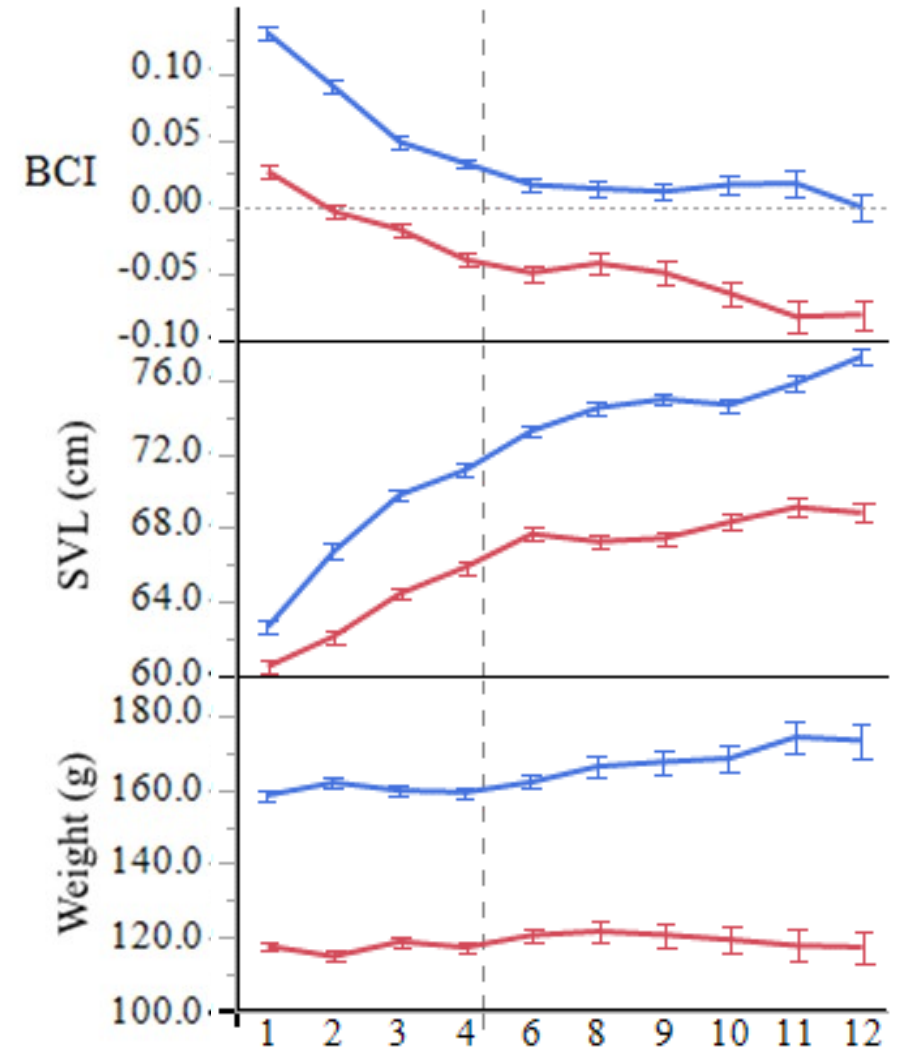
Everglades Cooperative Invasive Species Management Area

Preliminary Information-Subject to Revision. Not for Citation or Distribution

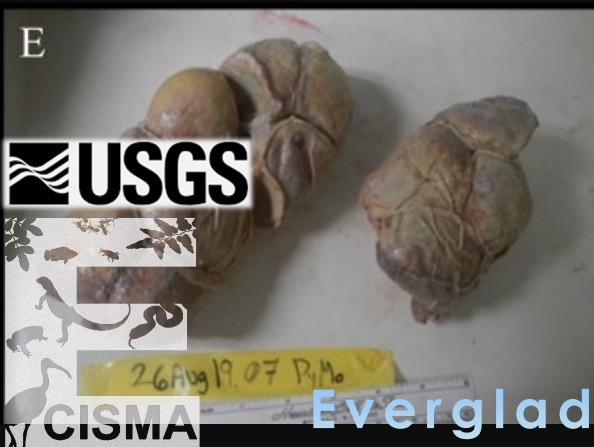
# Clutch predicts growth of hatchling Burmese pythons better than food availability or sex

Jillian Josimovich, Bryan Falk, Alejandro Grajal-Puche, Emma Hanslowe, Ian Bartoszek, Bob Reed, & Andrea Currylow

*In review*







# Egg Retention in Wild-caught *Python bivittatus* in the Greater Everglades Ecosystem, Florida, USA

Gretchen Anderson, Frank Ridgley, Jillian Josimovich, Bob Reed, Bryan Falk, Amy Yackel Adams, & Andrea Currylow

*In review*

Everglades Cooperative Invasive Species Management Area

Preliminary Information-Subject to Revision. Not for Citation or Distribution



# *Agkistrodon conanti* (Florida Cottonmouth) and *Python bivittatus* (Burmese Python). Predator-prey interaction

Ian Bartoszek, Gretchen Anderson, Ian Easterling,  
Jillian Josimovich, Adam Furst, Frank Ridgley,  
Austin Fitzgerald, Amy Yackel Adams, &  
Andrea Currylow

*In review*

Preliminary Information-Subject to Revision.  
Not for Citation or Distribution



Everglades Cooperative Invasive Species Management Area



# Future Directions

- Python Synthesis(!)
- Vital Rates - contribute to:
  - Abundance estimation given existing models, generate new models if needed
  - Enhance detection and monitoring tools for invasives
  - Continue collaborative research programs
  - Mentorship for researchers & managers

 USGS



Everglades Cooperative Invasive Species Management Area

# Invasive Burmese pythons in Florida: A synthesis of biology, impacts, and management tools “Python Synthesis”

Jackie Guzy, Bryan Falk, Brian Smith, J.D. Willson, Bob Reed,  
Mike Cherkiss, Kristen Hart et al.

*In prep.  
Ecological  
Monographs*

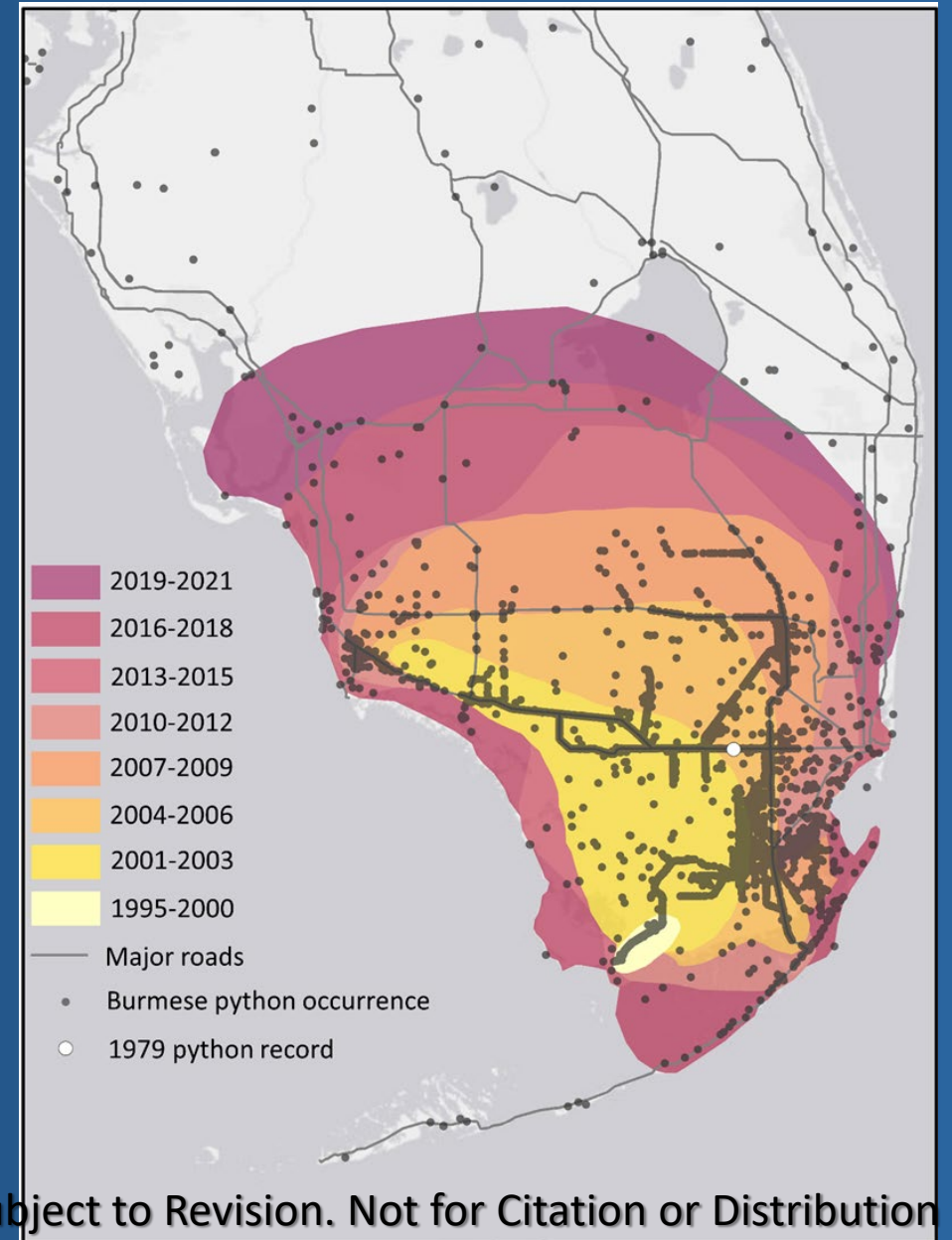
## Topics

- History of invasion
- Current distribution
- Basic biology
- Diet
- Movement, dispersal
- Habitat use
- Prey declines
- Trophic structure changes
- Pathogen/parasite spread
- Detection tools (e.g., eDNA)

## Future research directions highlights lack of key data:

- Information on abundance
- Detection probability is low
- Substantial capture effort (trapping, surveys, scouts)
- Limited methodologies focused on detection
- Available control tools are insufficient to eradicate

Preliminary Information-Subject to Revision. Not for Citation or Distribution



Everglades Cooperative Invasive Species Management Area

USGS



CISMA

*... so we don't have the whole picture*

More research needed on  
python vital rates:

- Age-/size-specific survival
- Sex ratios
- Age at maturity
- Reproductive output & frequency
- Dispersal
- Population size & growth rates



# Why Vital Rates? Life Tables

Vital Rates are necessary to:

- Maximize control efficacy
- Target critical life stages for control
- Identify rates creating additive mortality
- Elastic parameters with low variation = little use

- All life stages
- All potential habitats

Life History Trait	Site 1	Site 2
Size at maturity	2.2 m	1.8 m
Age at maturity	2 years	1.5 years
Reproductive rate	Annual	Biannual
Mean litter size	45 neonates	34 neonates
Median lifespan	15 years	22 years



Preliminary Information-Subject to Revision.  
Not for Citation or Distribution

# Why Vital Rates? Life Tables

Vital Rates are necessary to:

- Maximize control efficacy
- Target critical life stages for control
- Identify rates creating additive mortality
- Elastic parameters with low variation = little use

Vital Rate research benefits:

- Evaluate removal efficacy in population trajectory
- Target most impactful parameters in each habitat type
- Inform potential synthetic biology efforts of population suppression



Preliminary Information-Subject to Revision.  
Not for Citation or Distribution



Everglades Cooperative Invasive Species Management Area

Preliminary Information-Subject to Revision. Not for Citation or Distribution



U.S. Department of the Interior  
U.S. Geological Survey

Everglades Cooperative Invasive Species Management Area

## Questions



*Think locally, Act neighborly*  
invasive species know no boundaries!

