



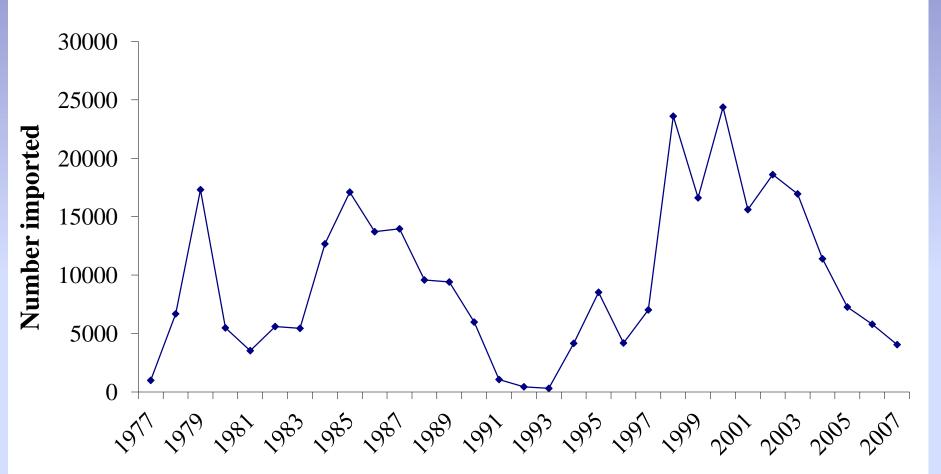
Where did they come from?

Proximate hypotheses

- Intentional releases
- Escapes from captivity
- Mass releases (Hurricane Andrew, 1992)

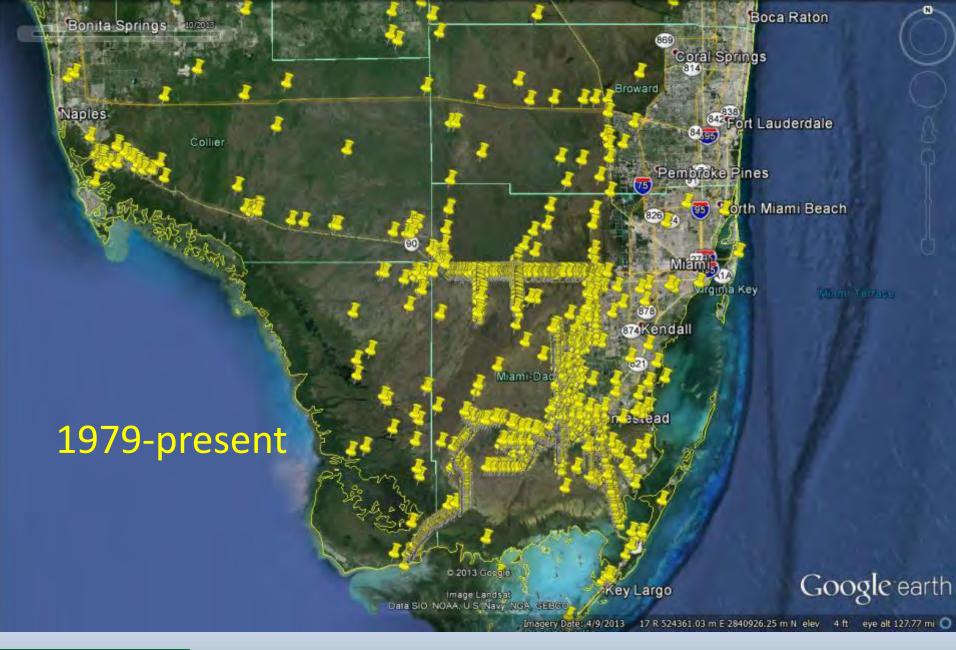


Ultimate answer: The live animal trade

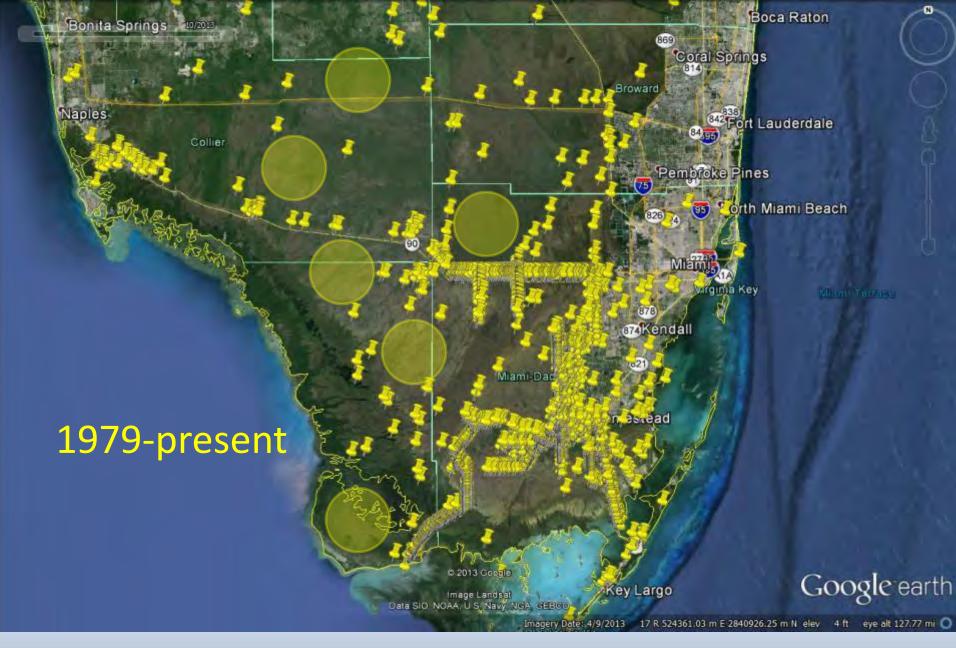










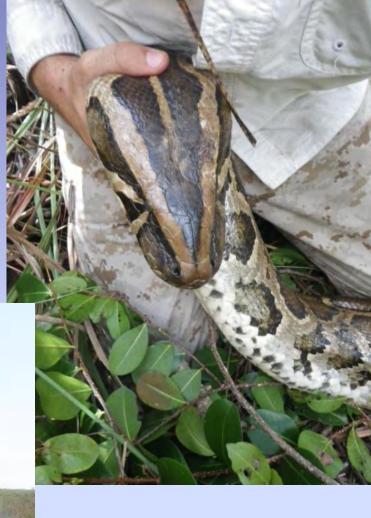




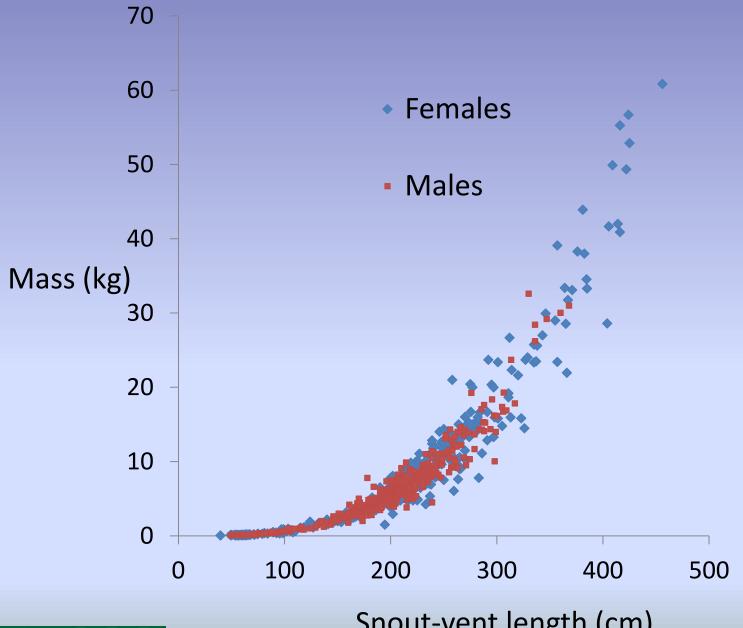
Body size

Average: 3 m, 10-12 kg

Maximum: >5.5 m, >75 kg









Snout-vent length (cm)

Population size: Unknown

>2,000 pythons collected, 90% since 2006 Most credible estimates >>10,000 individuals







Impacts











Birds

Wood stork Blue-winged teal

Limpkin Northern pintail

White ibis Domestic duck

Black vulture Domestic goose

Great blue heron Domestic chicken

Great egret Common moorhen

Snowy egret Clapper rail

Little blue heron King rail

Anhinga Virginia rail

American coot Sora

House wren Whimbrel

Magnificent frigatebird Red-winged blackbird

Purple gallinule Eastern meadowlark

Pied-billed grebe

Mammals

Key Largo woodrat

Round-tailed muskrat

Bobcat

Rabbit

Raccoon

River otter

White-tailed deer

Grey squirrel

Domestic cat

Black rat

Opossum

Rice rat

Cotton rat

Cotton mouse

Feral hog

Reptiles: American Alligator



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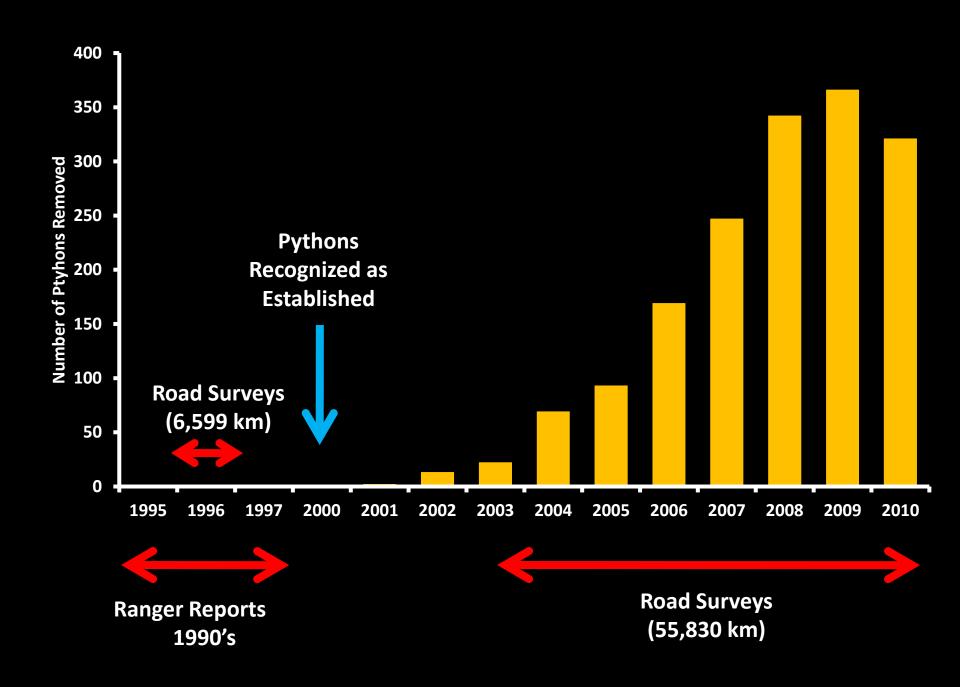
www.pnas.org

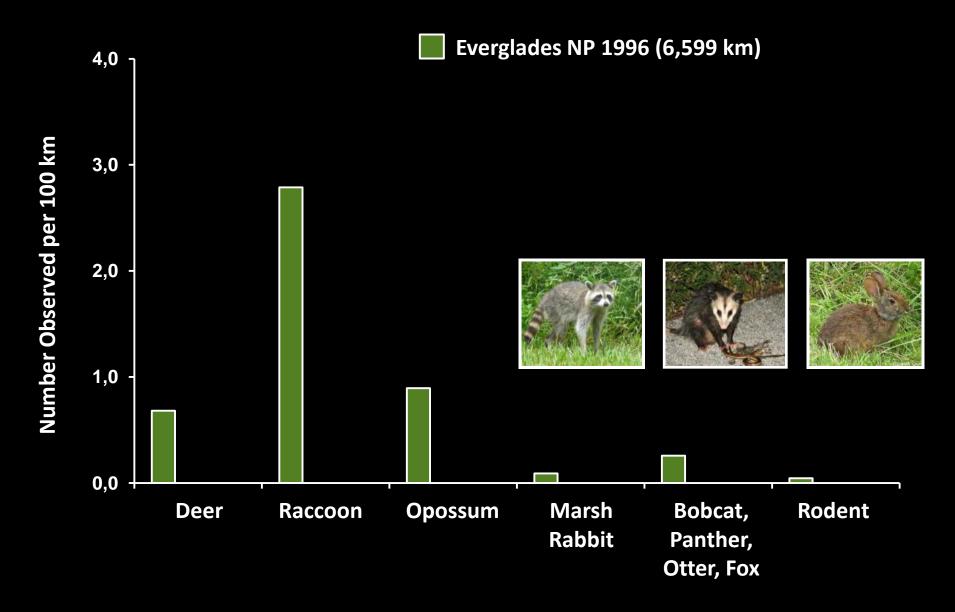
The threat of invasive pythons

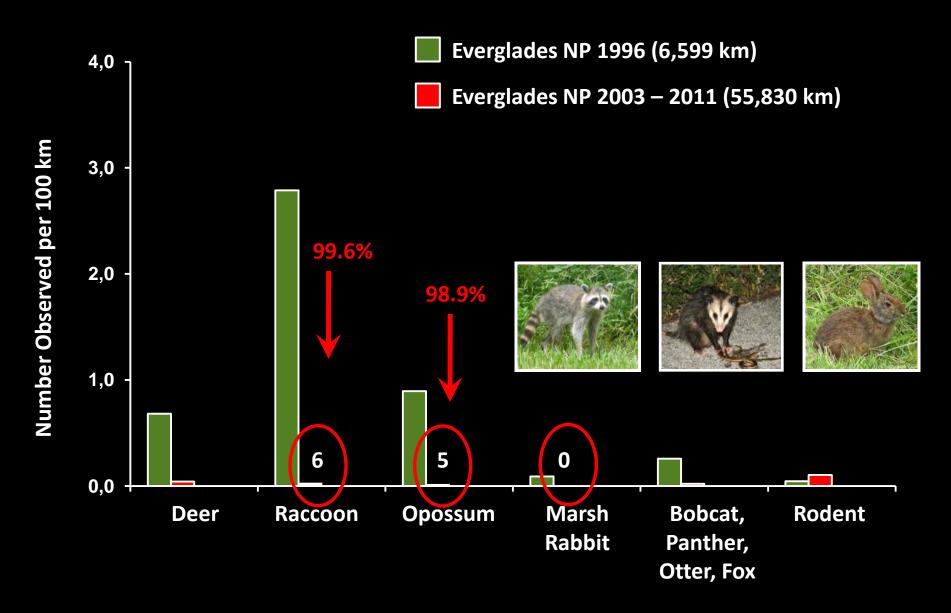
Retroviral origins of a placenta gene Characterizing reaction intermediates

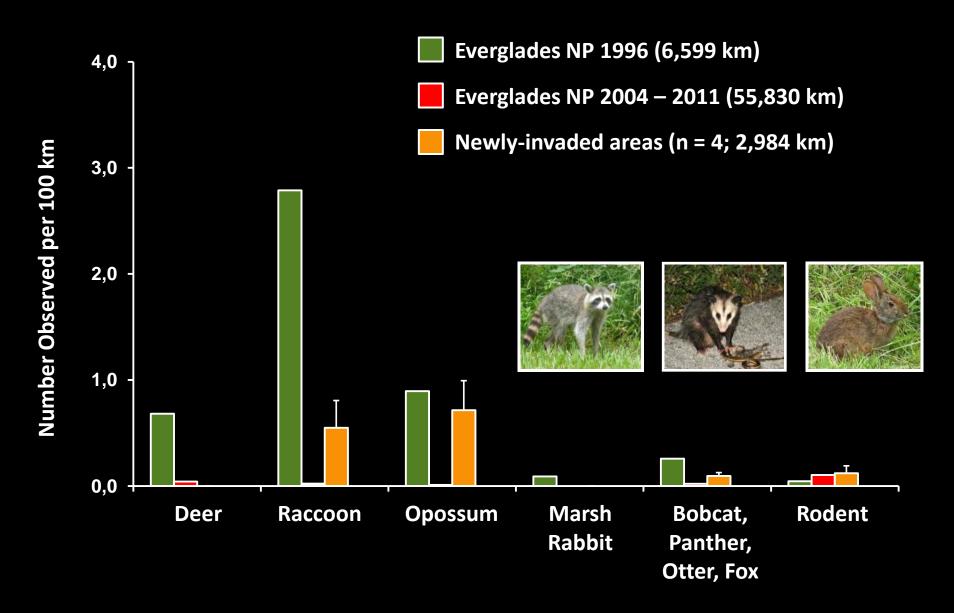
Leukemic relapse among cord blood recipients

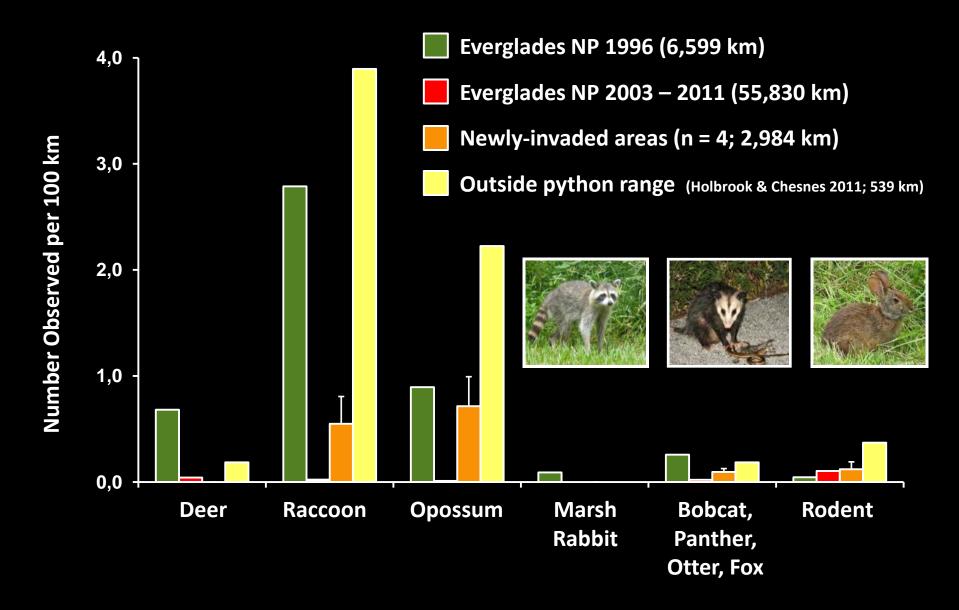
Epigenetic programming of hypoxia sensitivity











Detection



Abundance: Number of individuals in a population



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Density: Number of individuals per unit area Low-density species can be abundant if widespread



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Density: Number of individuals per unit area Low-density species can be abundant if widespread

Occupancy: Proportion of an area that is inhabited

Occupancy can be monitored to provide a relative

measure of abundance



Back to Brown Treesnakes.....





5 ha enclosed Brown Treesnake population on Guam

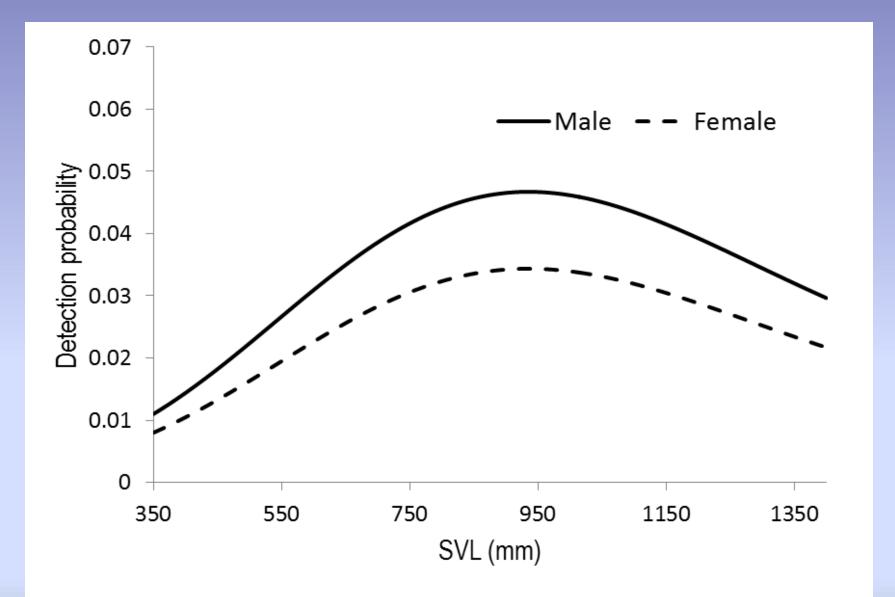
- Nocturnal searches, 192 snakes present
- ~2700 person-hours
- Estimating detection probability (p)



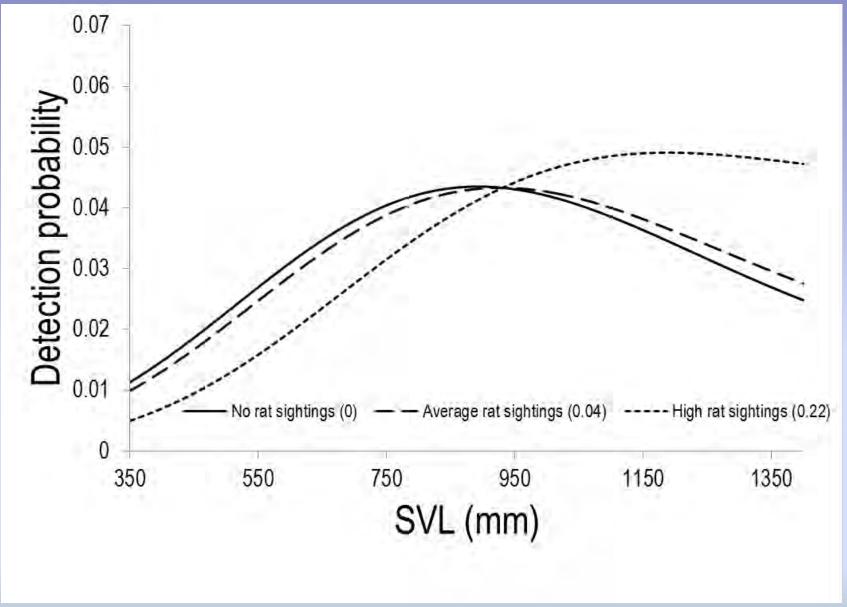
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- Nocturnal searches, 192 snakes present
- ~2700 person-hours
- Estimating detection probability (p)
- Overall p = 0.04
- 11 covariates modeled on p







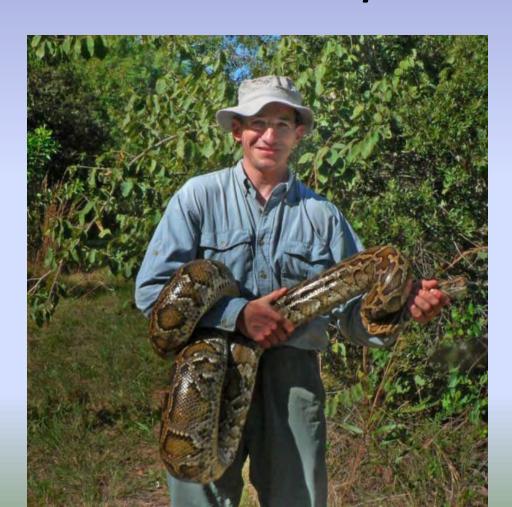




Now back to pythons....

Mark-recapture not possible

How can we estimate detection probability?



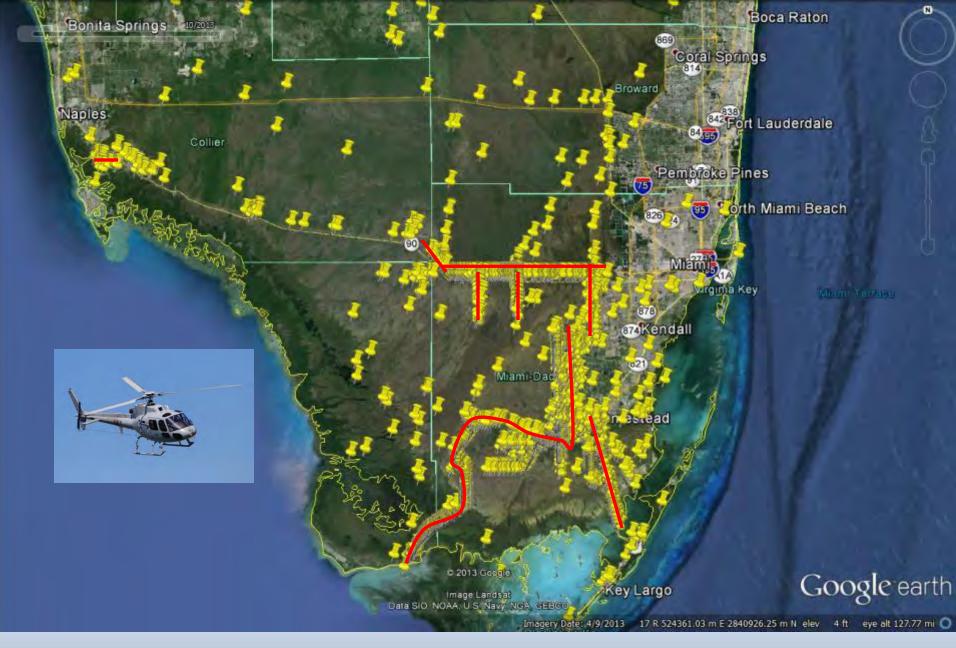


Road pythons

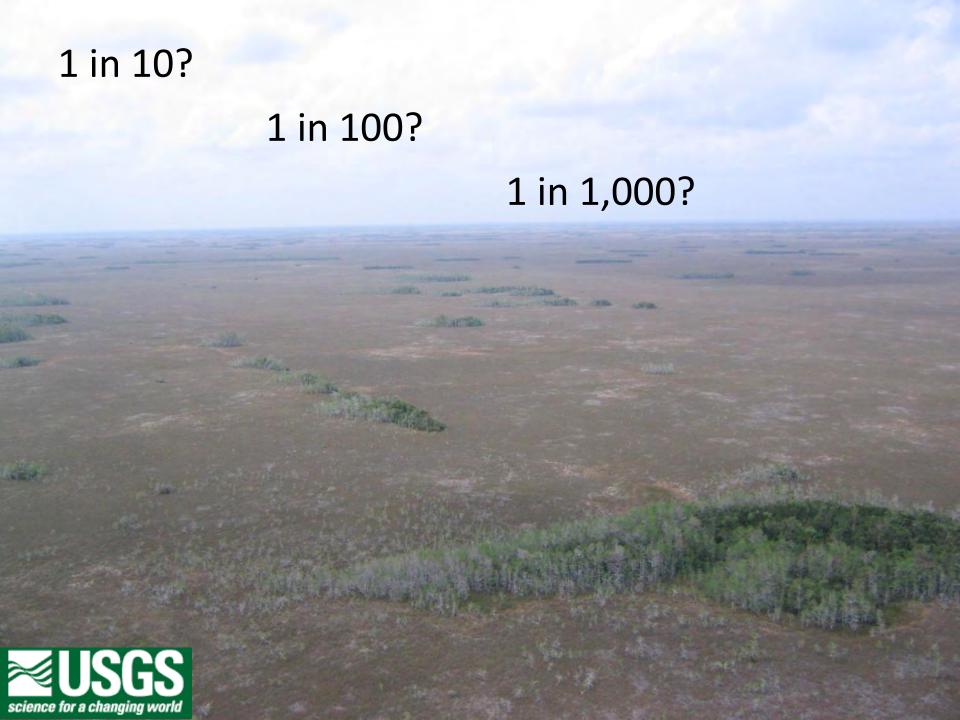












Multiple factors influence detection probability





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- Species attributes

Size Sex

Condition Satiety





Multiple factors influence detection probability

- Species attributes
- Environmental context

Weather

Habitat

Season





Multiple factors influence detection probability

- Species attributes
- Environmental context

- Observer biases

Skill

Behavior

Number of targets

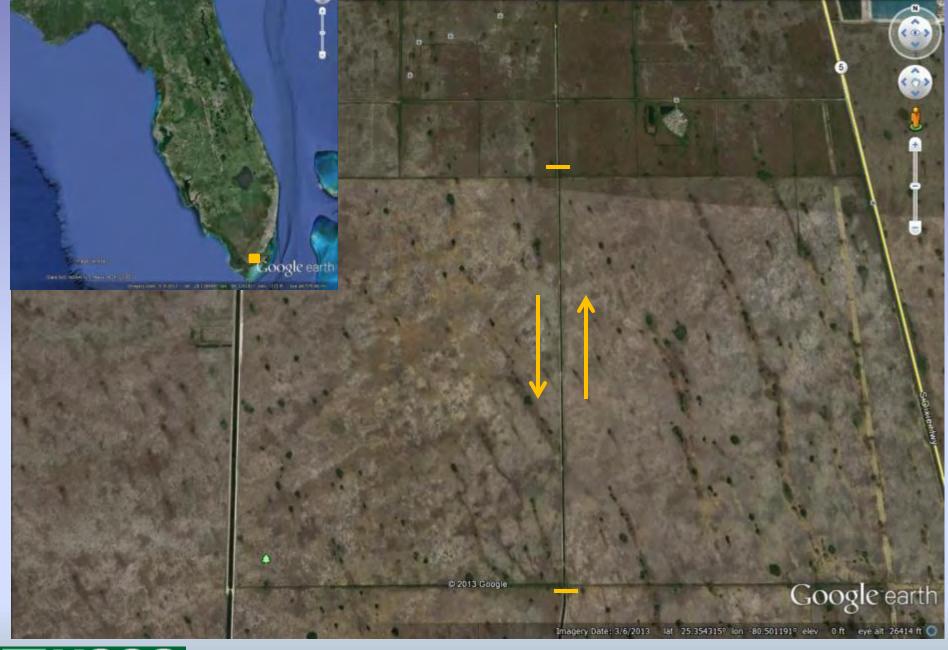




2013 Intensive surveys

- C-110 canal surveyed on foot 3x/week
- ≥ 2 independent observers/survey
- Round trip (both sides, ~8 km total)











3 adult male pythons received transmitters

ID	SVL (cm)	Dates tracked
PyMo27	171	16 Jan – 02 Jun 2013
PyMo32	215	16 Jan – 11 Apr 2013
PyMo60	293	01 Feb – 18 Mar2013





• 61 walking surveys of C-110



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- 11 additional pythons removed from C110 by cooperators



- 62 locations of 3 telemetered pythons, 16 Jan 02 July
- One or more pythons on canal or levee on 51 of 62 days
- 198 person-opportunities to see a telemetered python



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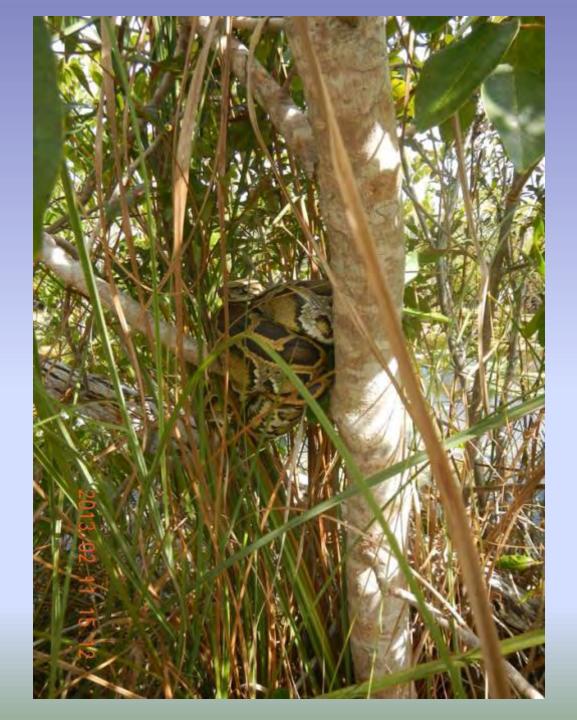
Number of times pythons detected during visual search = ?



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- One or more pythons on canal or levee on 51 of 62 days
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Number of times pythons detected during visual search = $\mathbf{0}$







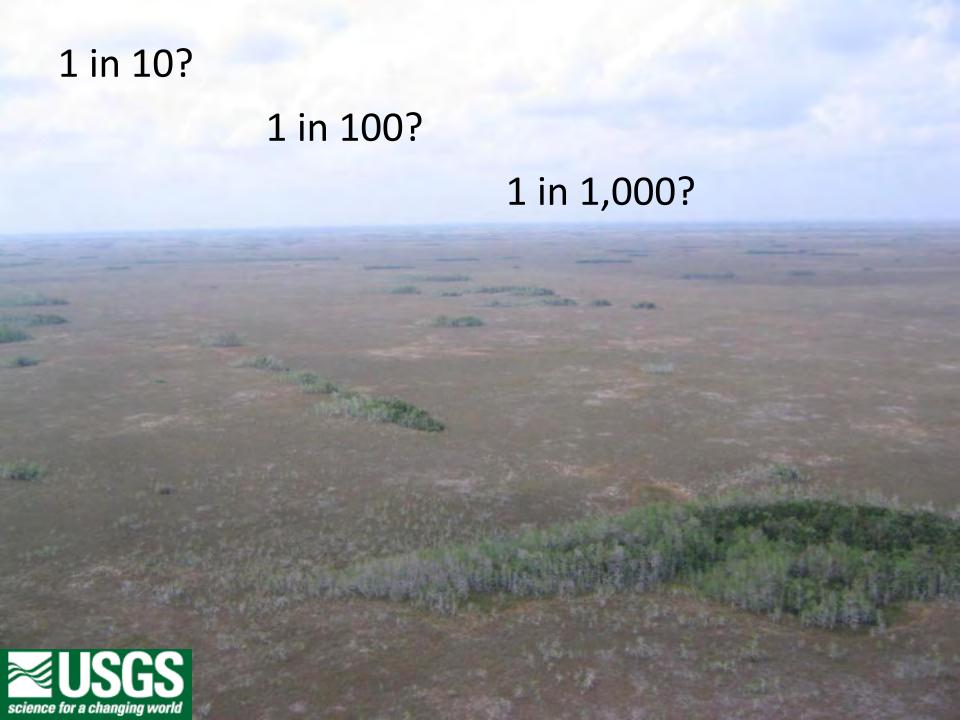
IF we had found one telemetered python...

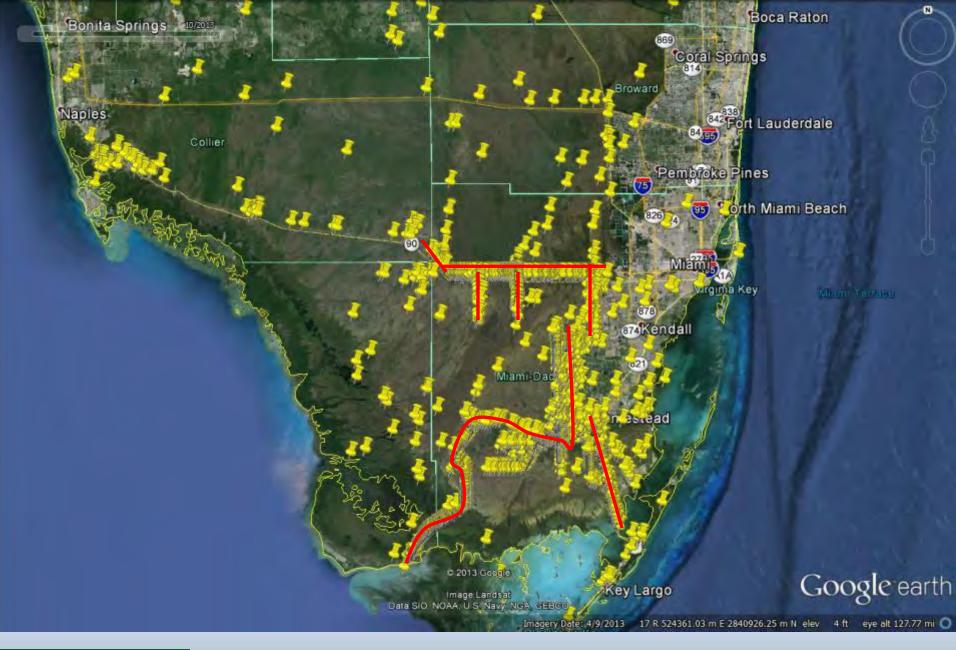


Raw detection probability across all opportunities:

$$1/198 = 0.005$$

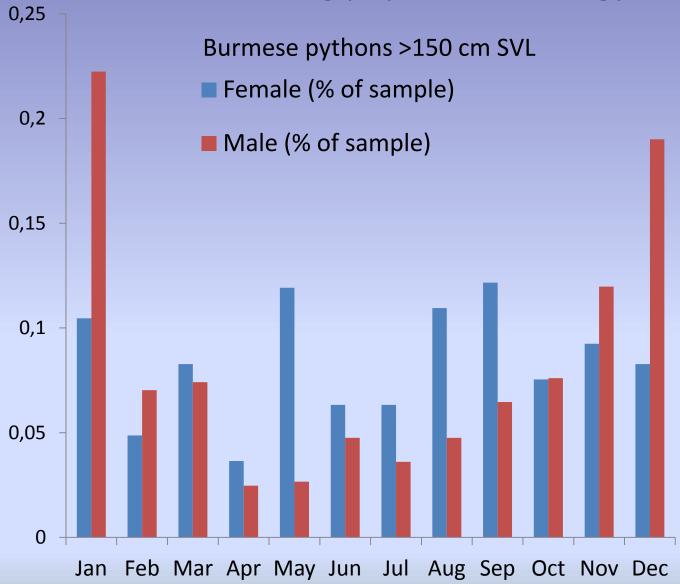






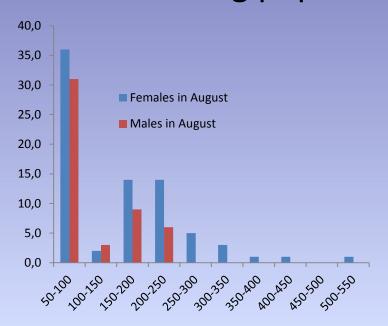


Implications for understanding population biology

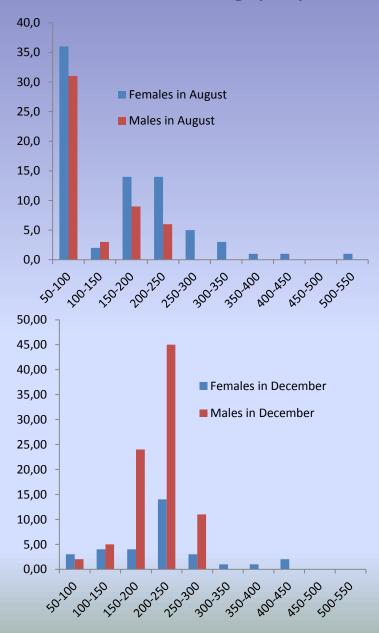




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- Severe declines of some prey species can be expected
- Snake population biology = detection probability
- Counts are almost certainly misleading
- Snake densities are underestimated
- Communicating these topics is challenging



Acknowledgments:

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