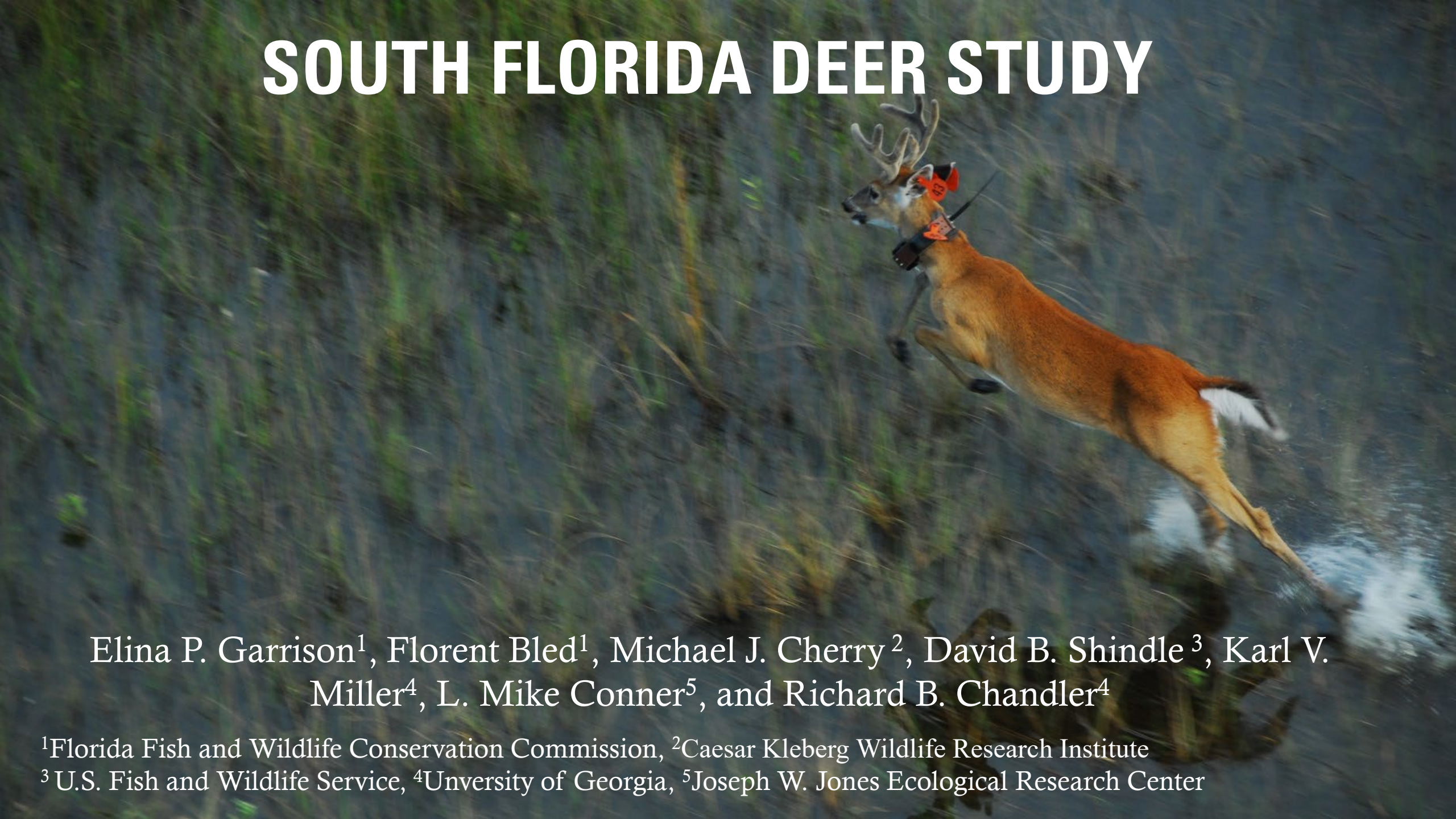
SOUTH FLORIDA DEER STUDY



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[1]Florida Fish and Wildlife Conservation Commission, [2]Caesar Kleberg Wildlife Research Institute
[3] U.S. Fish and Wildlife Service, [4]Unversity of Georgia, [5]Joseph W. Jones Ecological Research Center

HISTORY OF SOUTH FLORIDA DEER

- Generally low density, fluctuated with wet and dry years
- Drainage program: mixed blessing for deer
- Unregulated hunting, commercial deer hide trade, attempts to eradicate Texas cattle fever
- By late 1930 – lowest point

HISTORY OF SOUTH FLORIDA DEER

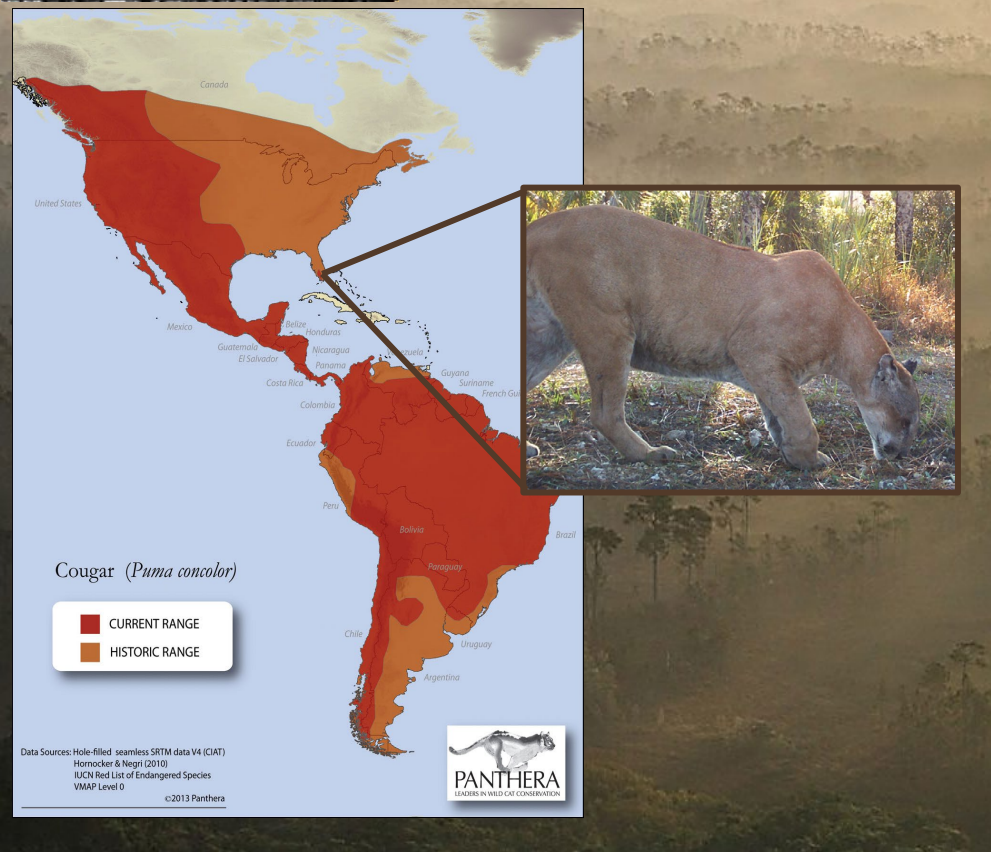
- 1940s: Beginning of recovery
- Enforcement of game laws, screw-worm eradication, restoration of deer populations and habitat management
- Likely exceeded historical levels

HISTORY OF SOUTH FLORIDA DEER

ROLE OF FLORIDA PANTHERS

- Panther population
  - Unlimited hunting and persecution

- 1967 Endangered Species
- 1995 Genetic restoration

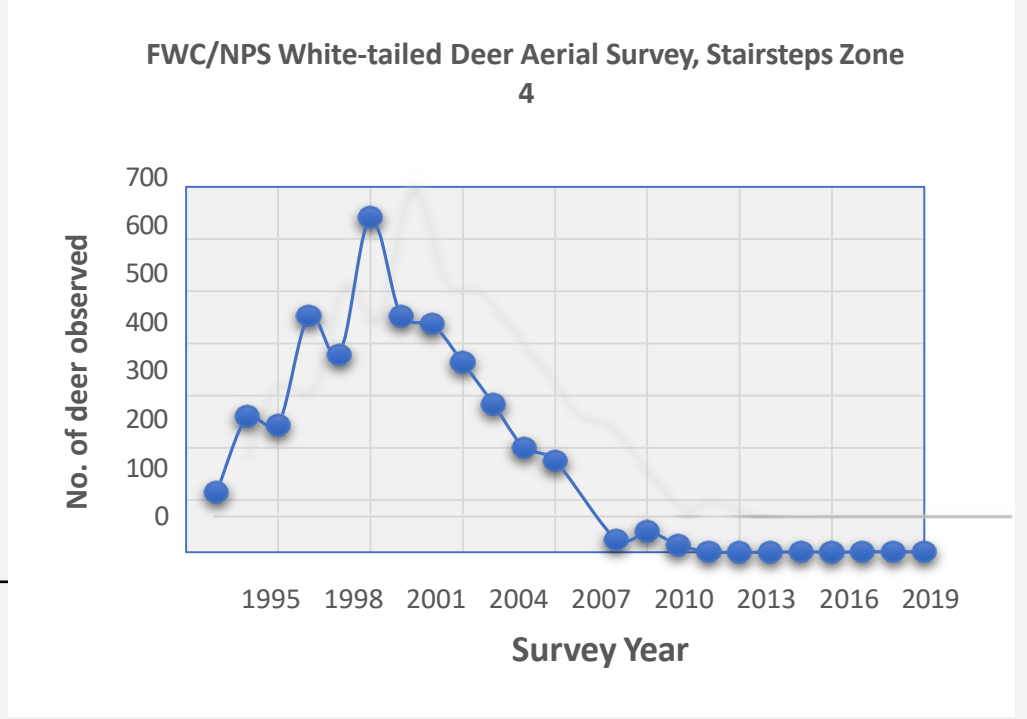


SOUTH FLORIDA DEER – CURRENT

CONCERNS OVER DEER POPULATION TRENDS

- Deer population declines
- Previous deer research: 1980-1990s

- Everglades restoration
- Predator community

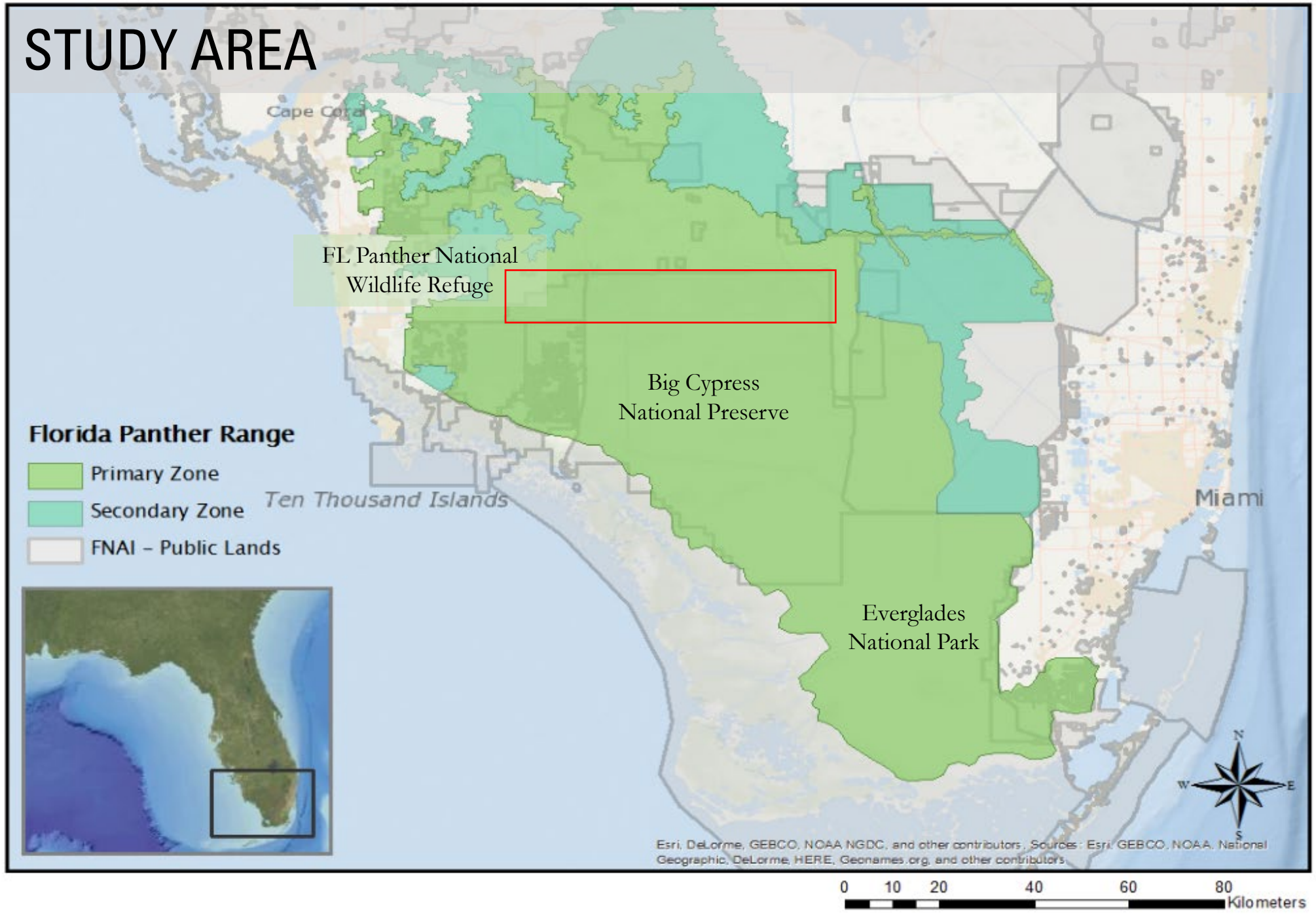


OBJECTIVES OF THE SOUTH FLORIDA DEER PROJECT

- Understand what factors influence deer population dynamics in South Florida.
  - Hydrology, hunting and predation

- Develop a monitoring method for large-scale investigation and monitoring of deer populations

STUDY AREA

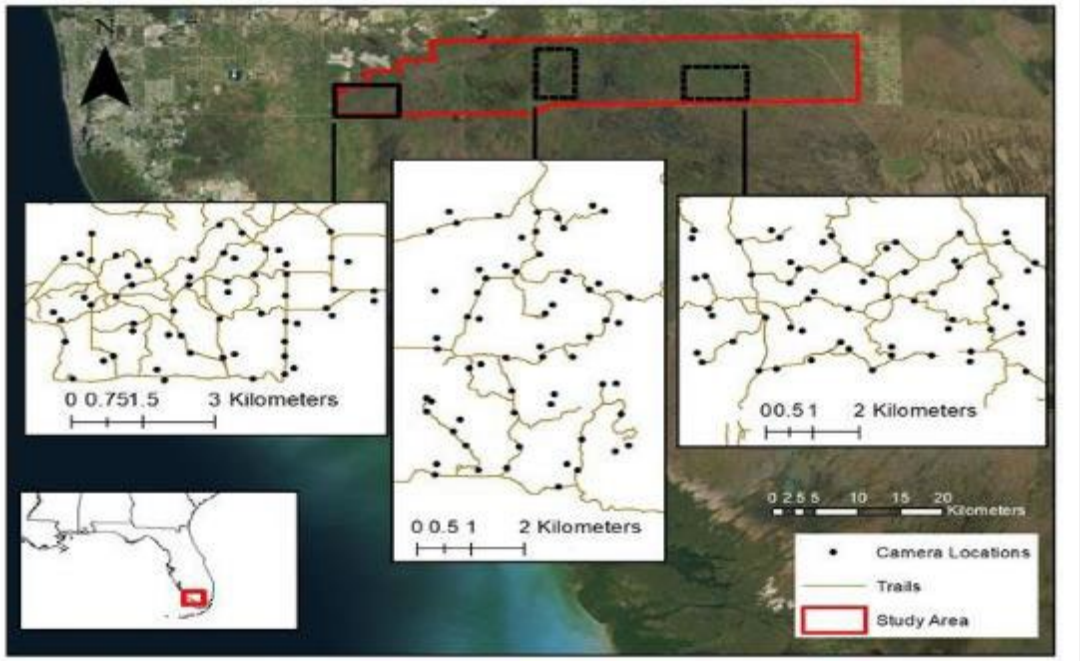

Cape Coral
FL Panther National Wildlife Refuge
Big Cypress National Preserve
Florida Panther Range
Primary Zone
Secondary Zone
FNAI – Public Lands
Ten Thousand Islands
Miami
Everglades National Park
N
W
E
S
Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors, Sources: Esri, GEBCO, NOAA, National Geographic, DeLorme, HERE, Geonames.org, and other contributors
0 10 20 40 60 80
Kilometers

METHODS

- Combine collar and camera data at a large scale
- Captured and collared deer in Jan 2015, Jan 2016, and Jan 2017
- Helicopter, darting, rocket net
- Fitted with GPS collars

METHODS: REMOTE SENSING TRAIL CAMERAS

- 180 unbaited, remote sensing cameras distributed across the 3 areas
- Operated 24hrs per day, year-round



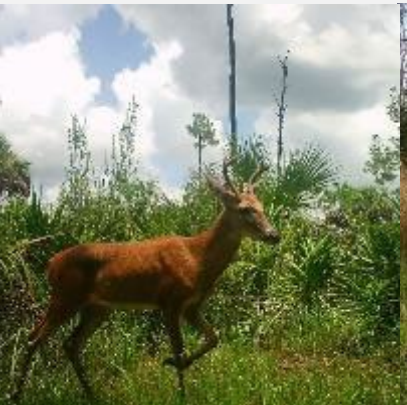
RESULTS: DEER CAPTURES

- 294 deer captured
  - 263 (172 F, 91 M) adults
  - 24 (13 F, 11 M) sub-adults

- 590,000 deer locations

RESULTS: REMOTE SENSING CAMERAS

- 477,000 wildlife and human images
- Cataloged by species, study area, etc.
- Deer: sex, age class, group size, individual ID, behavior, etc.

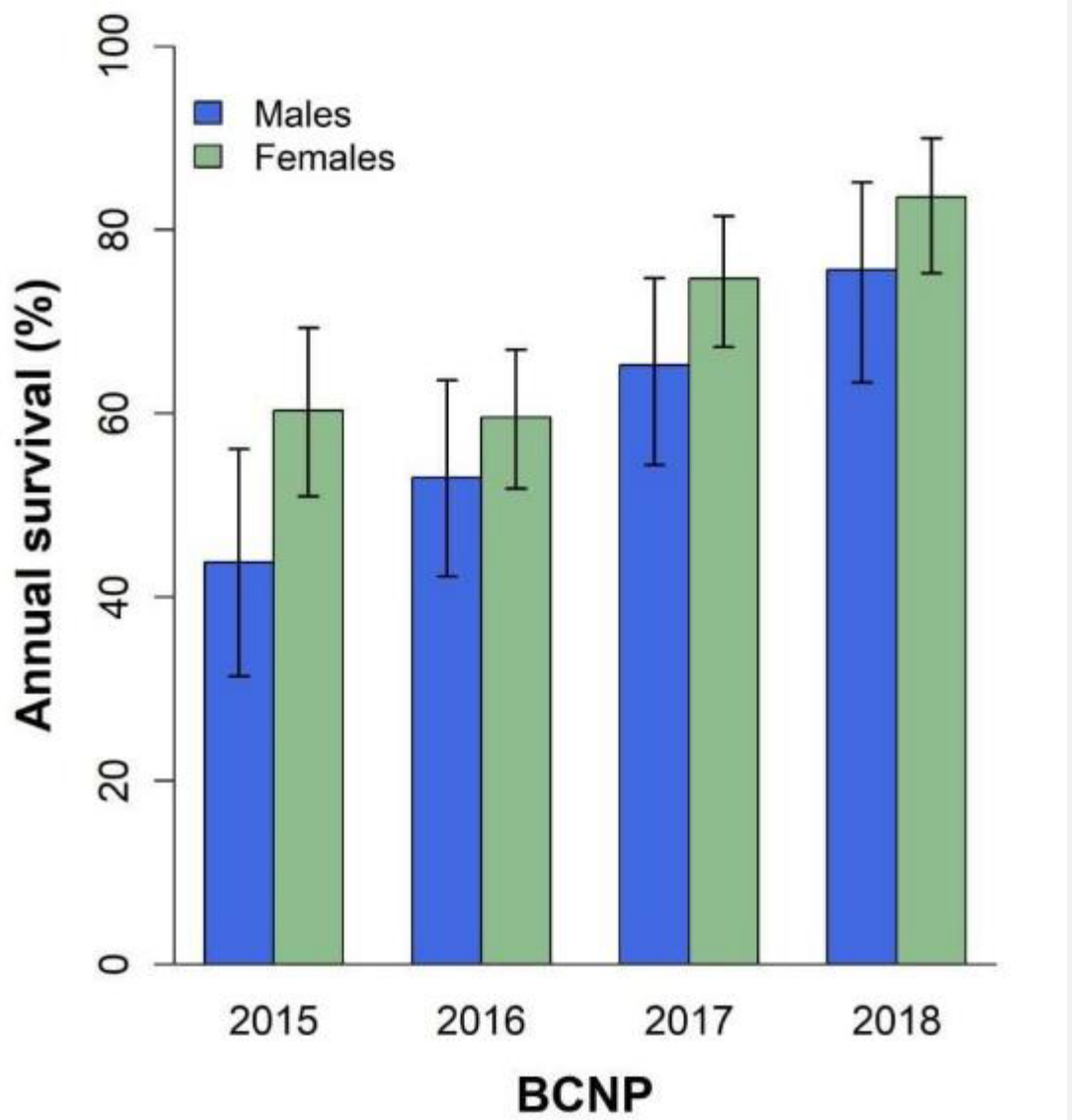




UNDERSTANDING WHAT FACTORS INFLUENCE DEER POPULATIONS IN SOUTH FLORIDA

- Sex, season and area-specific difference
- Average annual male survival rates: 45-79%
- Average annual female survival: 61-86%

- Compared to other deer populations – very low
- Increased over the course of the study



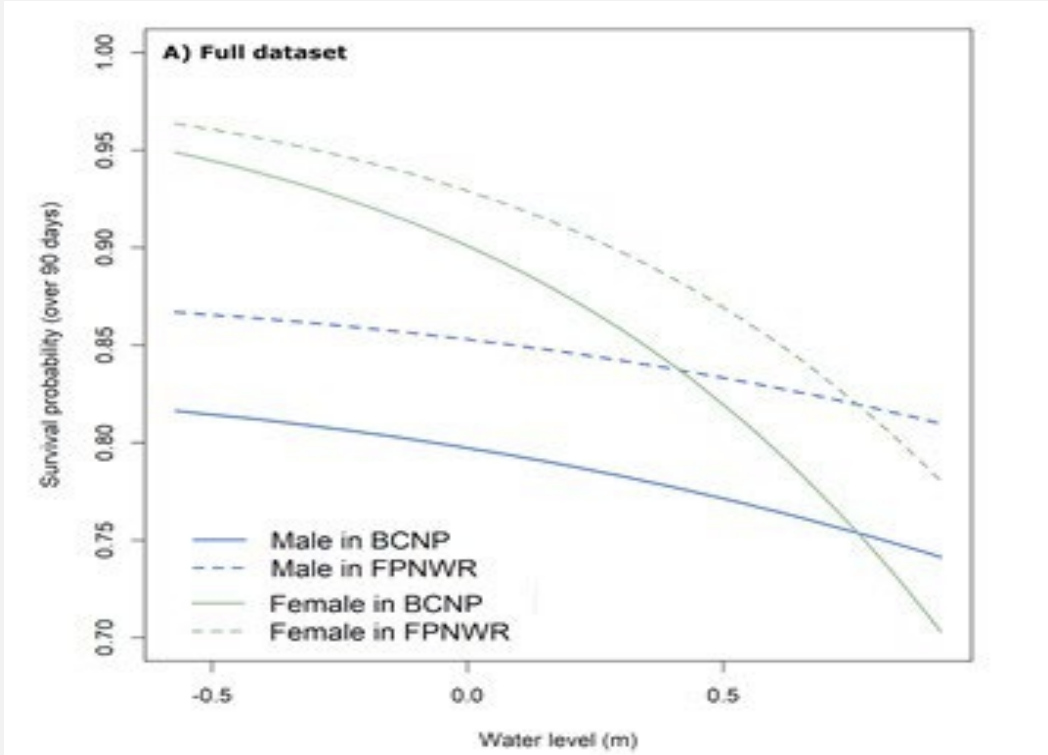
241 monitored deer, 134 mortalities

Cause	No.	Percentage
Panther	96	72%
Bobcat	7	5%
Pathology	4	3%
Predation (unknown)	4	3%
Research related	3	2%
Bear	2	1.5%
Poaching	2	1.5%
Alligator	1	1%
Hunting	1	1%
Unknown	14	10%

SURVIVAL AND WATER

- As water level increased, survival decreased
- More pronounced effect on female survival

- No deer died directly from drowning
- Water levels influenced movement - increased use of edges and roads during high water



Bled, F., Cherry, M. J., Garrison, E. P., Miller, K. V., Conner, L. M., Abernathy, H. N., ... & Chandler, R. B. (2022). Balancing carnivore conservation and sustainable hunting of a key prey species: A case study on the Florida panther and white-tailed deer. ***Journal of Applied Ecology*, *59*(8), pp. 2010-2022**.

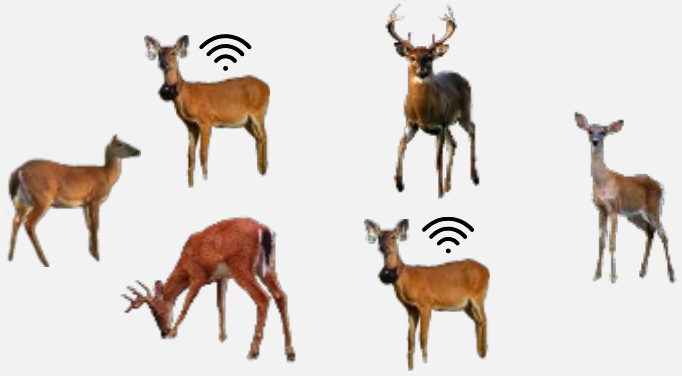
DEVELOPMENT OF A MONITORING METHOD

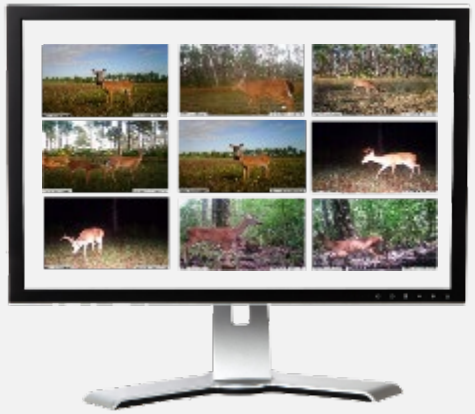
- Foundation: spatial capture-recapture (SCR) model
- Deer population – only partially marked

- For comprehensive, practical monitoring program for white-tailed deer – need to be able to account for unmarked individuals
- Here is where the collared, individually marked deer come in

Generalized spatial mark-resight (SMR) model

Stage 1



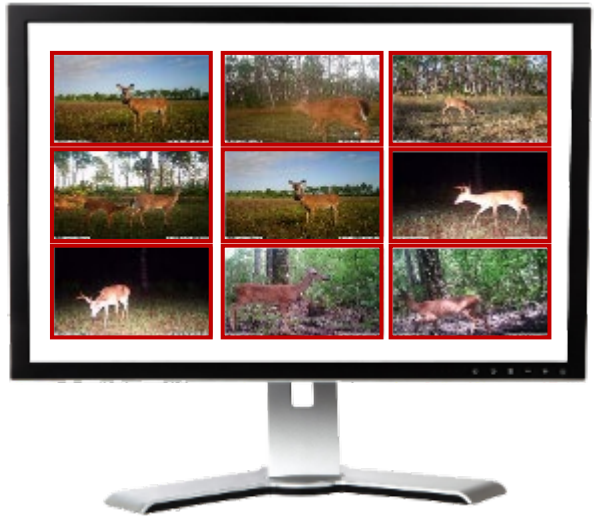


Detection Parameters

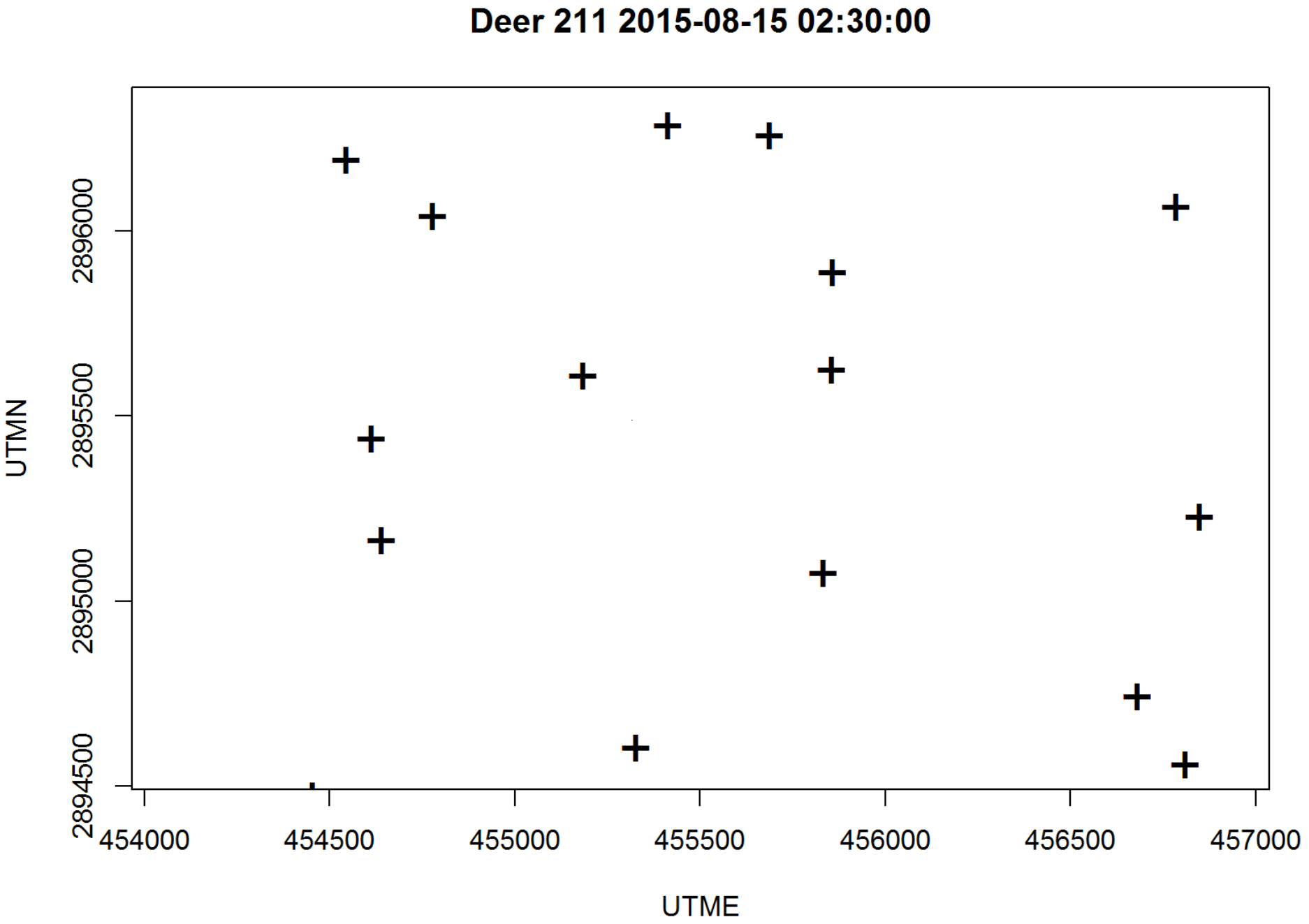
Baseline encounter

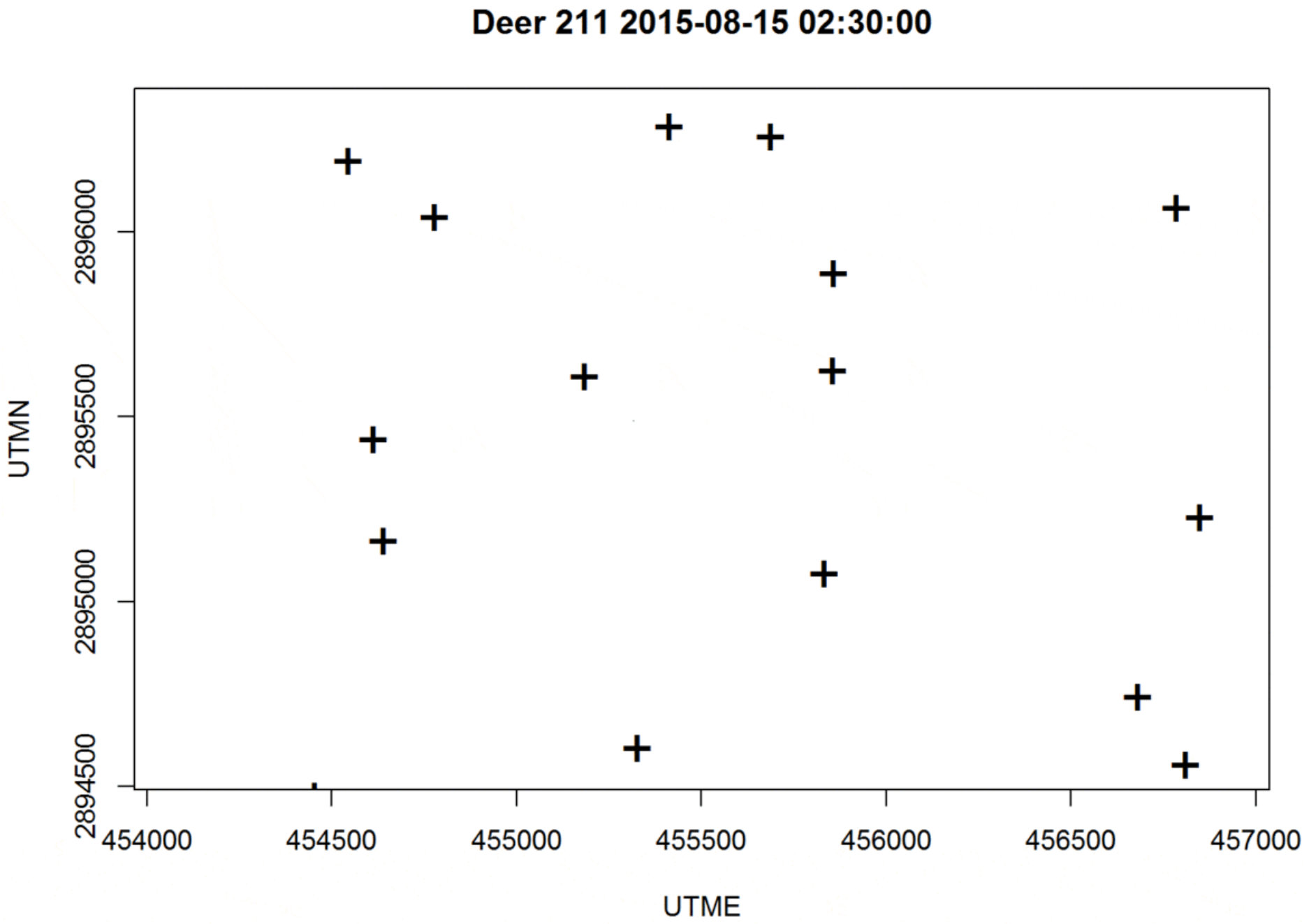
Spatial scale parameter

Stage 2



Density Abundance


Deer 211 2015-08-15 02:30:00
UTMN
2894500
2895000
2895500
2896000
454000
454500
455000
455500
456000
456500
457000
UTME


Deer 211 2015-08-15 02:30:00
UTMN
2894500
2895000
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2896000
454000
454500
455000
455500
456000
456500
457000
UTME

Margenau, L. L., Cherry, M. J., Miller, K. V., Garrison, E. P., & Chandler, R. B. (2022). Monitoring partially marked populations using camera and telemetry data. ***Ecological Applications*****,** e2553.

Chandler, R. B., Crawford, D. A., Garrison, E. P., Miller, K. V., & Cherry, M. J. (2021). Modeling abundance, distribution, movement and space use with camera and telemetry data. ***Ecology***, e03583

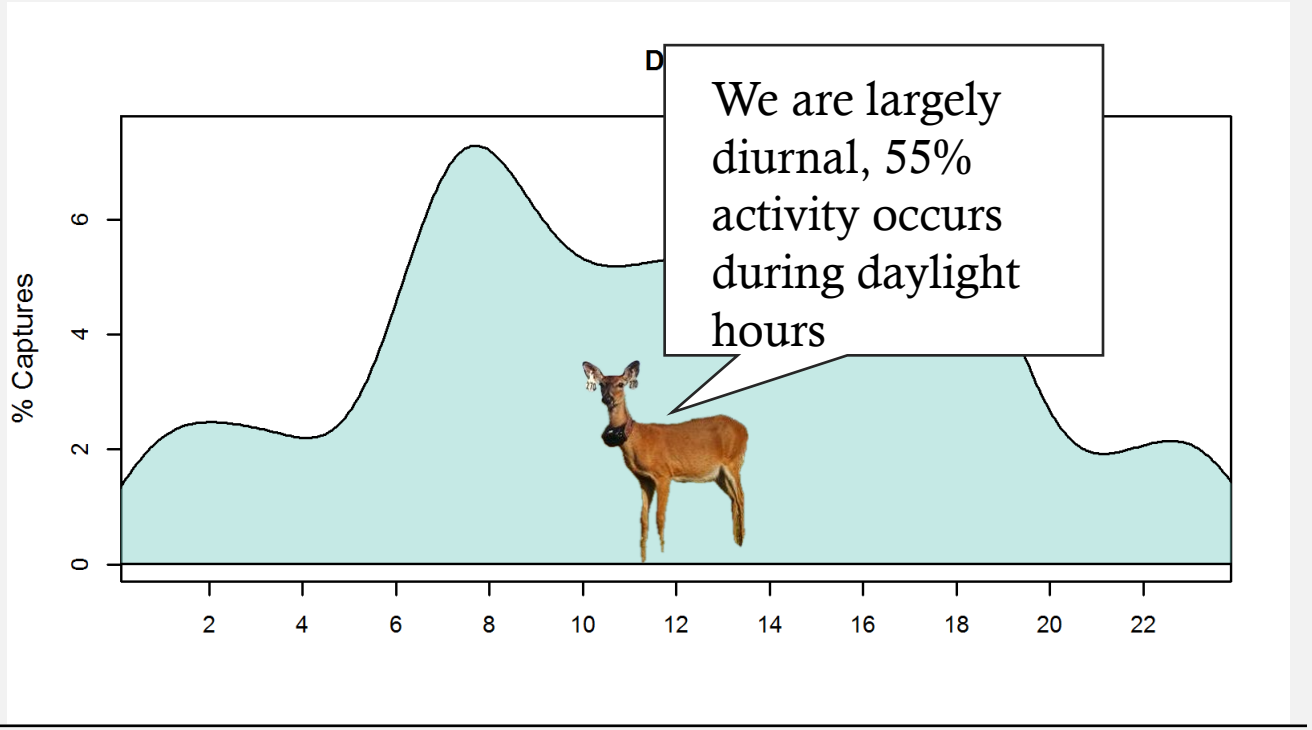
Chandler, R. B., Engebretsen, K. N., Cherry, M. J., Garrison, E. P., and K.G. Miller. (2018). Estimating recruitment from capture-recapture data by modeling spatio-temporal variation in birth and age-specific survival rates. ***Methods in Ecology and Evolution*** 9:2115-2130.

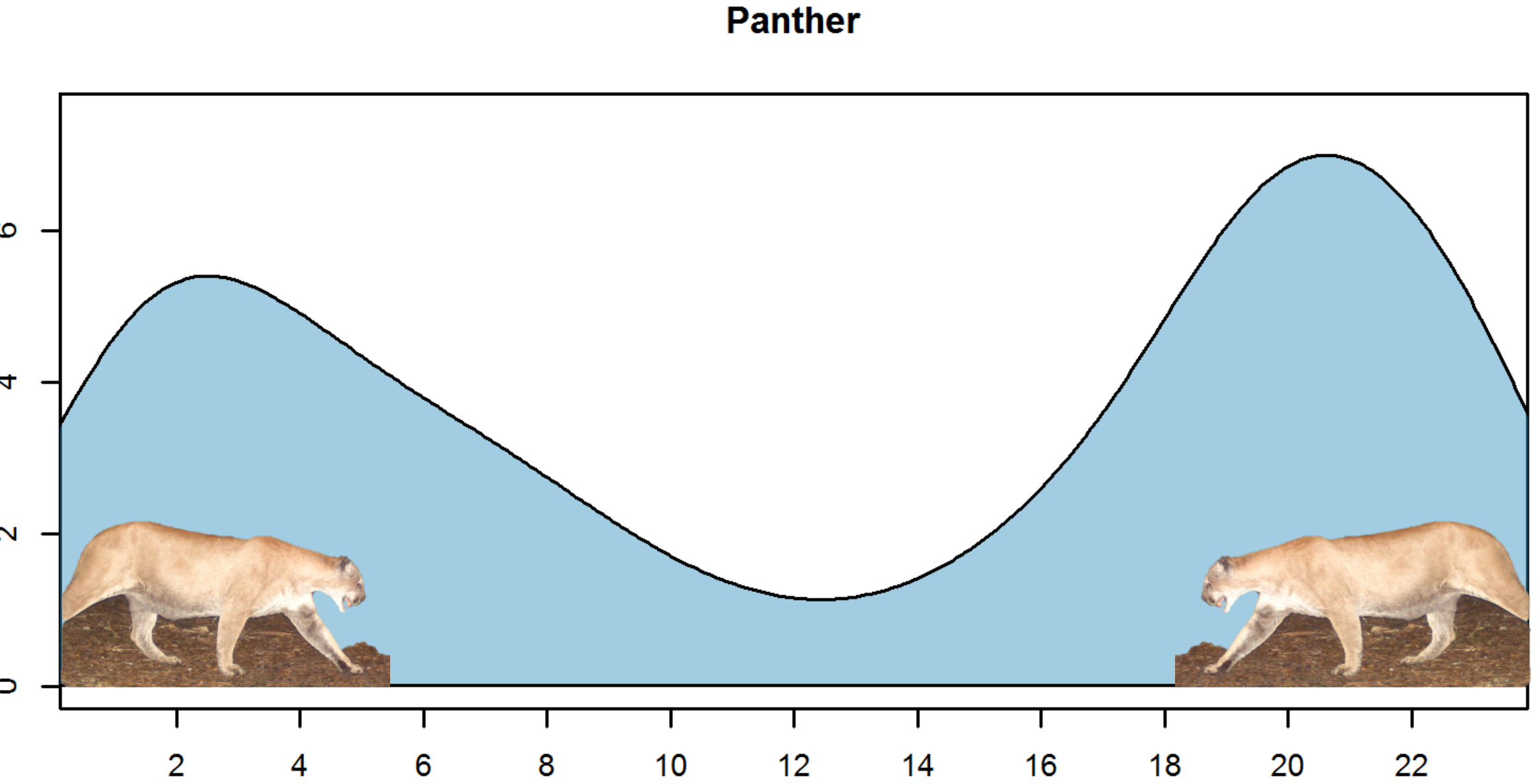
ECOLOGICAL APPLICATIONS
ECOLOGICAL SOCIETY OF AMERICA

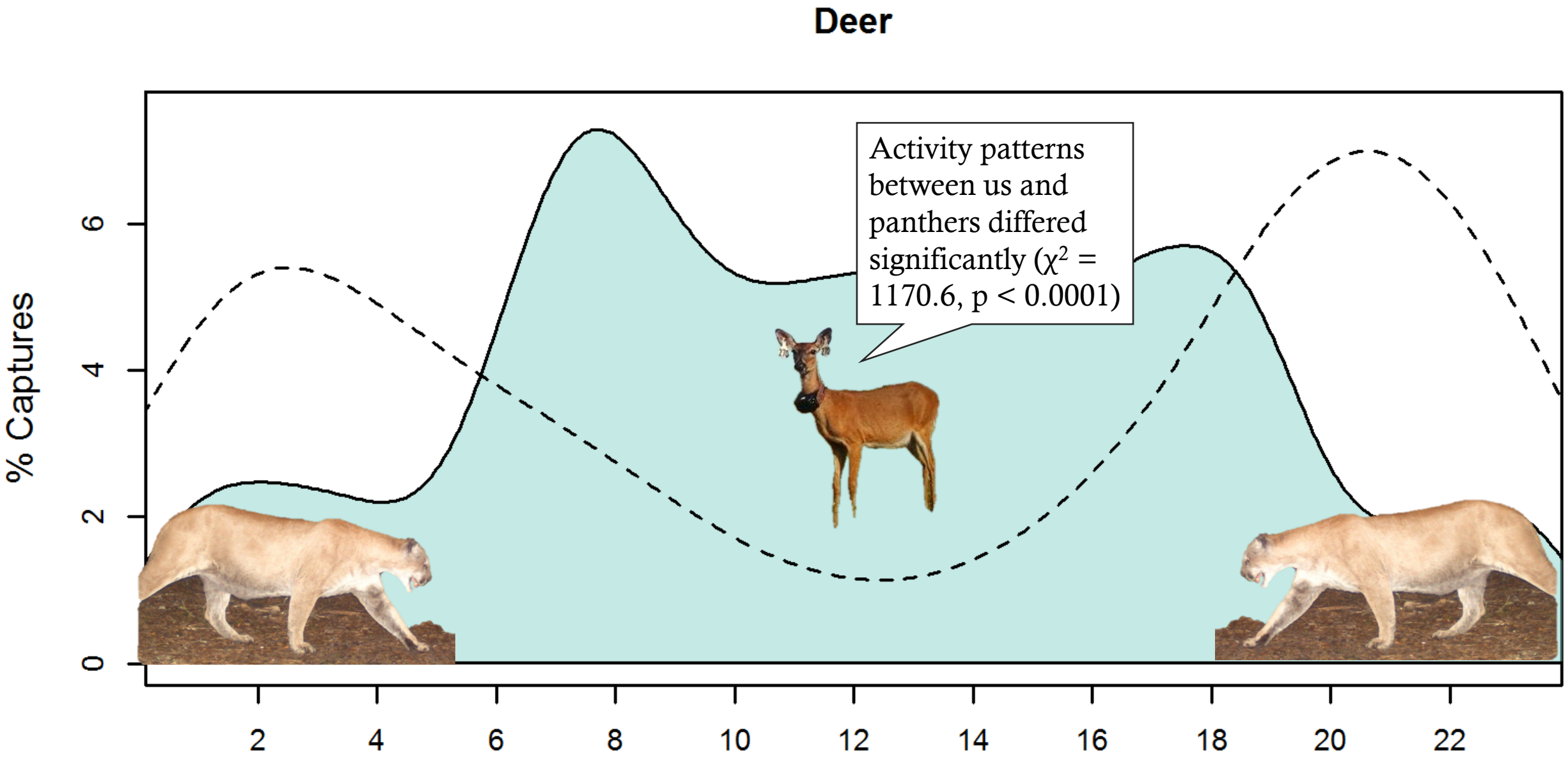
ECOLOGY
ECOLOGICAL SOCIETY OF AMERICA

Methods in Ecology and Evolution

“Deer move most at dawn and dusk. **End of story.** Like taxes and death, you can count on two things when talking about mature bucks: they move most at dawn and dusk, and during the rut. Deer are crepuscular. It’s built into their DNA.” -Quality Deer Management Association




Panther
0
2
4
6
2
4
6
8
10
12
14
16
18
20
22

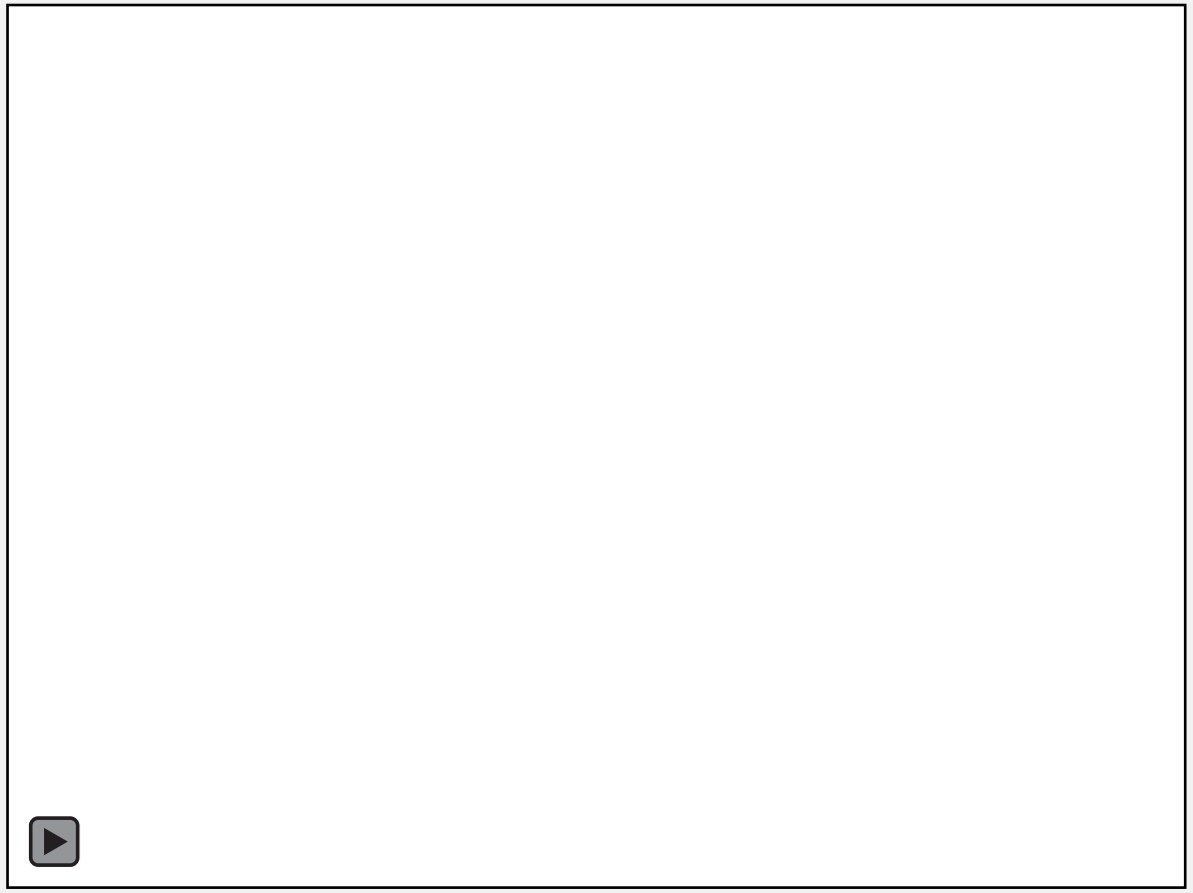

Deer
% Captures
0
2
4
6
2
4
6
8
10
12
14
16
18
20
22
Activity patterns between us and panthers differed significantly (χ^2 = 1170.6, p < 0.0001)

HOW HAVE THINGS CHANGED?

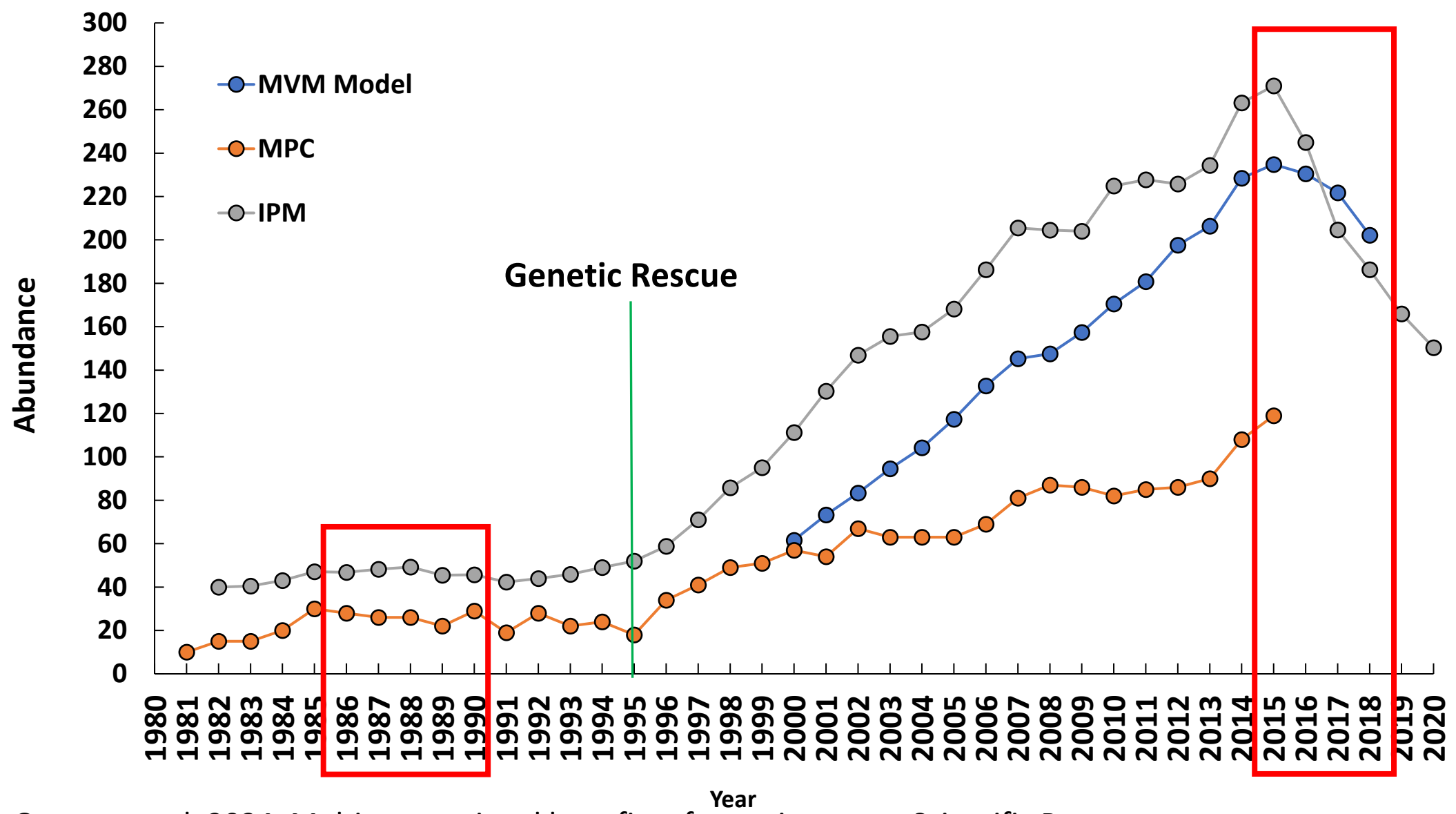
Relative to studies in the 1990's

- Panther predation increased
- Bobcat predation decreased
- Hunter harvest insignificant

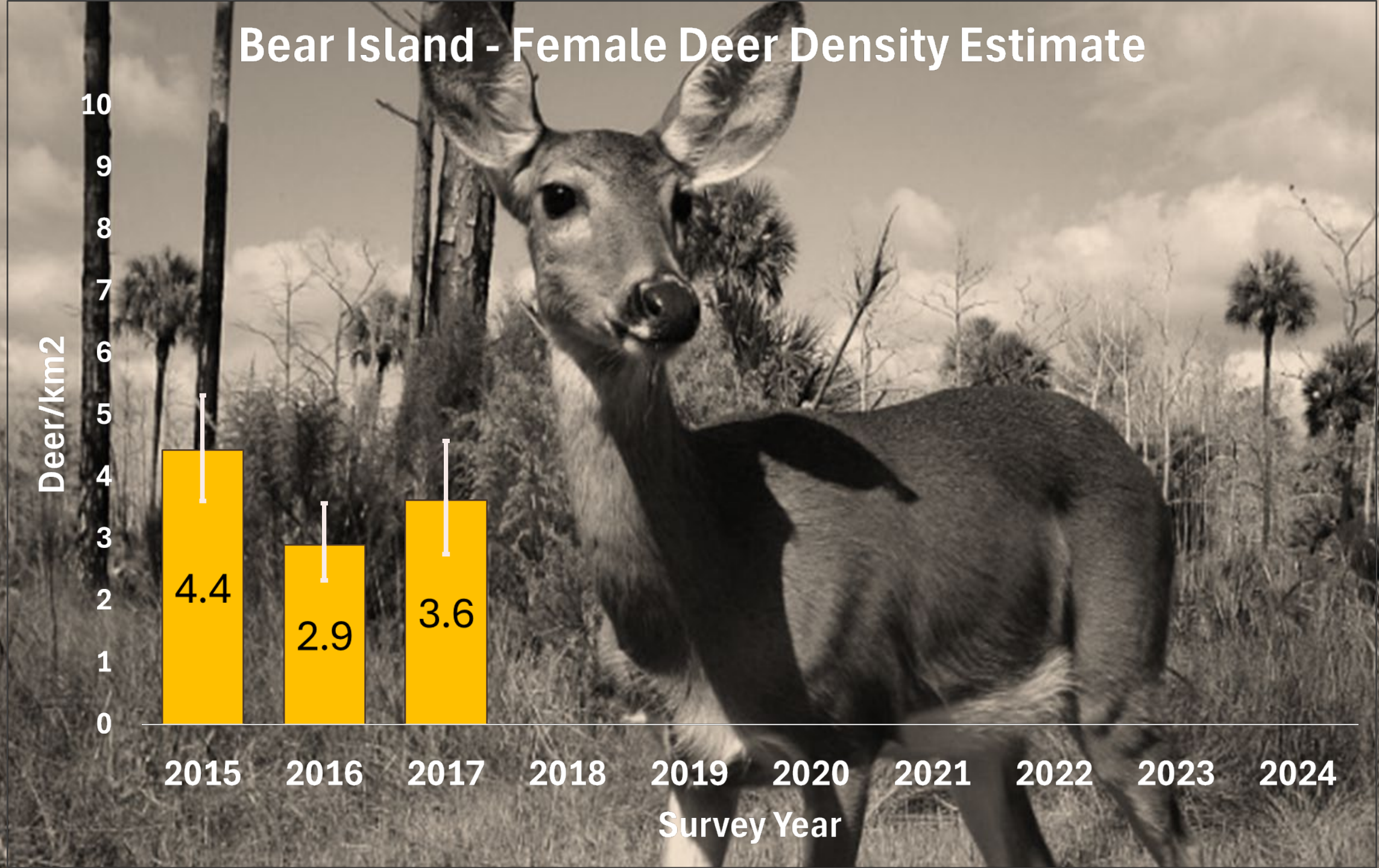
- Hydrology plays a part

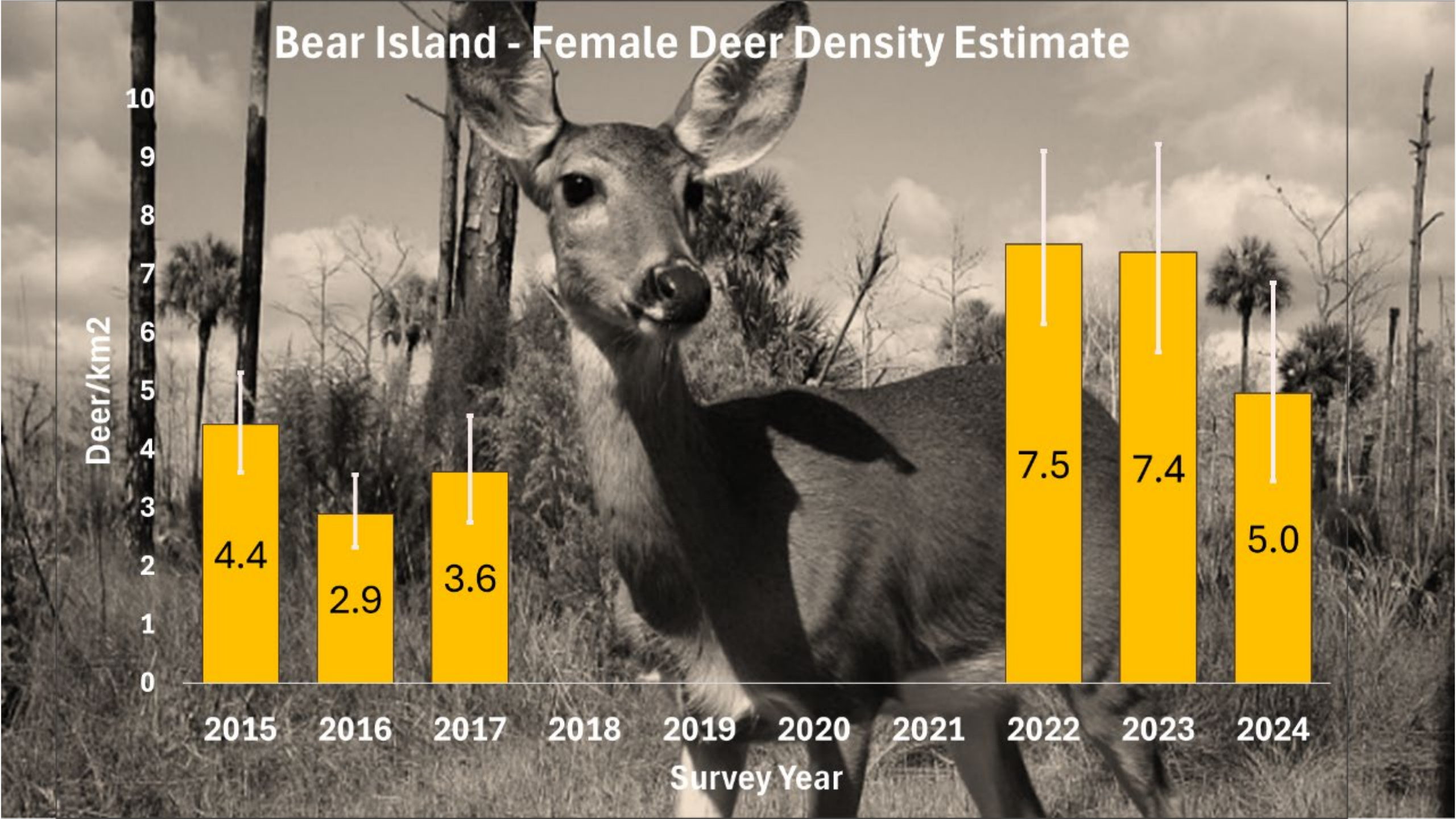


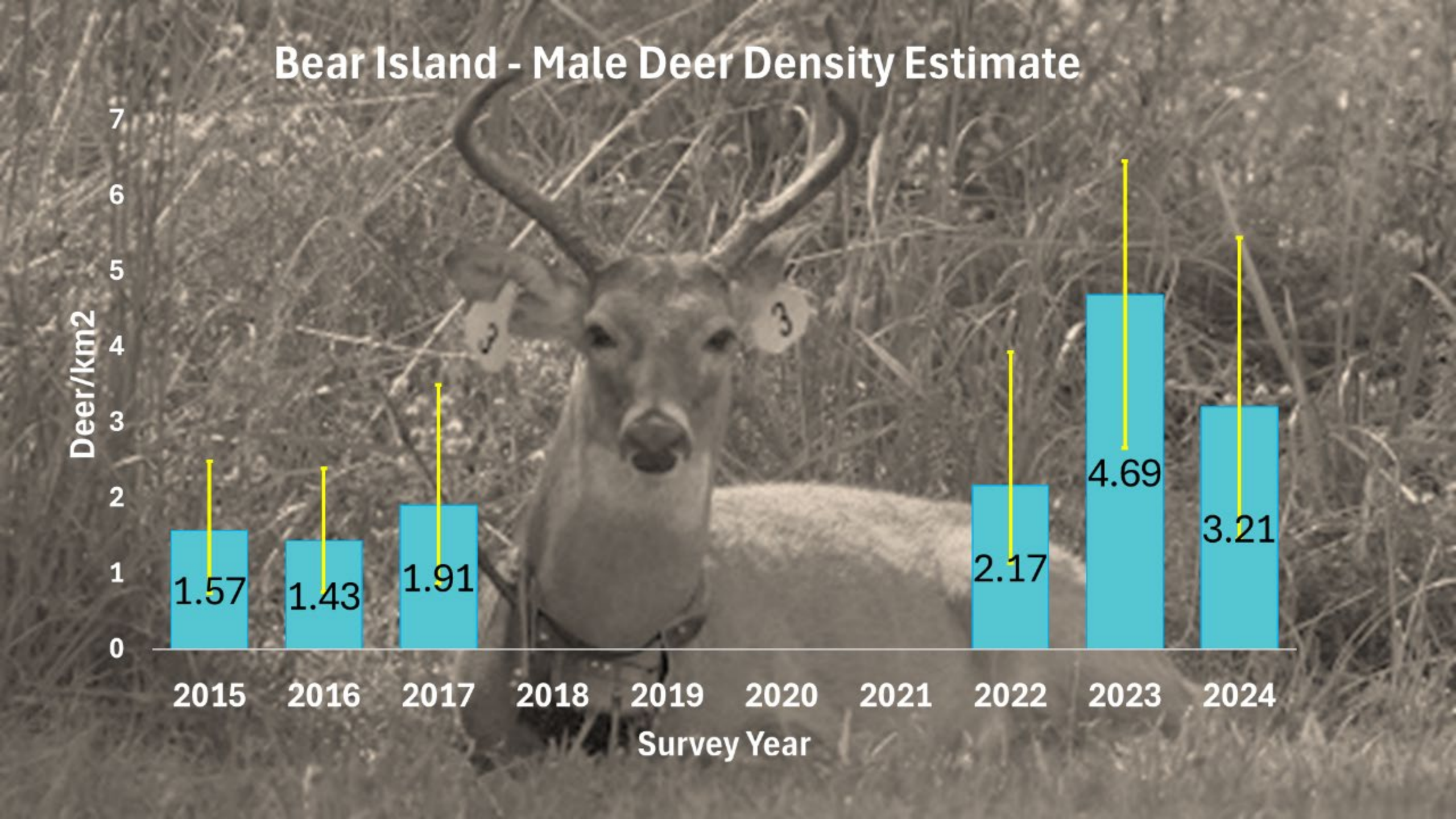
PANTHER INDEX AND ESTIMATE OF ABUNDANCE



Onorato et al. 2024. Multi-generational benefits of genetic rescue. Scientific Reports.


Bear Island - Female Deer Density Estimate
Deer/km2
10
9
8
7
6
5
4
3
2
1
0
4.4
2.9
3.6
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
Survey Year


Bear Island - Female Deer Density Estimate
Deer/km2
10
9
8
7
6
5
4
3
2
1
0
4.4
2.9
3.6
7.5
7.4
5.0
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
Survey Year


Bear Island - Male Deer Density Estimate
Deer/km2
0
1
2
3
4
5
6
7
1.57
1.43
1.91
2.17
4.69
3.21
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
Survey Year

SUMMARY

- Survival rates low, but increased during the study
- Majority of mortalities due to panther predation
- Increases in water depth negatively influenced female survival
- Mortality due to harvest minimal - conservative harvest is appropriate

SUMMARY

- However, still trouble in paradise
  - Population south of I-75
- On the table, off the table
- Continued management – active and ongoing

  Science-based monitoring

  Battle python invasion

  Habitat management

  Adaptive to the future changes in the ecosystem and landscape that go hand-in-hand with the Everglades restoration efforts

MS: Daniel A. Crawford (UGA), Kristin N. Engebretsen (UGA) and W. Hunter Ellsworth (Virginia Tech)
PhD: Heather N. Abernathy (Virginia Tech) and Lydia L. Stiffler (UGA)
Postdoc: Florent Bled (UGA)

U.S. Fish and Wildlife Service, Florida Panther National Wildlife Refuge
National Park Service, Big Cypress National Preserve
Florida Hunters