Variation in adult Burmese python (*Python molurus bivittatus*) survival across southern Florida

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Pythons in Florida

Impacts have been devastating

- Native species populations
- Disease/parasite spread
- Low detection influences our ability to understand what impacts their survival

Greatest obstacle to developing landscape-scale control programs

…is very low individual detection probabilities

USGS science for a changing world

NATIONAL PARK SERVICE

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION

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

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Advancing research on alien species and biological invasions

BURMESE PYTHONS IN FLORIDA: A SYNTHESIS OF BIOLOGY, IMPACTS, AND MANAGEMENT TOOLS

By

Jacquelyn C. Guzy, Bryan G. Falk, Brian J. Smith, John David Willson, Robert N. Reed et al.

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Special Issue

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SCAN ME

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Natural history of pythons in Florida: what we know about demography

- Mortality:
  - Alligators, bobcats, snakes, crocodiles, humans
- Breeding season: Dec – Mar, aggregate, multiple paternity
- Oviparous:
  - Brooding, shivering thermogenesis
  - Clutch size: ~20 - 50 eggs
  - Large snakes (~4.8 m snout-vent length): 79 – 95 eggs
- Minimum size at maturity
  - Females ♀ 2.10 m total length
  - Males ♂ 1.43m total length

Photo credit: Daniel Fliehler

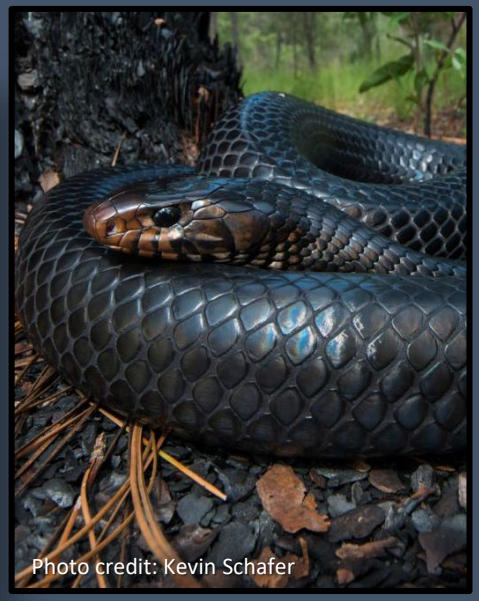
Photo credit: Kevin Schafer

Photo by Peter Crawford

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Natural history of pythons in Florida: what we don't know about demography

- Reproductive frequency: Annual? Biannual? Variation?
- Variation in age at maturity? Longevity?
- Growth rates of wild pythons?
  - Age: only identifiable 1st several months of 1st year
  - Variation in growth = hard to distinguish classes
- Survival:
  - Clutch?
  - Hatchlings: Limited. More Data needed across invaded range.

    In SW Florida: Annual survival 29% or 35% (whether unrecovered hatchlings presumed dead or censored)

Pittman and Bartoszek *BMC Zoology* (2021) 6:33
https://doi.org/10.1186/s40850-021-00098-2

RESEARCH ARTICLE

Initial dispersal behavior and survival of non-native juvenile Burmese pythons (*Python bivittatus*) in South Florida

Shannon E. Pittman[1,2*] and Ian A. Bartoszek[3]

  - Juvenile?
  - Subadult?
  - Adult?

Annual survival has not been well characterized

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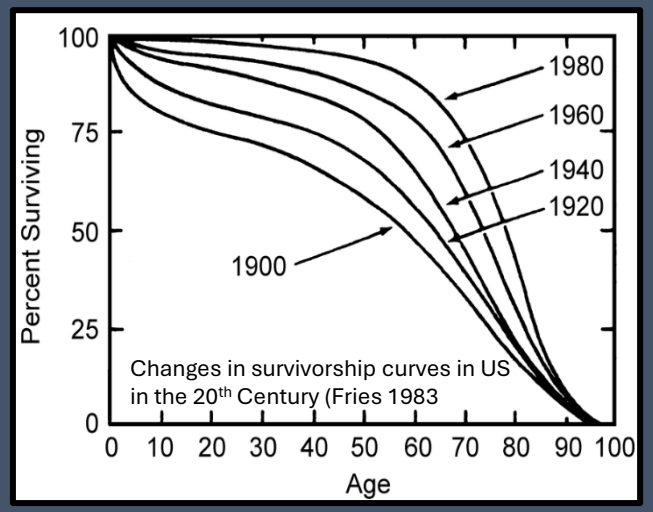
Why do we need survival estimates?

- Fill out a life table to:
  - Derive measures of mortality
  - Study longevity, fertility, dispersal, population growth (vital rates)



- Complete a structured population model
- Identify target age/size classes to improve removal efforts
- Estimate population growth rates to evaluate removals on population trajectory
- Inform genetic biocontrol efforts

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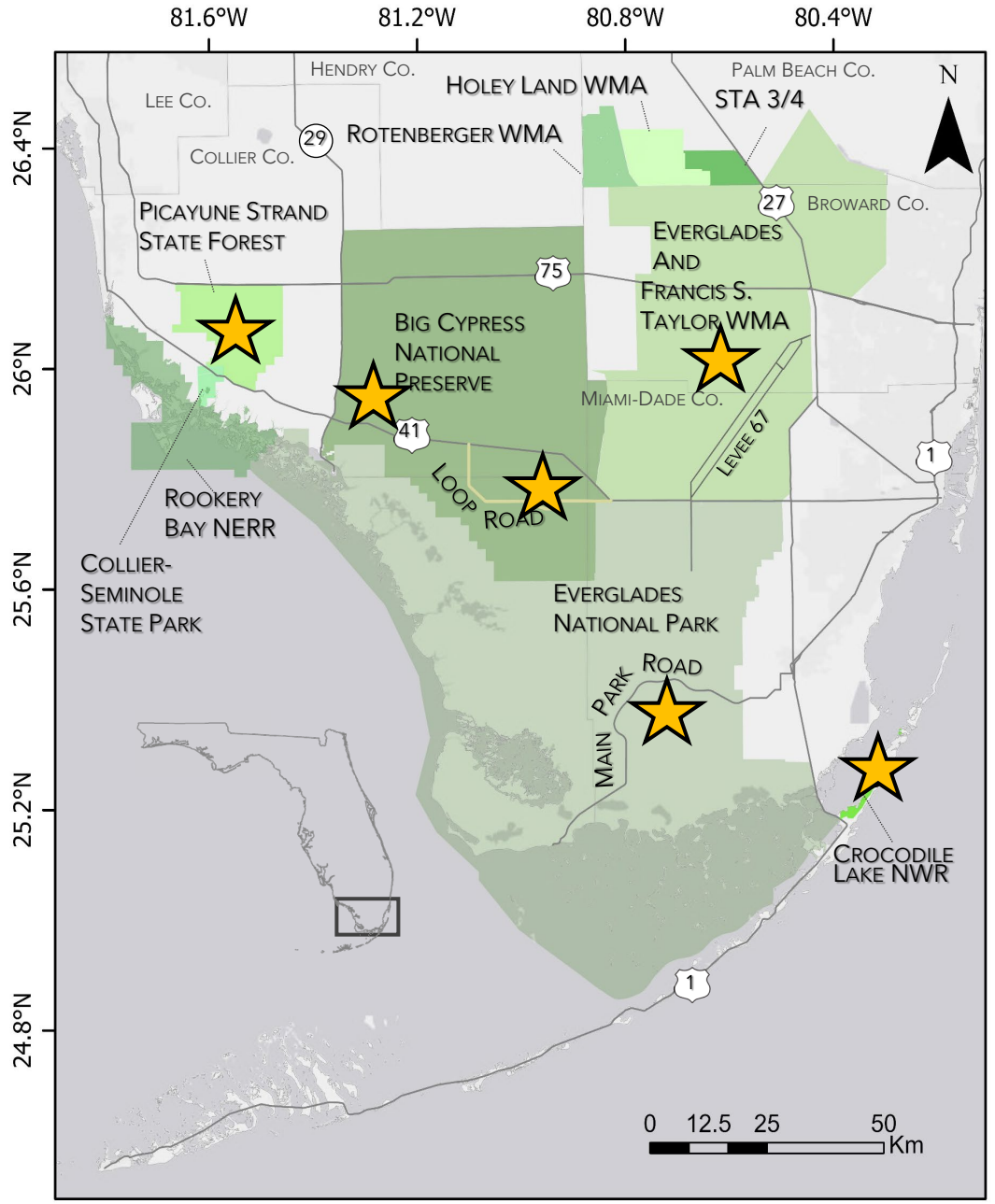
Survey locations across southern Florida

1. Southwest Florida
2. Big Cypress National Preserve – Turner
3. Big Cypress National Preserve – Loop
4. Everglades National Park
5. Crocodile Lake NWR – Key Largo
6. Everglades and Francis S. Taylor WMA

2005-2024 (18 years), 224 adult pythons

VHF telemetry

- Ground tracking on foot by **>135** people
- Fixed wing aircraft
- Airboat, kayaks, boats



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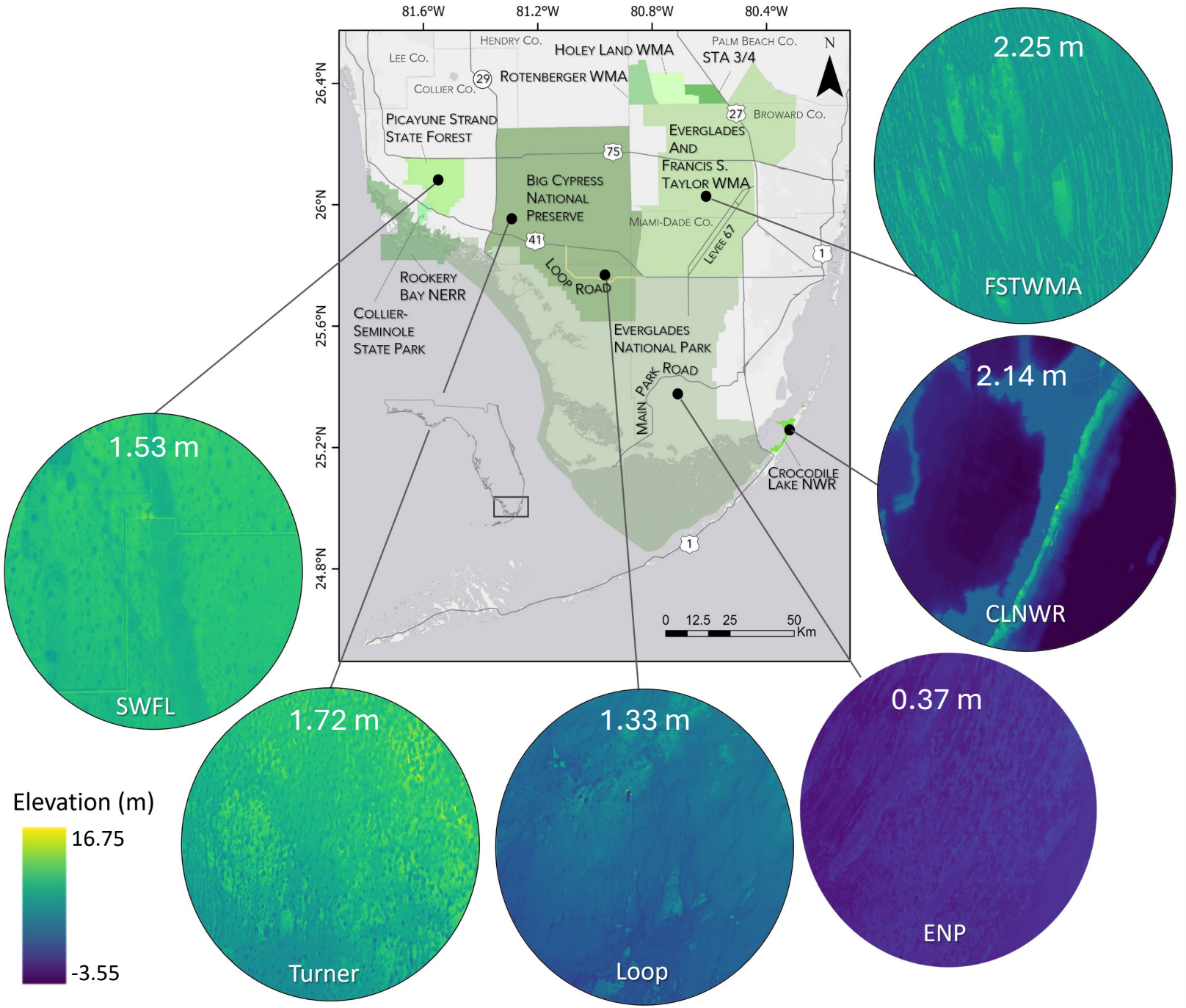
Habitat variation

- Upland pine flatwoods
- Hardwood hammocks
- Hardwood swamp
- Herbaceous wet prairies
- Forested freshwater wetlands
- Tree islands
- Marshes
- Open-water slough
- Coastal mangrove forests

Varies from average of 0.37 to 2.25 m above sea level



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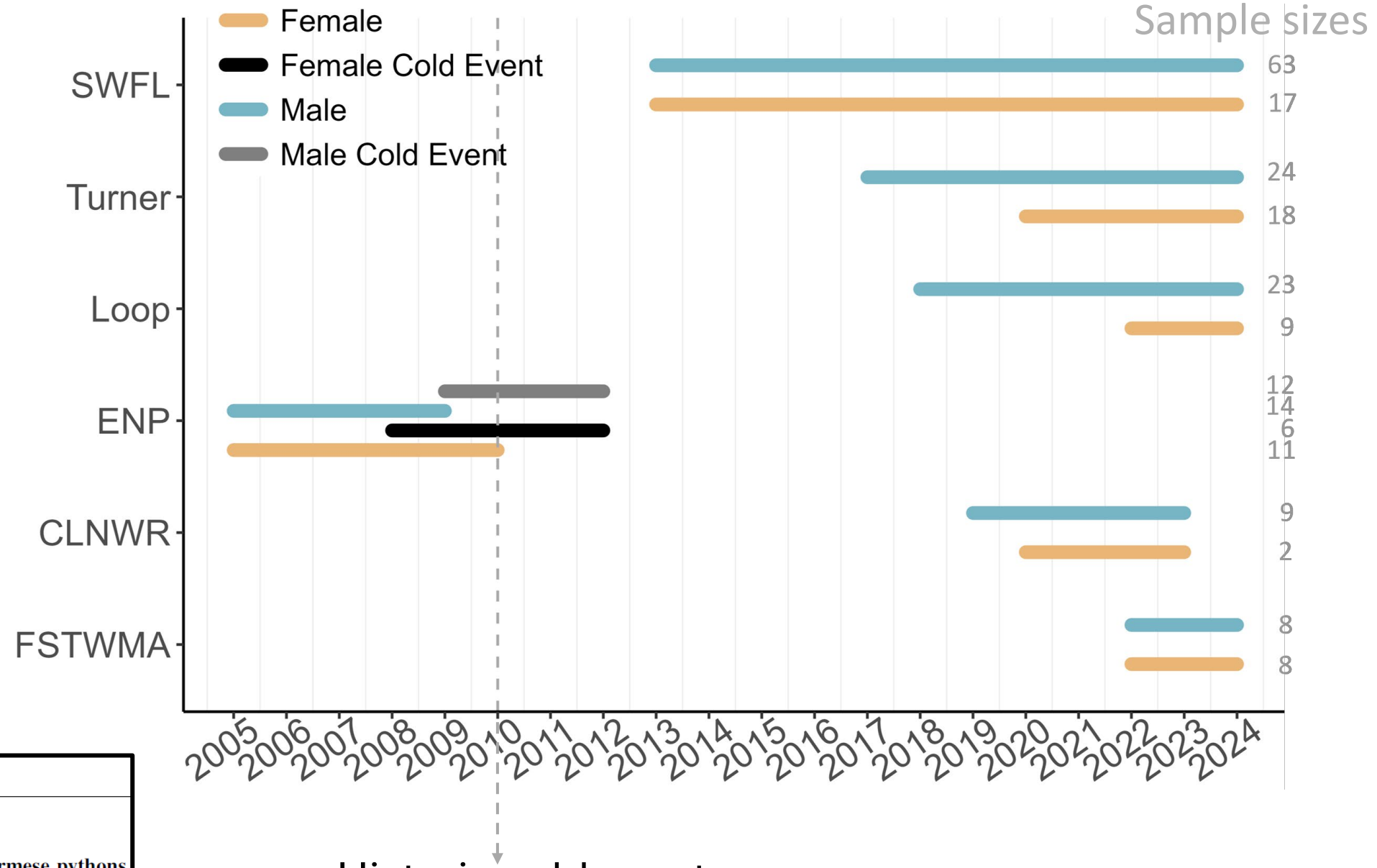
Tracking window



- Air temperatures at or below 10°C (50°F) for at least 48 h.
- Temps went as low as -4°C (25 °F)

Biol Invasions (2011) 13:143–151
DOI 10.1007/s10530-010-9797-5

ORIGINAL PAPER

Cold-induced mortality of invasive Burmese pythons in south Florida

Frank J. Mazzotti · Michael S. Cherkiss · Kristen M. Hart · Ray W. Snow · Michael R. Rochford · Michael E. Dorcas · Robert N. Reed

Historic cold event
January 2-11, 2010

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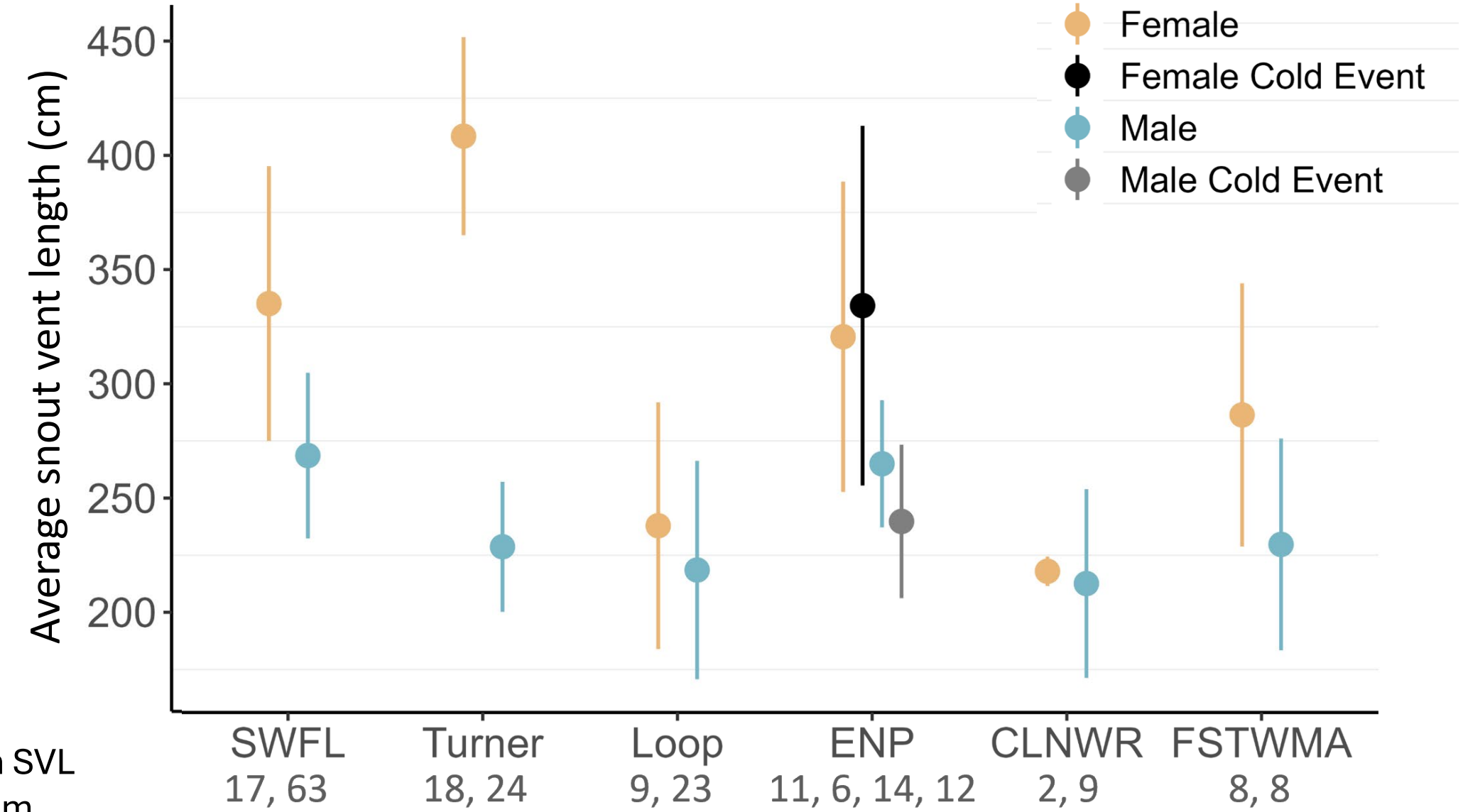
Average body size



Females: 2 to 4 m SVL
Males: 2 to 2.7 m

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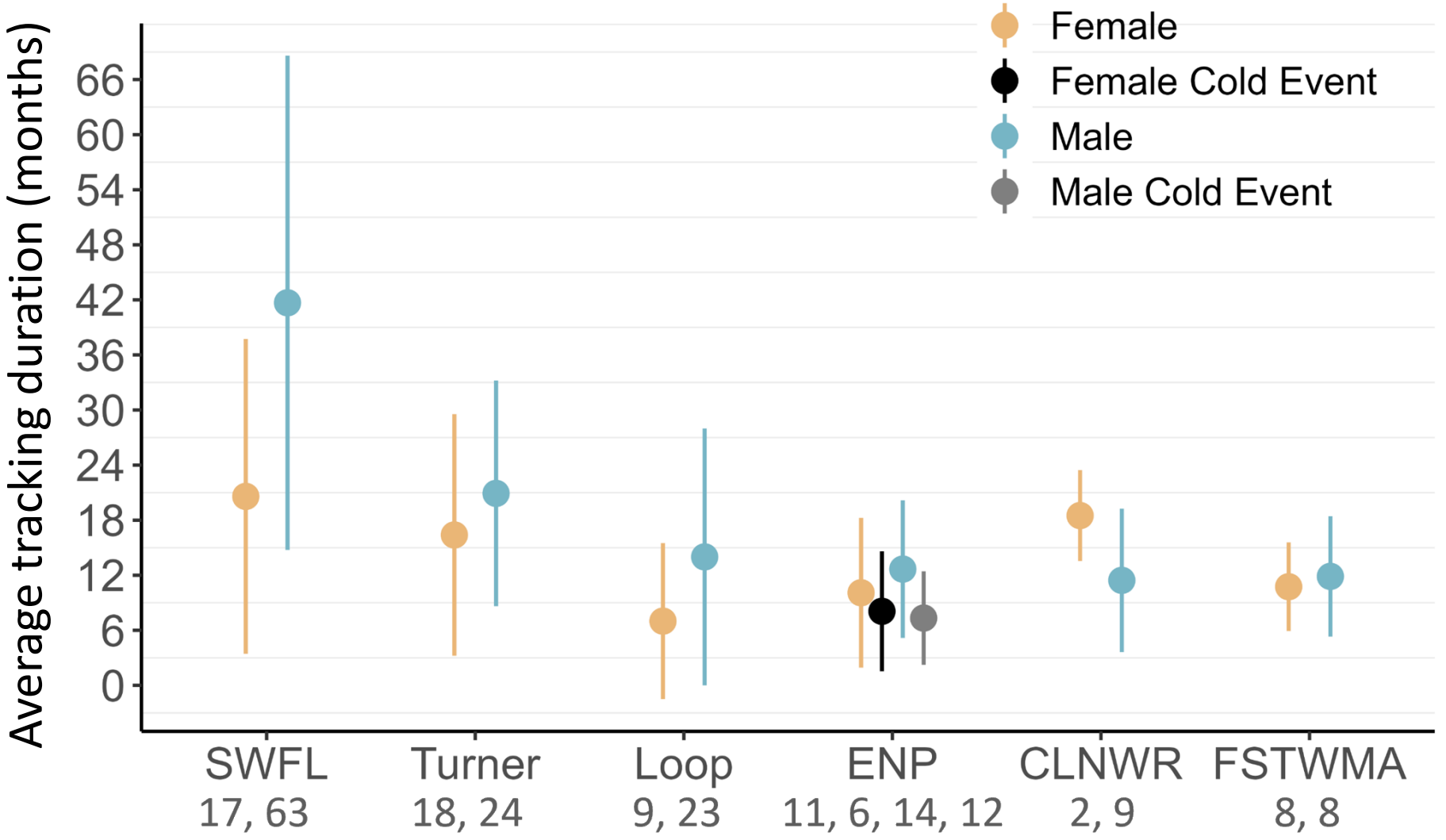
Average tracking duration



Females: 7 to 21 months
Males: 8 to 42 months

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Analysis

- Known fate Cormack Jolly Seber model
- Censored removed snakes or those with unknown fates
- Covariates:
  - Historic cold event January 2010
  - Size (snout-vent length)
  - Site
  - Sex

Photo by Grant McCargar

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

Known mortalities

64 of 224 pythons with known mortality

Cause of mortality	Count of pythons	
	Observed	Assumed
Alligator	4	10
Bobcat	3	
Cold event January 2-11, 2010	8	
Fecal impaction	1	
Heavy machinery	5	1
Python contractors	3	
Public landowners	3	
Motor vehicle	5	5
Unknown	15	
Cached by mammal	1	
Total	48	16

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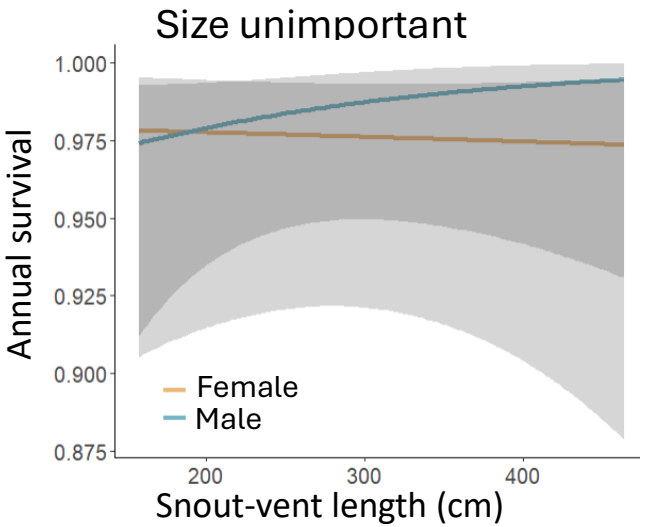
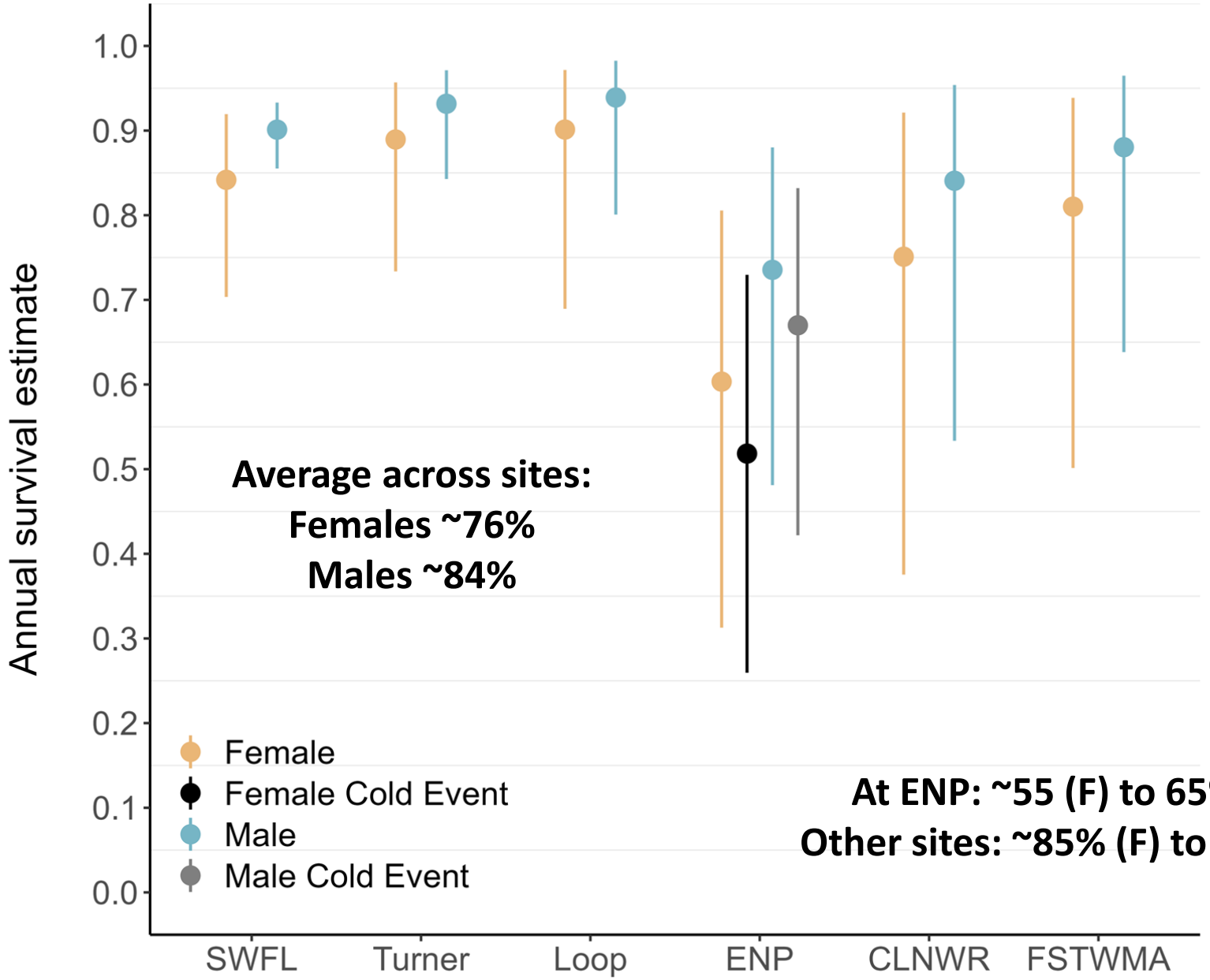
Annual adult survival

Habitat (site), sex, and historic cold event are important





Average across sites:
Females ~76%
Males ~84%

At ENP: ~55 (F) to 65% (M)
Other sites: ~85% (F) to 90% (M)

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Annual adult survival in other species

- Very limited data in snakes, especially pythons
  - Cryptic, low densities, sporadic activity patterns
    - Very difficult to study; many years required

- Water pythons : 60–94%; includes subadults (*Liasis fuscus*, Madsen et al. 2006)
- Indigo snake: 70–85% (*Drymarchon couperi,* Hyslop et al. 2012)
- Western rattlesnake: 51–67% (*Crotalus viridis,* Bruckerhoff et al 2015)
- Timber rattlesnake: 72–98% (*C. horridus*, Olson et al. 2015)
- Eastern massasauga: 35–95%, mean 67% (*Sistrurus catenatus*, Jones et al. 2012)
- Texas rat snake: 65–83% (*Elaphe obsoleta*, Sperry and Weatherhead 2008)

Burmese pythons:
Females ~76%
Males ~84%

Photo by Gretchen Anderson

Habitat at Everglades National Park

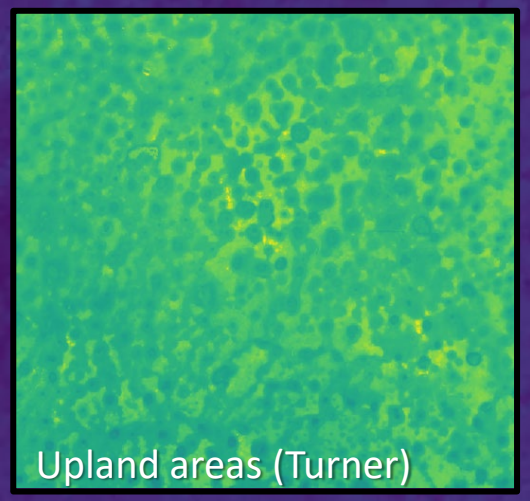
Survival is lower but pythons proliferated here

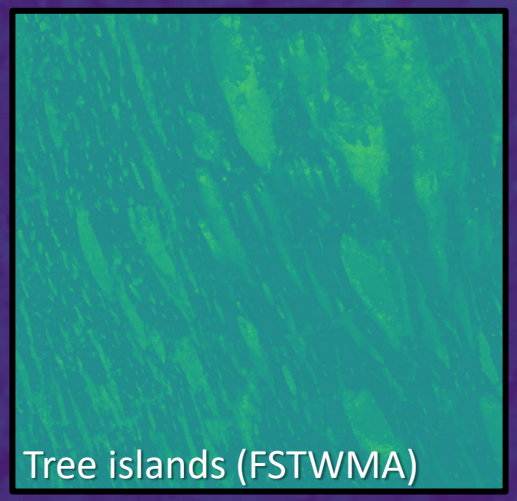
- Yet this is not the best habitat
- Many areas are at or below sea level

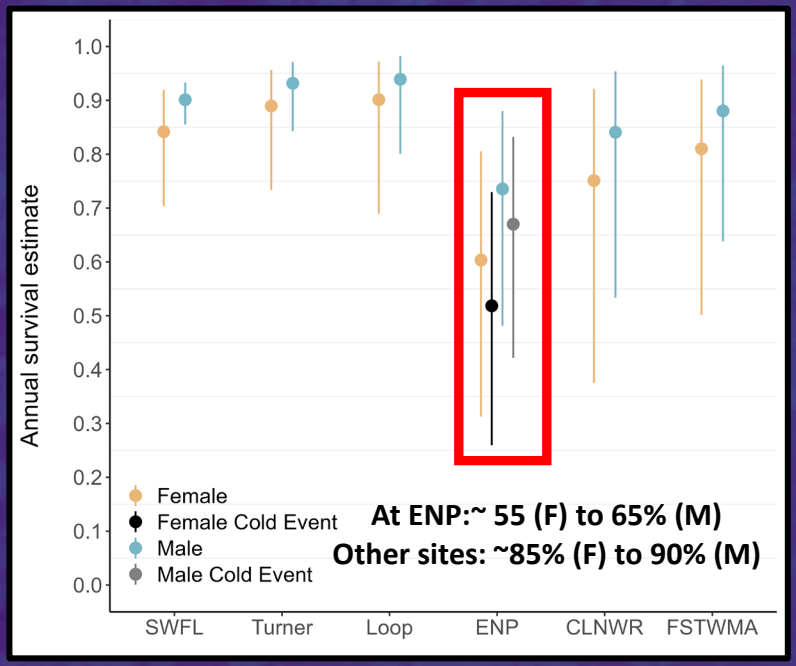
Preferred habitat is a mosaic with adjacent uplands

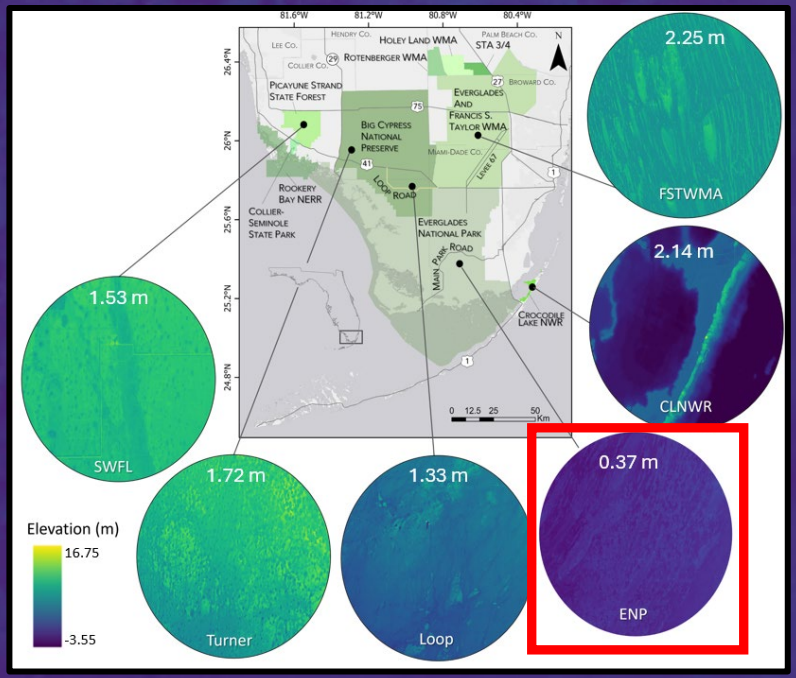
Hart et al. 2015, B. Smith et al. 2016, Bartoszek et al. 2021, S. Smith et al. 2021

- Underscores threat to other areas of Florida
- How may Everglades flow restoration influence pythons?









Conclusions

224 pythons, at six locations, range of habitats

- Known mortalities primarily include natural predators, road strikes, and a historic cold event
- Female survival is lower at all sites
- Survival varies, lowest at ENP
- Data contribute to a life table
  - Estimate a population size in a location, with caveats of low detection
  - Can inform genetic biocontrol efforts

Data needed for survival in all age classes to

- Understand most vulnerable stages
- And those with highest impact on native prey populations
  - To target for removal

Photo by Grant McCargar

Photo by Judy Baird

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Photo by Grant McCargar

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Questions?

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