U.S. Geological Survey FL Invasive Species Research Updates

Wetland and Aquatic Research Center (Davie) | Fort Collins Science Center (South FL Field Station)
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Presented by Jacquelyn Guzy

Primary Collaborators: National Park Service Everglades National Park & Big Cypress National Preserve, University of Florida, Zoo Miami, Conservancy of Southwest Florida, USFWS Crocodile Lake National Wildlife Refuge

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USGS science for a changing world

Ongoing Collaborative Projects

- Specimen Management & Data Summaries
  - Python and tegu captures contribute to demography
  - Python demography paper nearing submittal
- Diet Analyses (since 2015)
  - 610 python, 1,383 tegu digesta samples
  - > 70 species in python diets; MS student working on tegu diets
- Tegu Surveillance (since 2016 around Everglades NP)
  - 10-yr Stationary and mobile EDRR cameras monitored
  - MS student working on changes over time
- Scout Python Collaborative
  - collect data across region (systematic, standardized)

Ongoing Collaborative Projects

- Stress & Reproductive Physiology
  - Use hormones paired with behaviors to predict reproductive & stress patterns year-round
- Early Detection and Rapid Response (EDRR)
  - Tegu trapping
  - Feb 2021: Female nonnative milksnake found and removed!
  - Goal = stay ahead of invasion curve
- Hatchling/Juvenile Python Survival

Recent Publications from Collaborative Research

- Multiple paternity in pythons (Skelton et al. 2019)
- Tegu thermal biology (Currylow et al. 2021)
- Tegu overwinter survival in AL (Goetz et al. 2021)
- Y-maze reptile experiments (Parker and Currylow et al. 2021)
- Python Accelerometry (Whitney et al. 2021)
- Python range use in SW FL (Bartoszek et al. 2021)
- Python hatchling growth (Josimovich et al. 2021)
- Scientific word choice (Fitzgerald et al. 2021)
- Mammalian predation on adult pythons (McCollister et al. 2021)
- Native species depredate young pythons (Bartoszek et al. 2021)
- Python nest defense and depredation (Currylow et al. 2022)
- Python egg retention (Anderson et al. 2022)

Python Science Synthesis: In Review with Neobiota

Invasive Burmese pythons in Florida: A synthesis of biology, impacts, and management tools

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Decades of research by federal, state, tribal, and academic entities has provided important insights on the invasion

- How and when pythons were introduced
- Current range (eDNA is useful)
- Diet (consume a wide range of vertebrate prey)
- Movement (homing, navigation)
- Habitat use (semi-aquatic)
- Prey/mammal declines (biodiversity loss)
- Parasites, disease transmission vector
- **Individual detection probability = very low: hinders every aspect of management**
- Substantial effort has gone into evaluating control tools (e.g., trapping, visual surveys, scout snakes); **options limited (low detection, habitat accessibility)**

Little information on demography (survival, growth, reproduction)

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USGS Vital Rates Research Collaborative: Coordinated Multi-year Burmese Python Vital Rate Research Strategy for South Florida

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USGS Python Vital Rate Collaborative Research

USGS + partners + stakeholders

Age-/size-specific survival rates

Sex ratios

Age/size at maturity

Reproductive output and frequency

Population growth rates

Dispersal

Benefits of vital rate research: Interpret what removals mean

- Inform control tool efficacy (e.g., are removal efforts accomplishing population decline?)
    - Modeling population growth rates to evaluate removals on population trajectory
- Obtain biological information (e.g., disease spread, trophic cascades, prey-base shifts)
- Inform potential management strategies (i.e., genetic biocontrol - skew sex ratios for population control)

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Current vital rates study:

Adult females

- Reproductive output and frequency
  - Body size to clutch size
  - Hatching success/survival
  - Population growth potential
- Sex ratio (by clutch)
- Size-specific survival

Known-age female hatchlings

- Age-specific survival
- Age/size at maturity
- Dispersal

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Juvenile Python Survival & Dispersal in Big Cypress National Preserve

- 2020: 1 of 12 survived
- 2021: 1 of 22 survived
- 2022: Added a site at Loop Rd.
- Hatchlings have high mortality?
- Influenced by small hatchling body sizes?
- Need more data

Hatchling Python Survival

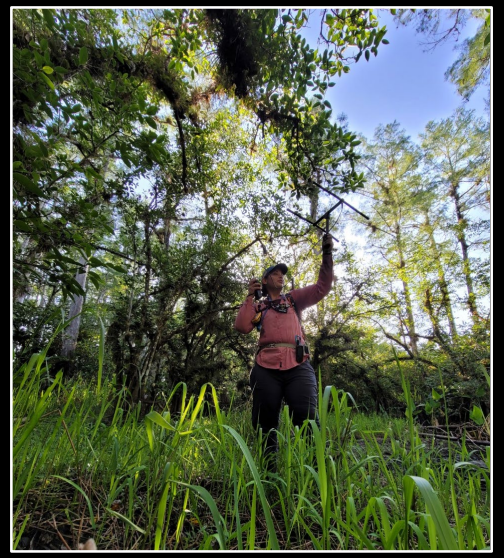
Hatchlings from nests & State removal programs

Research Goals

1. Survival rates
2. Habitat use
3. Behavior
4. Growth rates: size at maturity → reproductive output
5. Bonus research: Interior habitat use, hormones, population genetics

Continued UF/USGS Research Internship Opportunities

- Program began 2014 Christina Romagosa and USGS
- Labor for intensive fieldwork
- Mentoring on invasive species management
- Promotes diversity
- Interns have published papers
- Supports graduate students conducting invasive herp research



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2019-2022 Products from Collaborative Research

Multiple paternity in pythons: Skelton et al. 2019. Genome-Wide SNP Analysis Reveals Multiple Paternity in Burmese Pythons. Journal of Herpetology.

Documented multiple paternity in Burmese pythons

Tegu thermal biology: Currylow et al. 2021. Thermal stability of an adaptable, invasive ectotherm: Argentine giant tegus in the Greater Everglades Ecosystem, USA. Ecosphere.

Wild tegus can maintain stable temps throughout winter; some do not hibernate = adaptable, underscoring invasion threat

Tegu overwintering survival (Alabama): Goetz et al. 2021. Argentine Black and White Tegu can survive winter under semi-natural conditions well beyond their current invasive range. PLoS ONE.

12 tegus (FL) hibernated in man-made underground refugia (AL); 7 survived a year. Potential to spread despite non-ideal climatic conditions

Y-maze use with large invasive reptiles: Parker and Currylow et al. 2021. Using Y-mazes to assess chemosensory behavior in reptiles. J. Visual Experiments.

Technique helps understand scent trailing behavior of tegus and pythons. Cues promoting exploratory behavior = development of more effective control tools??

Python Accelerometry: Whitney et al. 2021. Accelerometry to study fine-scale activity of invasive Burmese pythons in the wild. Animal Biotelemetry.

Spent much time resting; also moved continuously for several hours; diel shifts in activity (temperature/season); accelerometers = fine-scale activity, behavior

Python range use in SW FL: Bartoszek et al. 2021. Spatial ecology of invasive Burmese pythons in southwest Florida. Ecosphere.

Quantify movement and habitat use of 25 adult pythons; home range 7.5 km^2, maximum mean daily movement rate 520 m/day; varied habitat use

Mammalian predation on adult pythons: McCollister et al. 2021. Native mammalian predators can depredate adult Burmese pythons in Florida. Southeastern Naturalist.

Adult male python consumed by a Bobcat, and an adult female survived a bear attack.

Python hatchling growth: Josimovich et al. 2021. Clutch may predict growth of hatchling Burmese pythons better than food or sex. Biology Open.

Most phenotypic variation in morphometrics, growth, and behavior best explained by clutch. Maternal, location, genetic, correlates could be > food availability

Scientific word choice: Fitzgerald et al. 2021. Identifying Negative Sentiment Polarity in the Judas Technique. Conservation Science and Practice.

Scientists and researchers should prioritize neutral and descriptive language to avoid affecting valuation of our subjects. Refer to study animals as Scout snakes

Native species depredate young pythons: Bartoszek et al. 2021. Herpetological Review 52 (4):860-862.

Two instances of a cottonmouth consuming hatchling pythons in our radiotelemetry studies.

Python nest defense and depredation: Currylow et al. 2022. Face-off: Novel depredation and nest defense behaviors between an invasive and a native predator in the Greater Everglades Ecosystem, Florida, USA. Ecology and Evolution.

Discovered first instance of any animal depredating a python nest in the wild (bobcat). Check out video on YouTube!

Python egg retention: Anderson et al. 2022. The Herpetological Journal. Egg Retention in Wild-caught *Python bivittatus* in the Greater Everglades Ecosystem, Florida, USA.

Several cases of egg retention in wild pythons from FL; effect on survival or future reproduction unknown; condition may be more common that previously thought

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