SCIENCE OFFICE RESEARCH

Pinelands Commission Meeting

February 13, 2026

SCIENCE OFFICE PERSONNEL

John Bunnell (37 years in December)
Patrick Burritt (18 years in March)
Chris Jeitner (3 years in April)
Christine Healy (2 years in November)
Tyler Christensen (~3 weeks)

CURRENT RESEARCH AND MONITORING

Groundwater Level Monitoring

Surface Water Level Monitoring

Pinelands-wide Water Quality Monitoring

Frog and Toad Monitoring

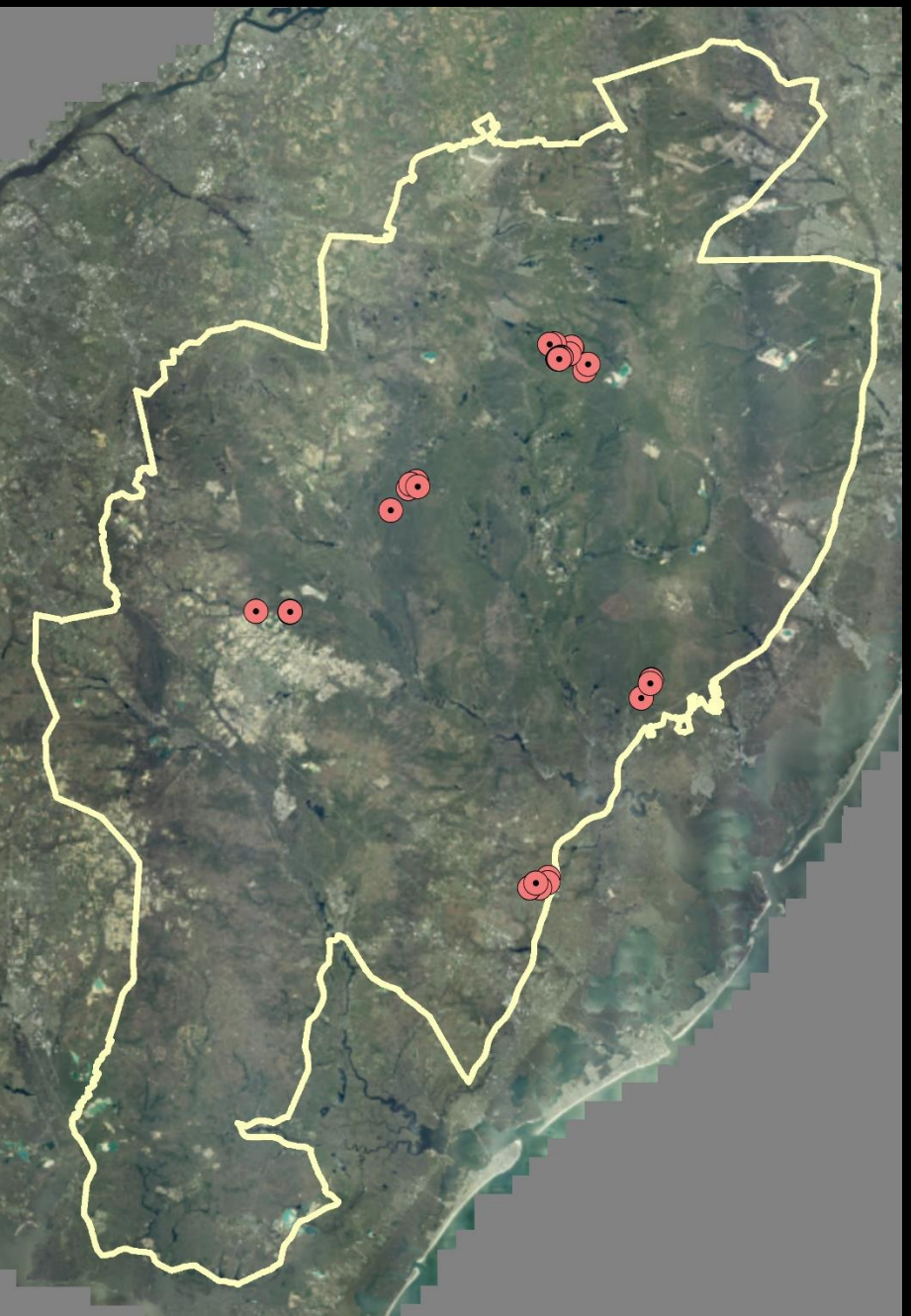
Rare Snake Monitoring

Snake Fungal Disease Monitoring

King Snake Study

Box Turtle Study

GROUNDWATER MONITORING



Joel Mott from Communications Office

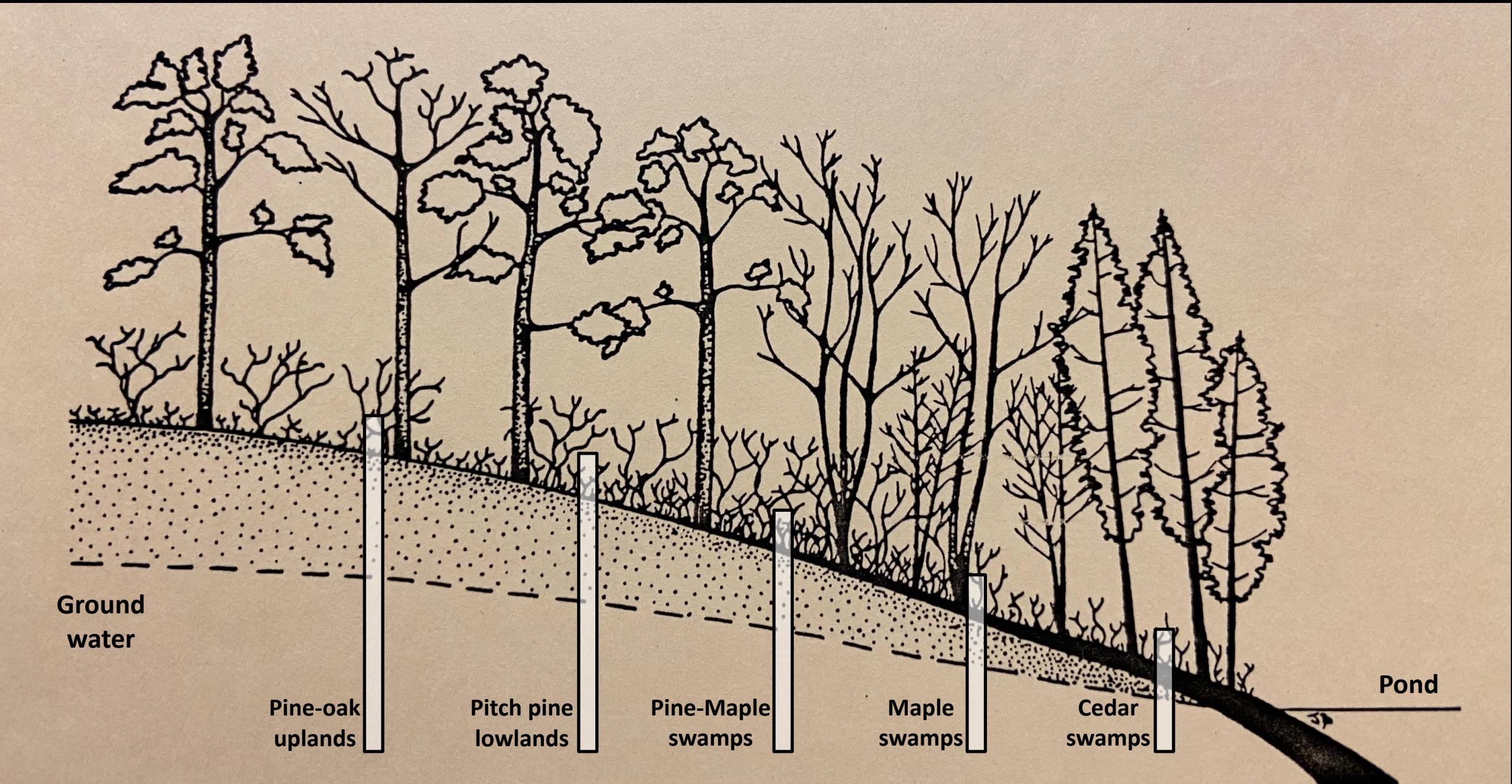
Measure groundwater in 33 forest plots

5 forest plots monitored since 1987
Installed for Dr. Zampella's PhD work
38 years so far

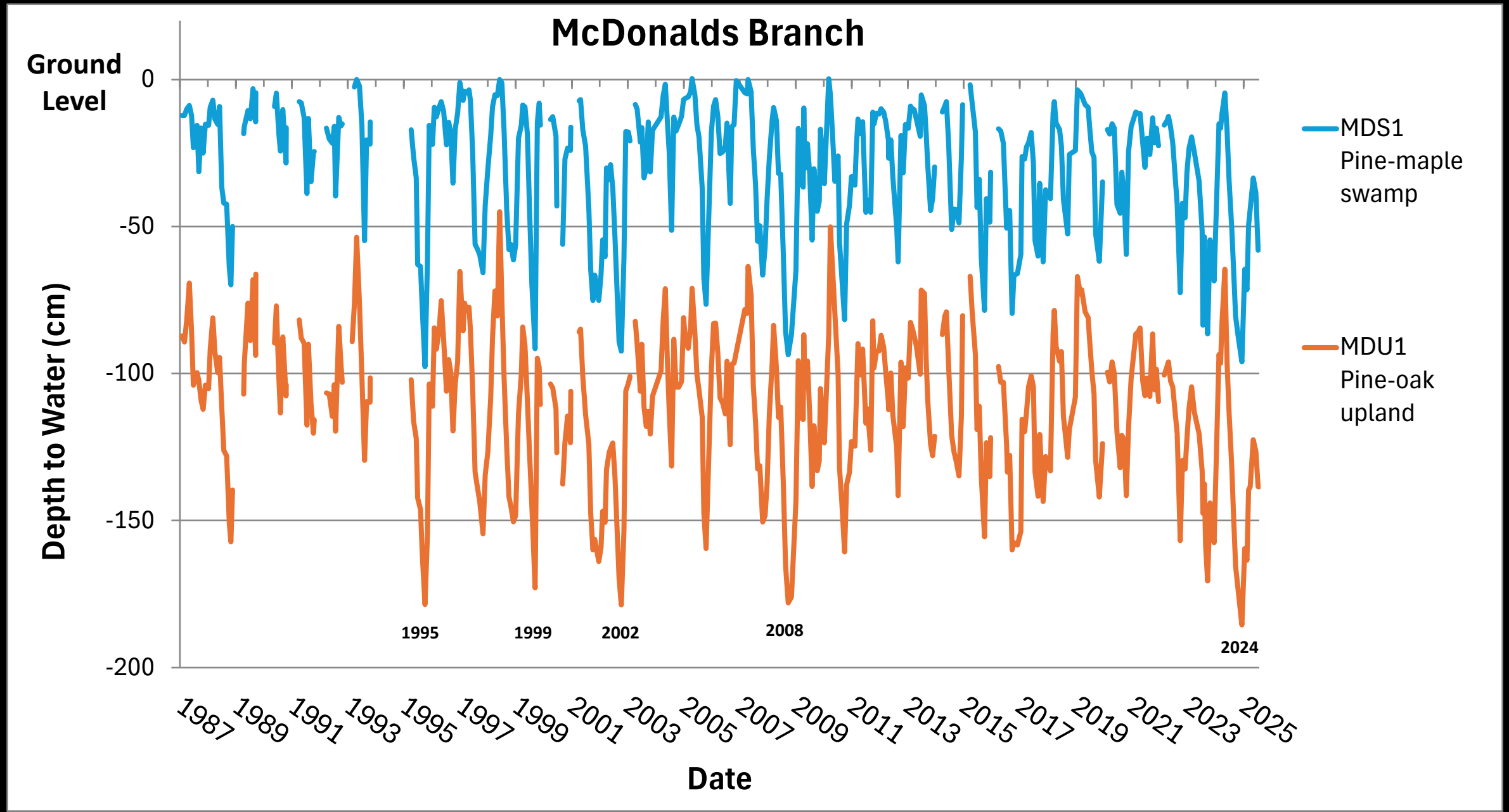
28 forest plots monitored since 2004
Installed as part of the Kirkwood-Cohansey Project
21 years so far

WHY? To monitor changes in groundwater levels over time

GROUNDWATER MONITORING



GROUNDWATER MONITORING



GROUNDWATER MONITORING

This forest plot in McDonalds Branch was measured manually every month since 1987

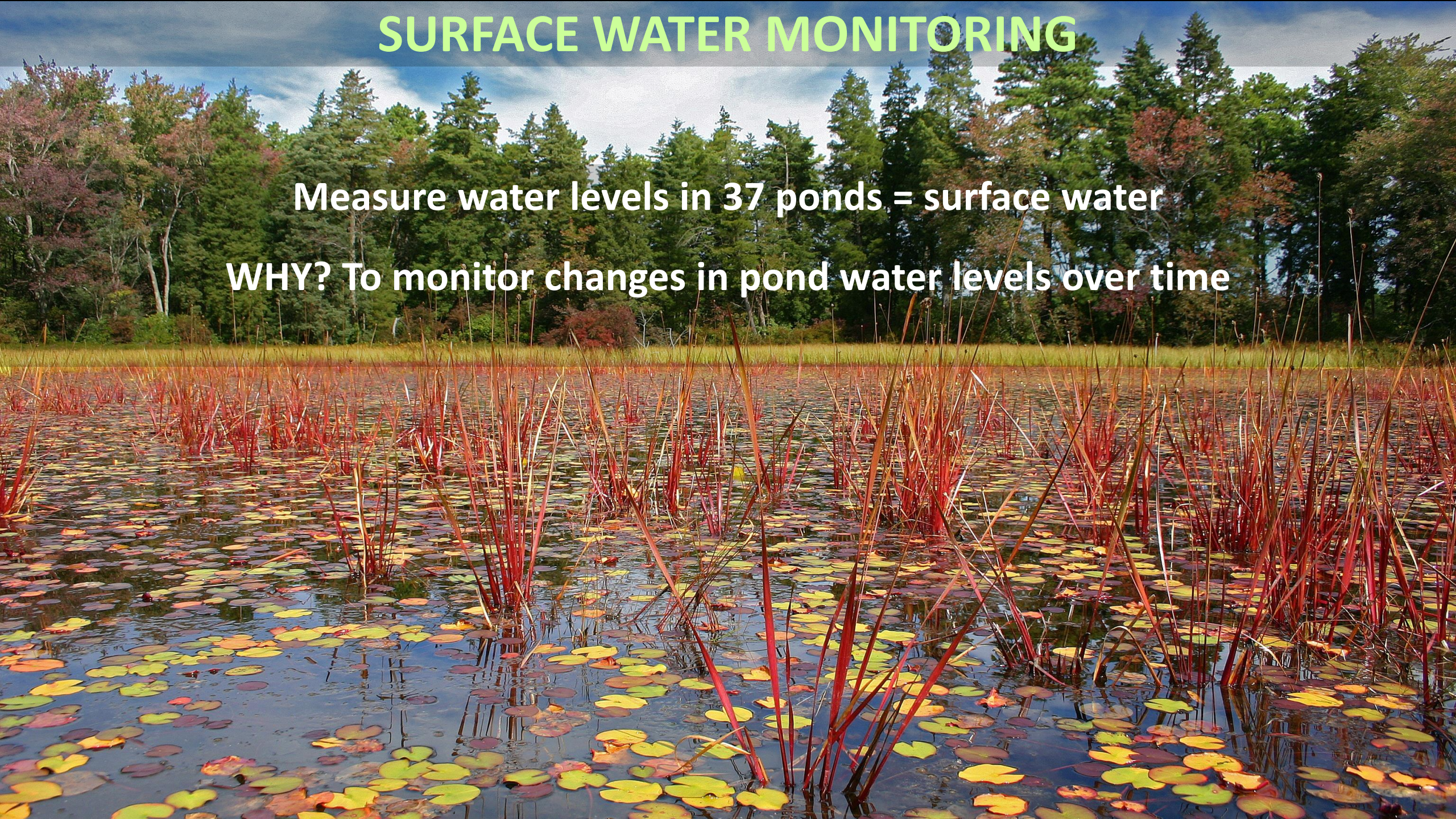
USGS installed metal well for KC Project

In 2017, a data logger was installed

A data logger automatically measures and records groundwater levels

The data logger has been recording groundwater hourly since 2017

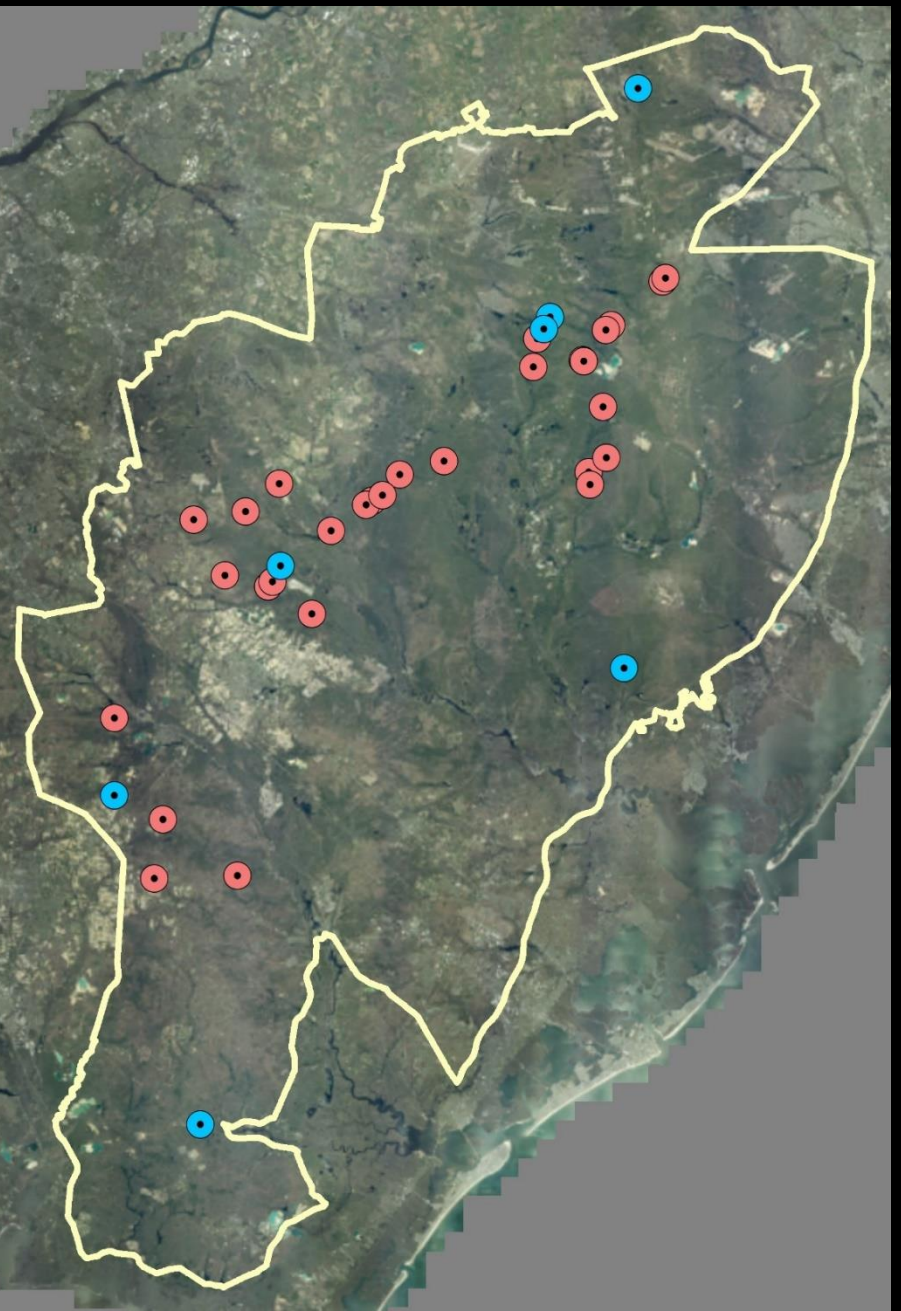
SURFACE WATER MONITORING

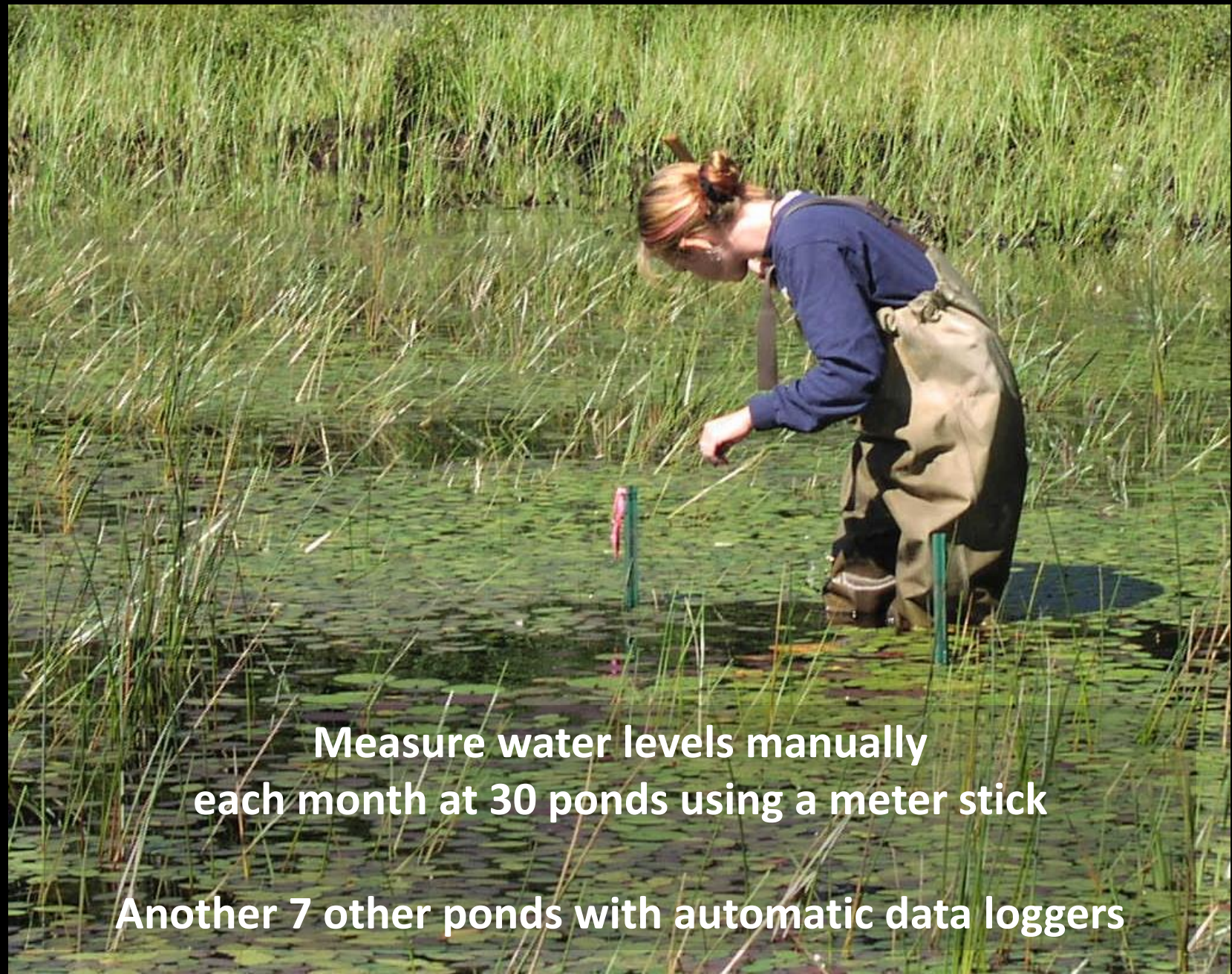


Measure water levels in 37 ponds = surface water

WHY? To monitor changes in pond water levels over time

SURFACE WATER MONITORING

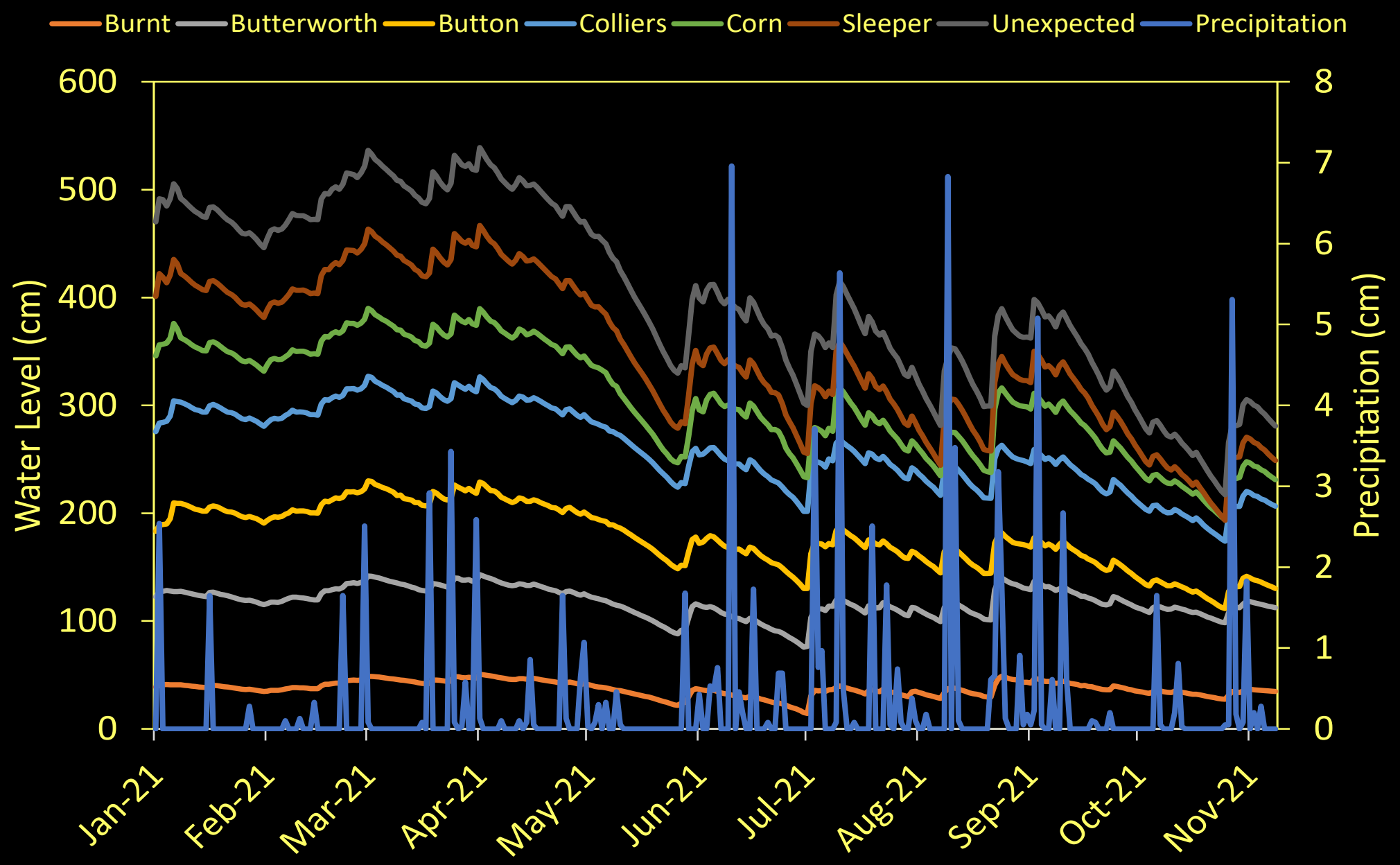




Measure water levels manually
each month at 30 ponds using a meter stick

Another 7 other ponds with automatic data loggers

SURFACE WATER MONITORING



7 ponds monitored with automatic data loggers

SURFACE WATER MONITORING

Chris Jeitner has been replacing water level data loggers with weather stations (3 of 5 installed)

Solar powered

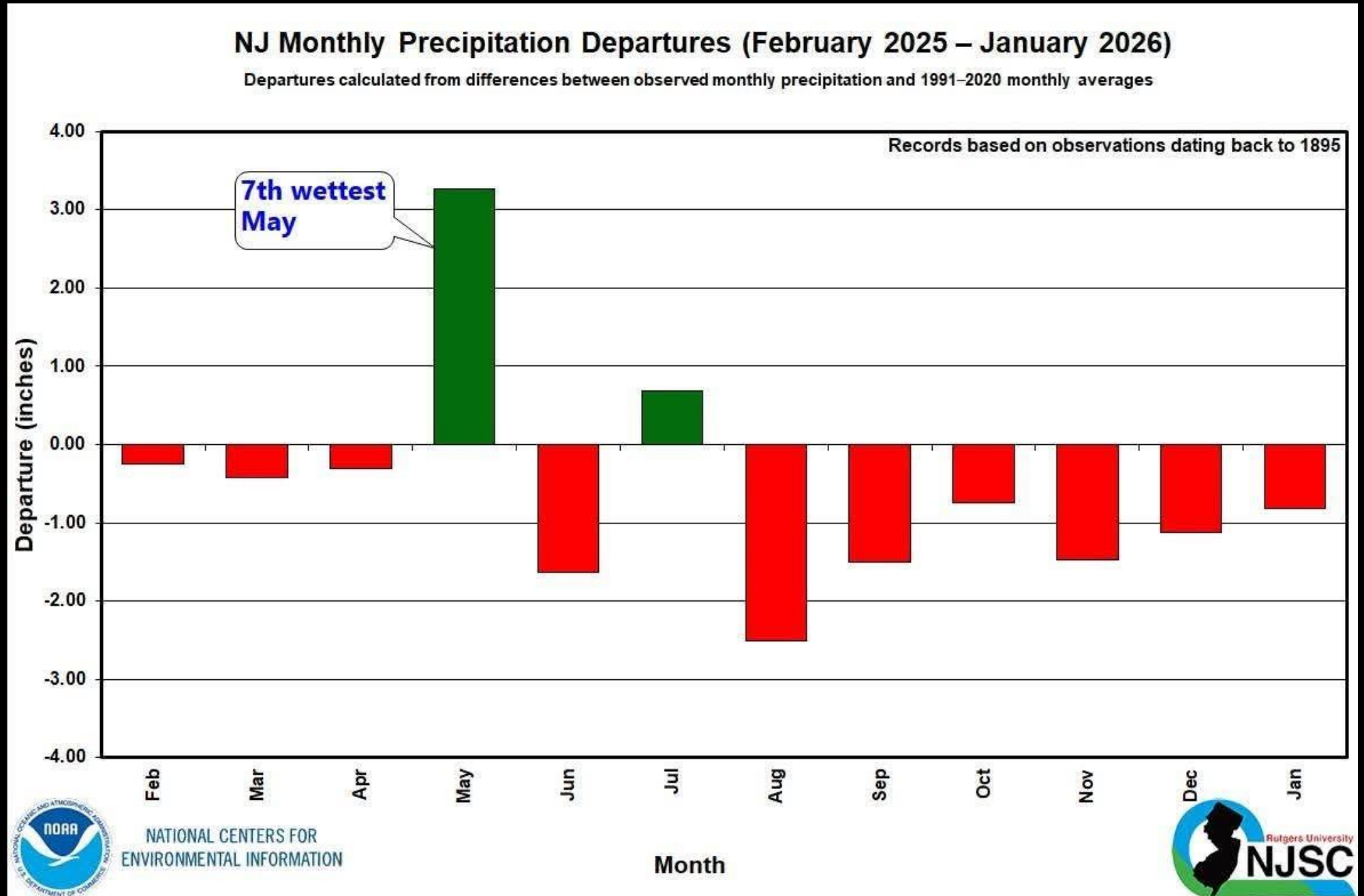
Air temperature
Humidity
Precipitation
Barometric pressure
Water depth
Water temperature

SURFACE WATER MONITORING

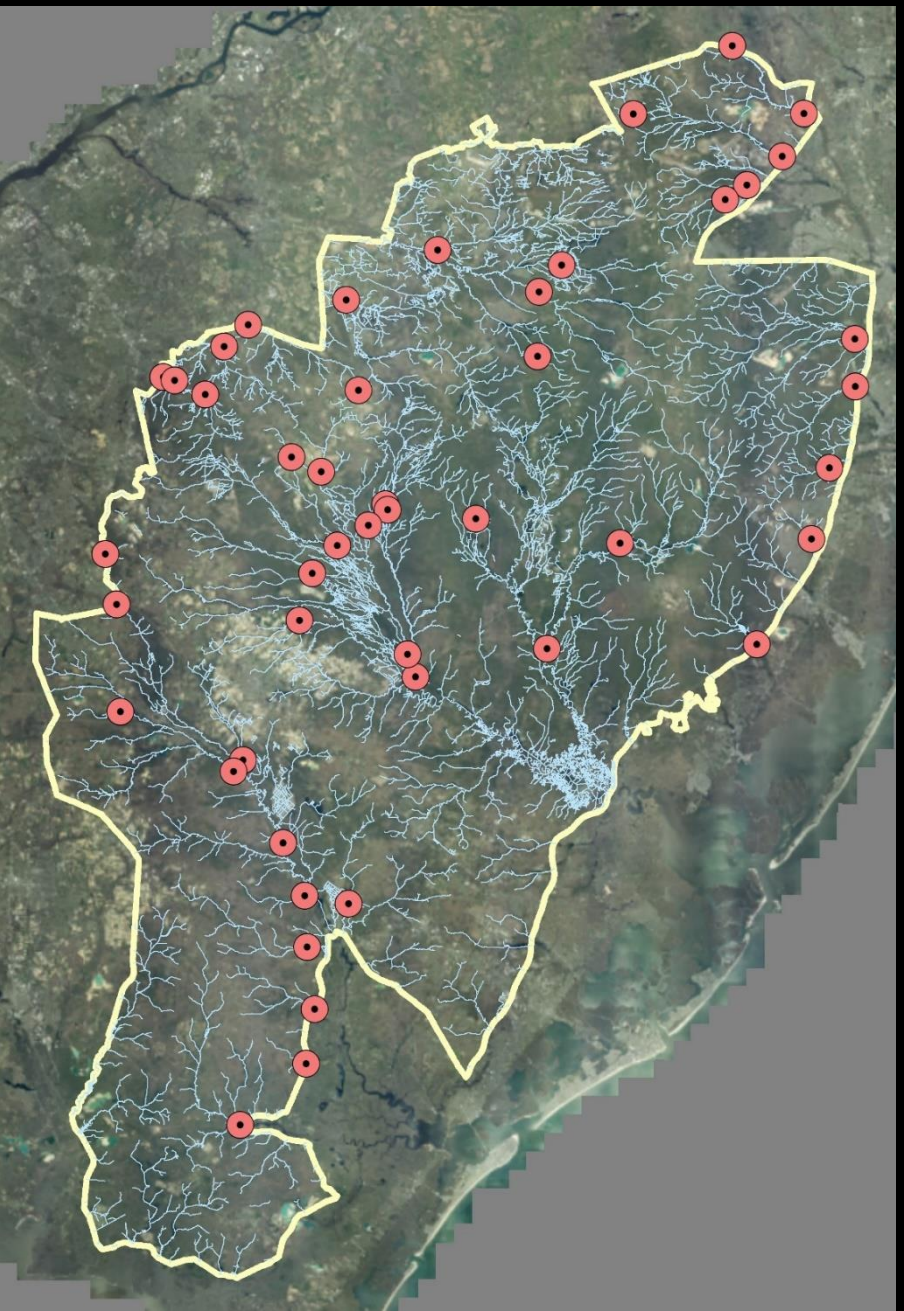
Weather station at Colliers Pond
in Colliers Mills Wildlife Management Area
October 2024

SURFACE WATER MONITORING

PRECIPITATION DATA



PINELANDS WIDE WQ MONITORING



Four Pinelands watersheds
Mullica, Rancocas, Great Egg, Barnegat Bay

Selected 47 stream sites covering a range of land use and water quality conditions

Monitored annually since 2005

April, June, August, and October

WHY? To monitor for changes in water quality overtime

PINELANDS WIDE WQ MONITORING

Measure pH

how acid the water is

Measure specific conductance

Ability of water to conduct an electrical current

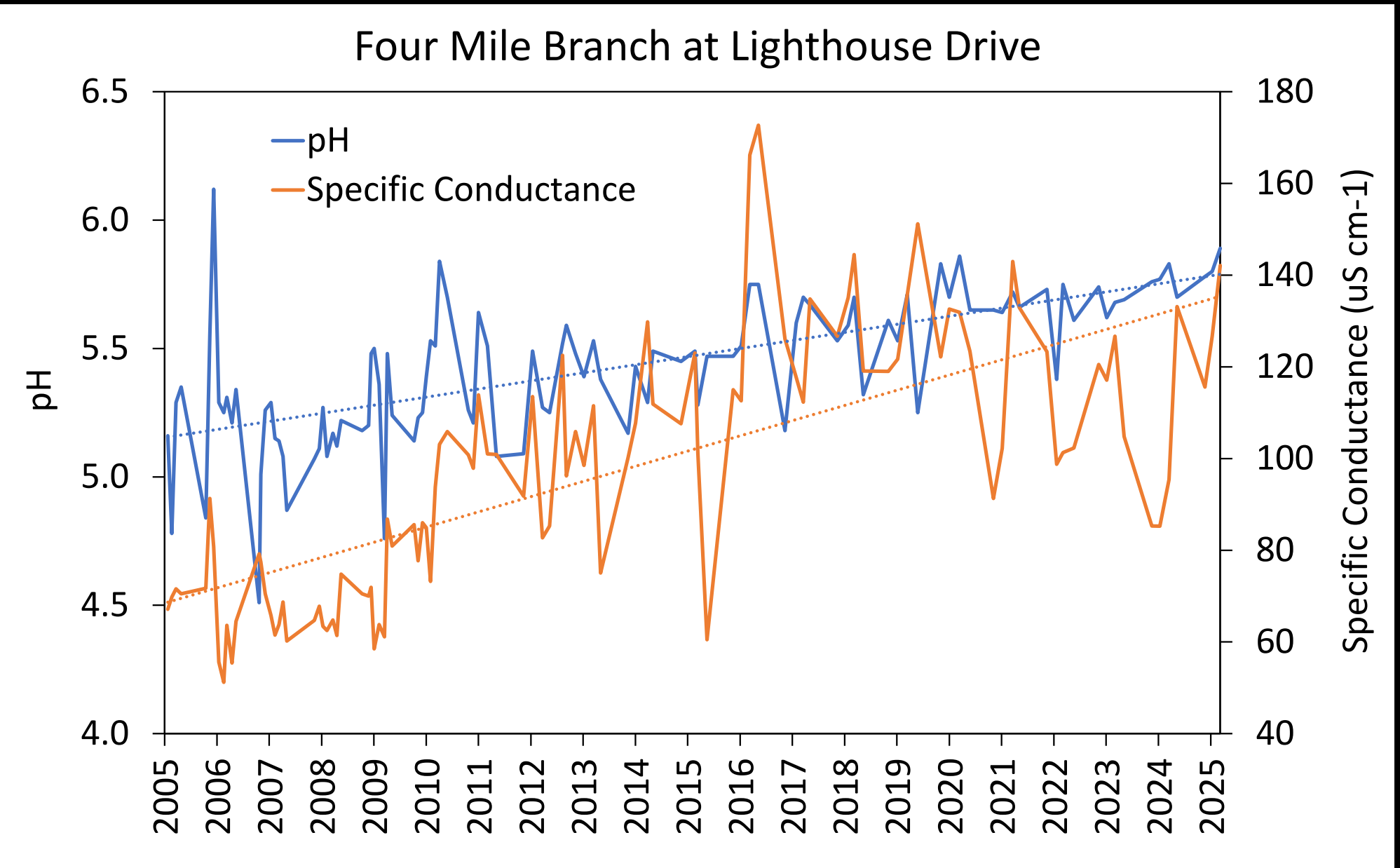
Some positive ions:

Ca, Mg, Na, K, Fe

Some negative ions:

H, Cl, SO_4, NO_3, PO_4

PINELANDS WIDE WQ MONITORING



Pinelands reference water quality conditions

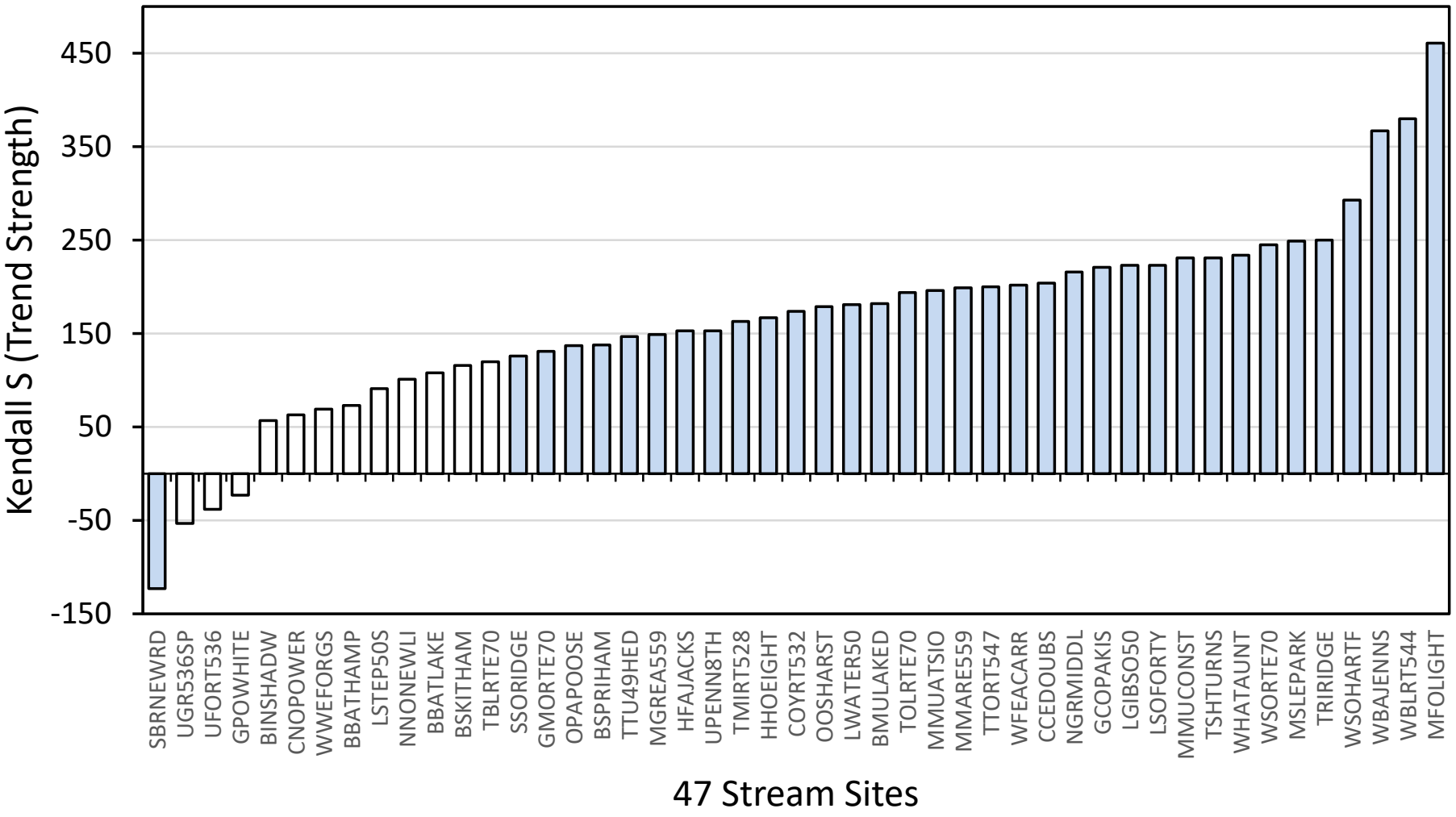
pH ~ 4.5
SC ~ 40

PINELANDS WIDE WQ MONITORING

Dr. Marilyn Sobel, retired Commission research scientist, has been rehired to analyze the 20-year data set and draft a manuscript for publication

PINELANDS WIDE WQ MONITORING

Trends in pH

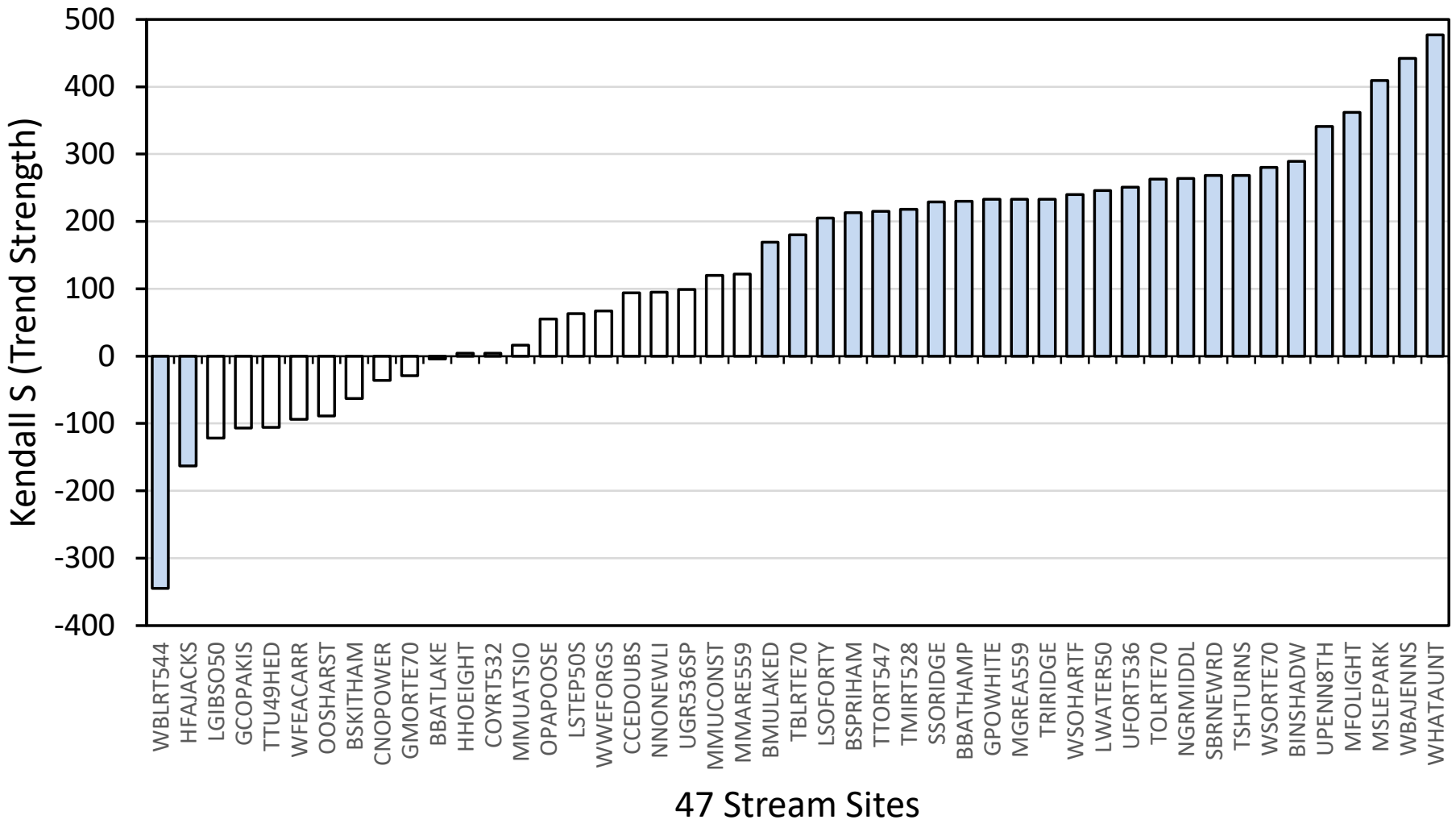


34 of 47 sites (72%) significant increase

1 of 47 sites (2%) significant decrease

PINELANDS WIDE WQ MONITORING

Trends in SC

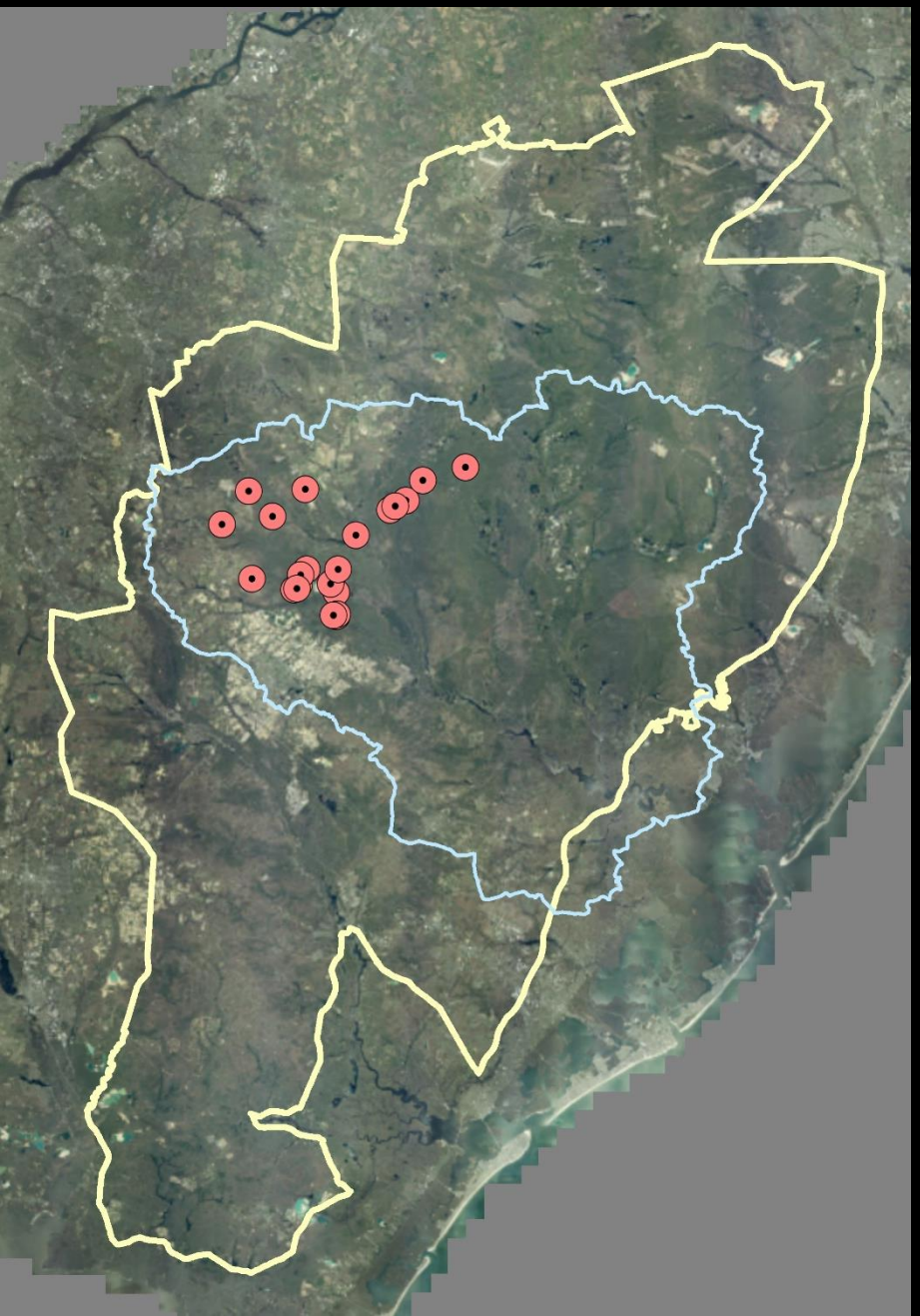


25 of 47 sites (53%) significant increase

2 of 47 sites (4%) significant decrease

More to come in the future

ANNUAL FROG AND TOAD MONITORING



22 ponds
in the
Mullica River
Basin

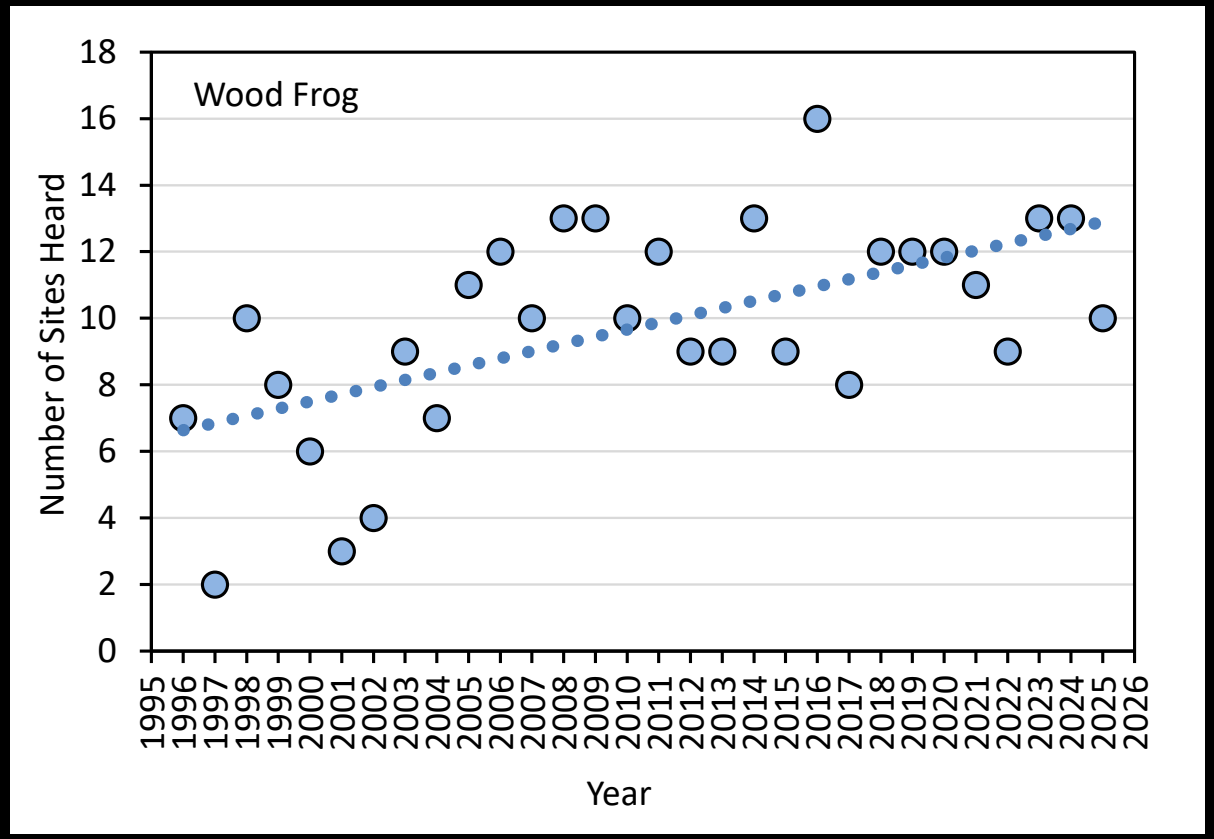
Springtime
vocalization
surveys

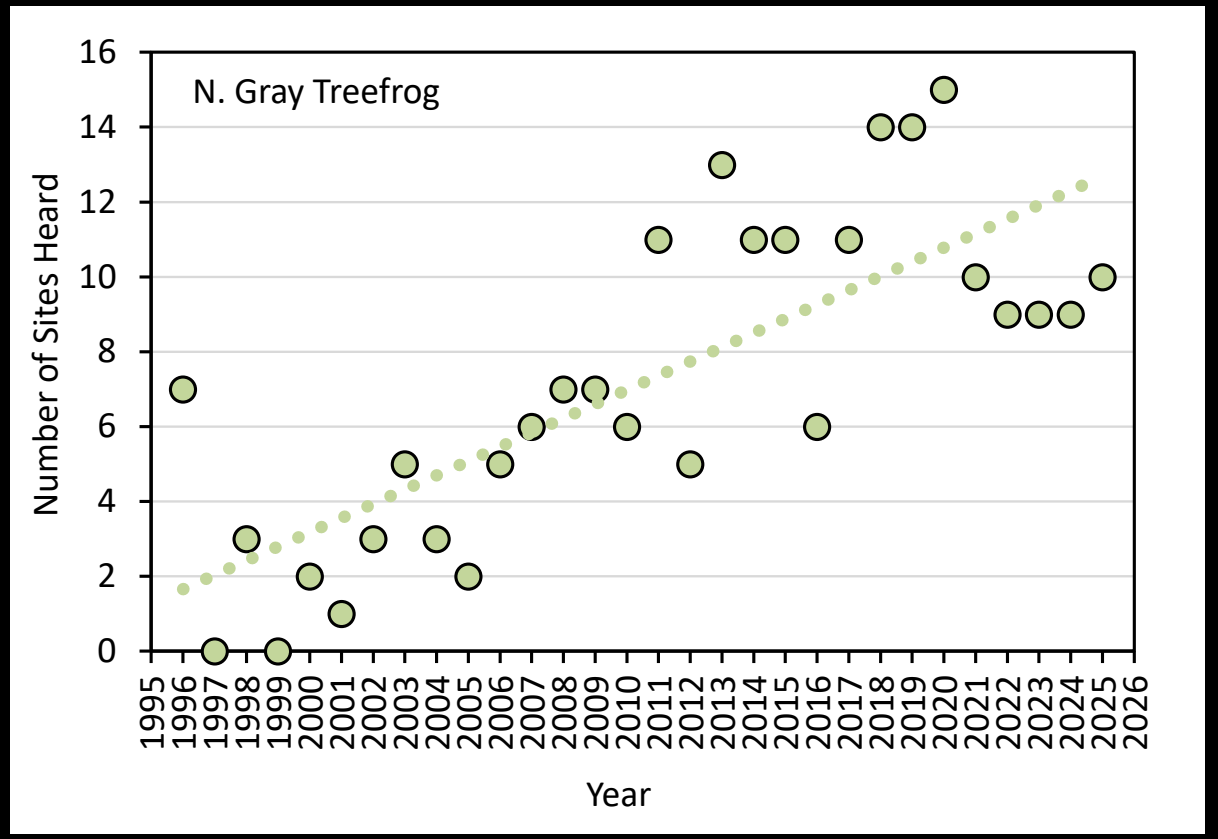
WHY?
To monitor
changes in calling
frogs and toads
over time

ANNUAL FROG AND TOAD MONITORING

30 years of vocalization surveys

Christine Healy will be analyzing trends in calling frogs and toads soon





RARE SNAKE MONITORING

Corn snake (endangered species)

Northern pine snake (threatened species)

RARE SNAKE MONITORING

Weigh and measure snakes

Passive Integrated Transponder (PIT) tag for permanent ID

RARE SNAKE MONITORING

Radio telemetry

Surgically implant radio transmitters in corn snakes and pine snakes

Surgeries done by Commission scientists trained by Dr. Howard Reinert of TCNJ

Use a receiver and antenna to relocate snakes

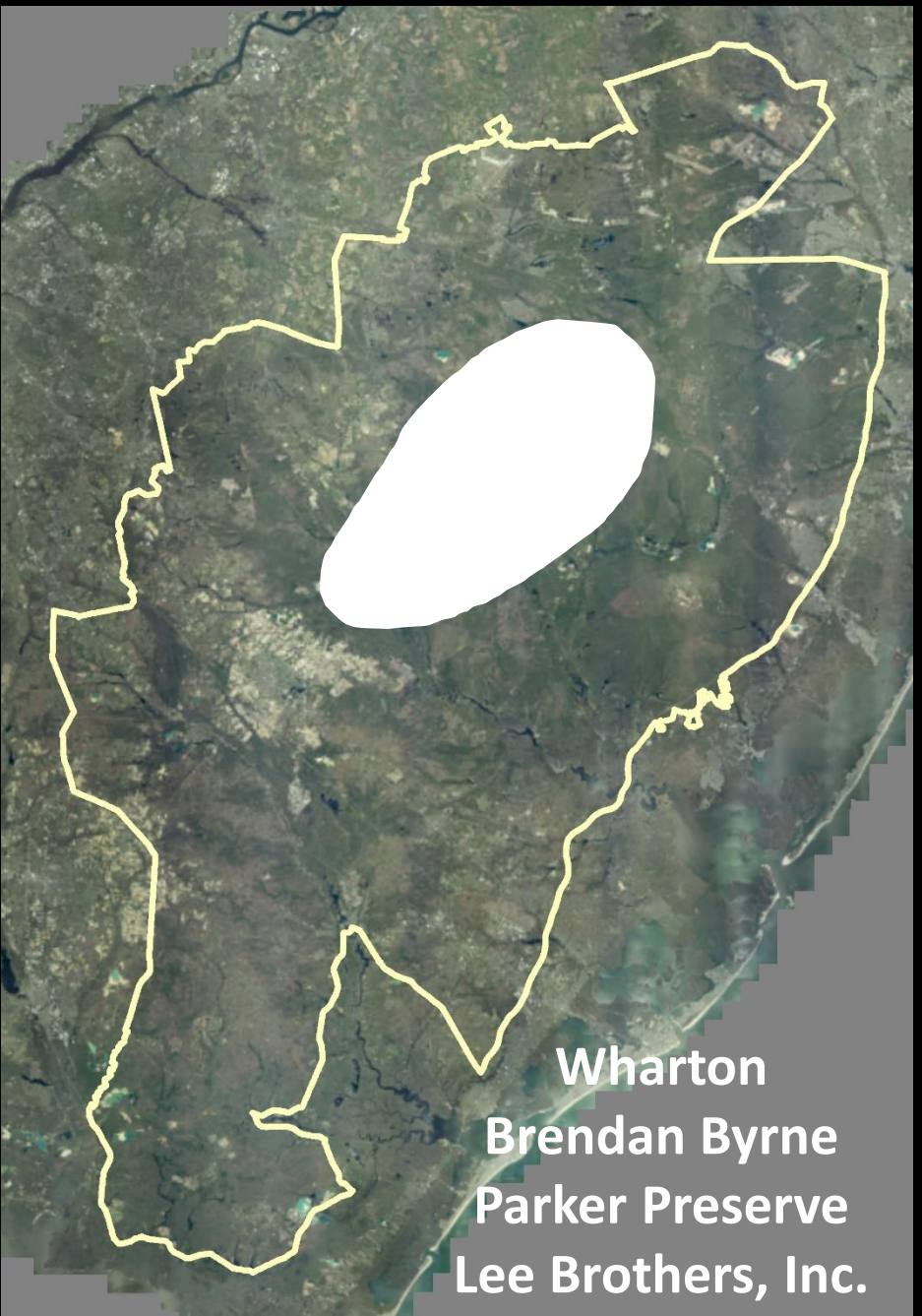
RARE SNAKE MONITORING

No surgeries after September 15th

Not enough time to heal up before winter

Attach a radio transmitter to the tail using tape

RARE SNAKE MONITORING



WHY?

1. Locate hibernacula and nest areas
2. Overwintering and emergence timing

Development application surveys
Vegetation management on utility ROWs
Forest Stewardship and Cedar Restoration
Enduro events

3. Habitat types that animals use

Trigger surveys for development applications
NJDEP Landscape Project
Habitat management

RARE SNAKE MONITORING

Pinelands Hibernacula

Human made

Buried junk
Rubble piles
Old foundations

Natural

Mammal burrows
Stump holes

RARE SNAKE MONITORING

Little data on long-term rare snake trends in the Pinelands

Hibernacula corrals are a non-invasive method to census snakes

No disturbance to hibernacula or hibernating snakes

Camera monitoring network for security

RARE SNAKE MONITORING

Box corrals are used near roads and trails

RARE SNAKE MONITORING

Hibernacula

Corn snakes
100 corralled
35 not corralled

Pine snakes
34 corralled
31 not corralled

Numbers change over time

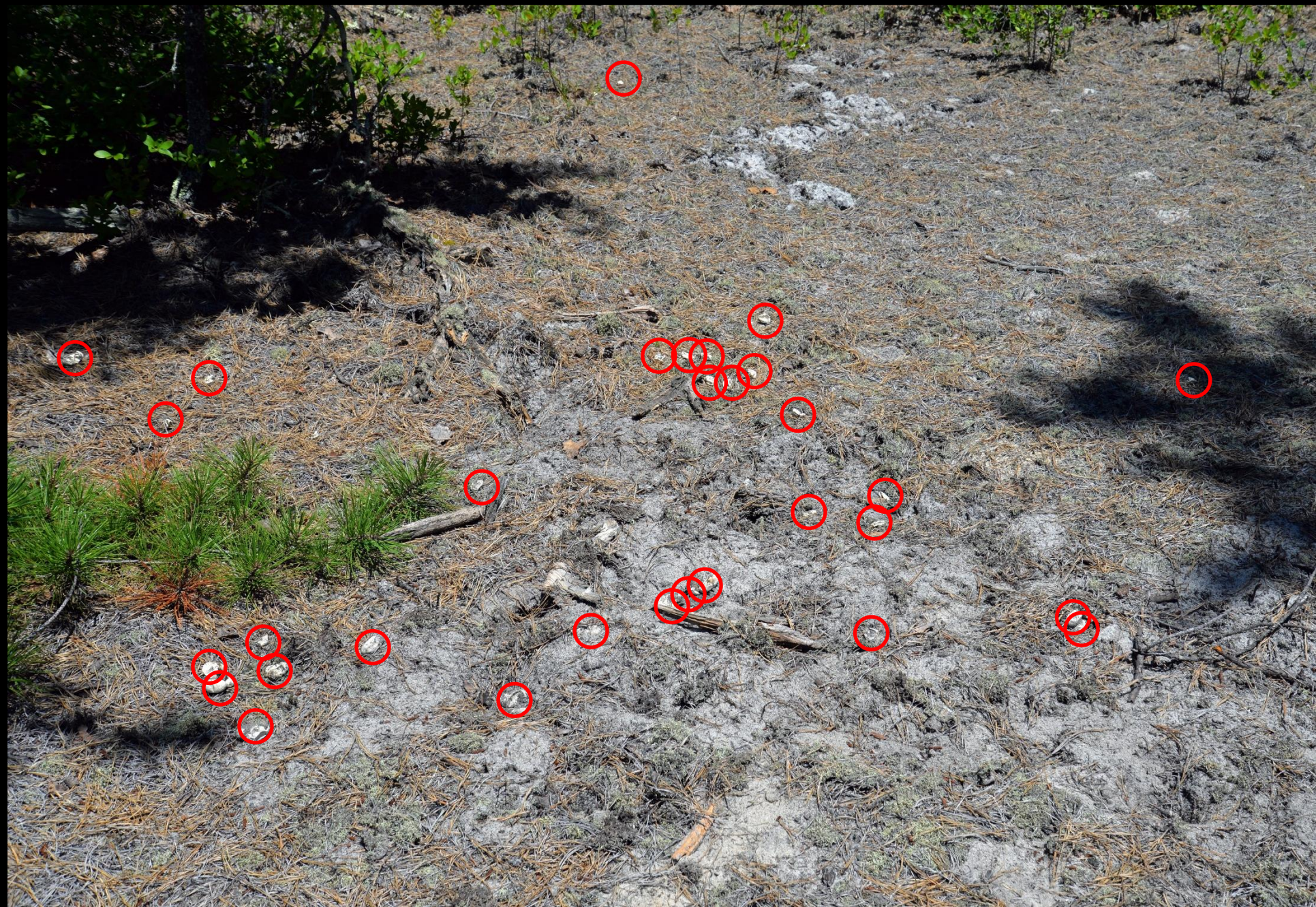
RARE SNAKE MONITORING

Look for nest areas

Also focus on corn snakes and pine snakes

RARE SNAKE MONITORING

Communal corn snake nest area destroyed by predators



RARE SNAKE MONITORING

Female pine snakes dig their own nests

RARE SNAKE MONITORING

RARE SNAKE MONITORING

PIT tag for permanent ID
Weigh and measure
Release at nest site

Corn snake hatchlings

Pine snake hatchlings

RARE SNAKE MONITORING

Number of unique individuals captured during the monitoring program

Snake Species	# Non-hatchlings	# Hatchlings	Total #
Northern water snake	1	-	1
Eastern ribbon snake	2	-	2
Northern redbelly snake	2	-	2
Northern scarlet snake*	2	-	2
Timber rattlesnake**	6	-	6
Black rat snake	12	-	12
Eastern garter snake	14	-	14
Rough green snake	14	-	14
Eastern milk snake	23	-	23
Eastern hognose snake	37	58	95
Eastern king snake	92	110	202
Northern black racer	213	10	223
Northern pine snake*	327	401	728
Corn snake**	484	860	1344
Total Number	1229	1439	2668

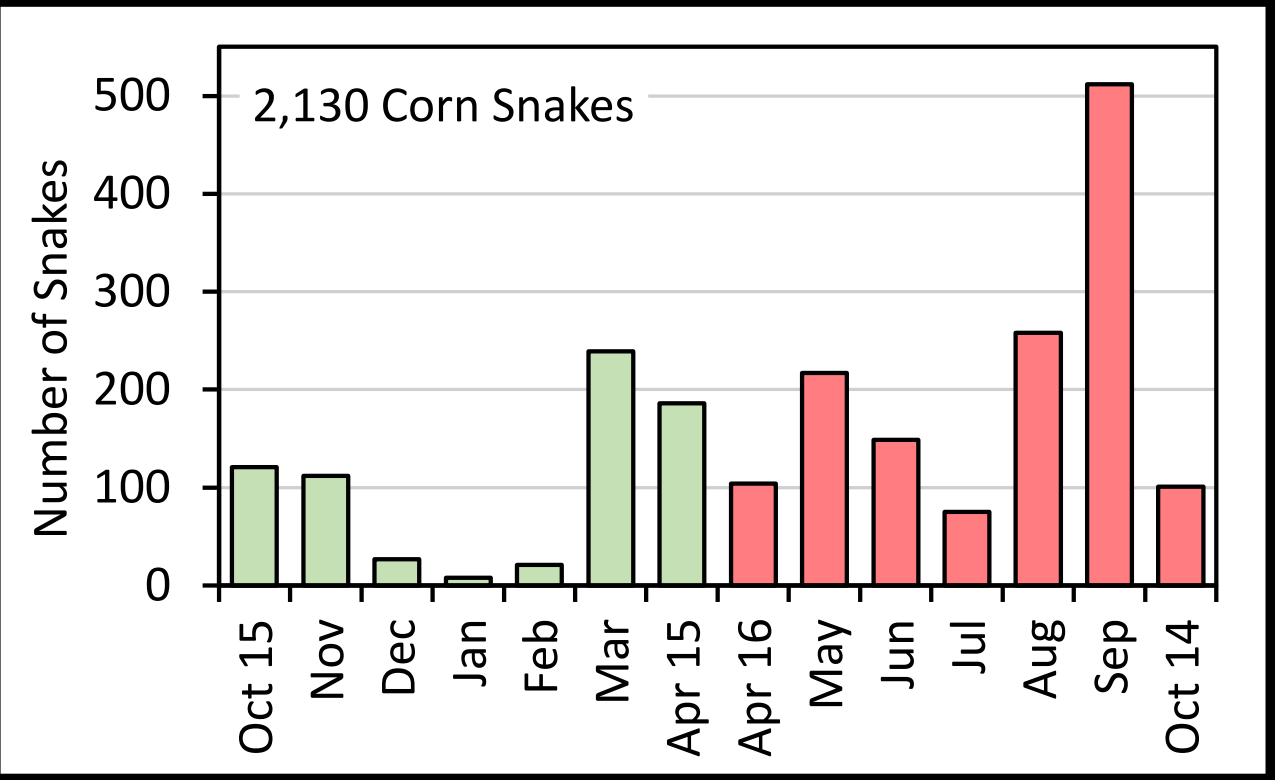
RARE SNAKE MONITORING

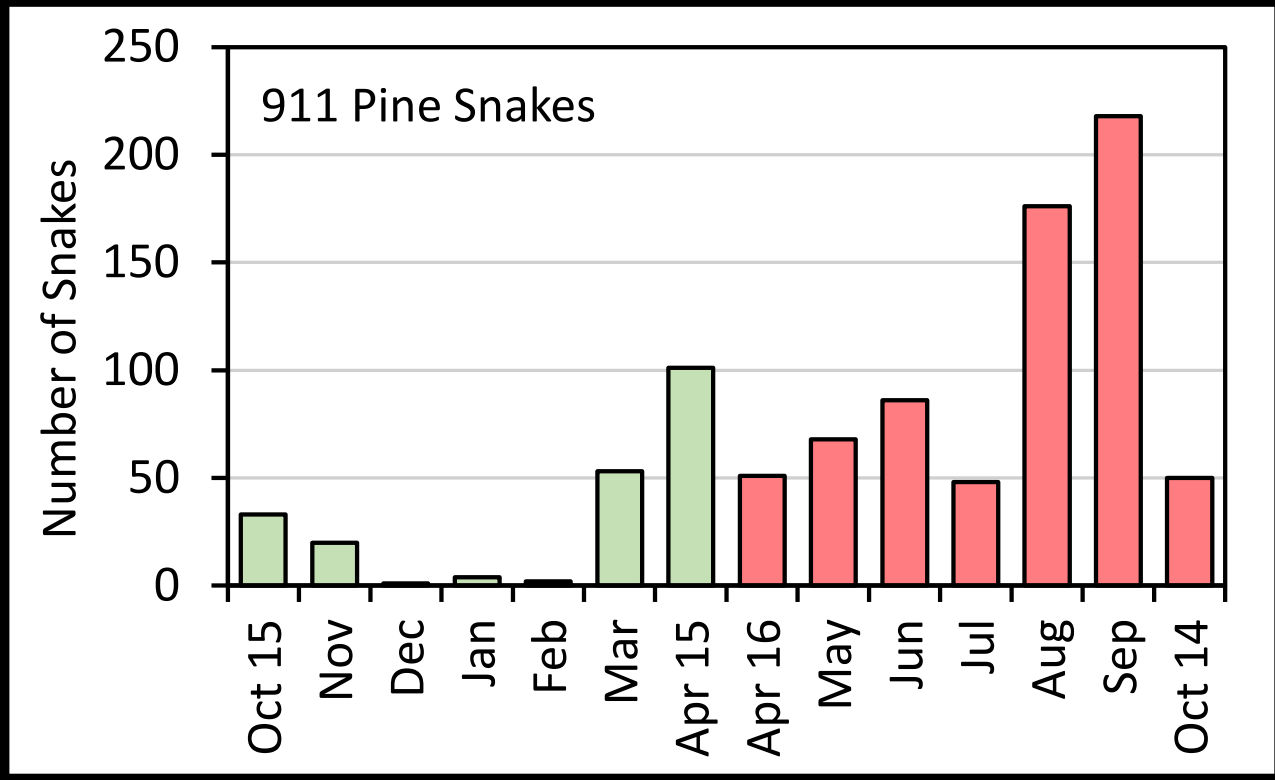
Number of unique individuals captured during the monitoring program

Snake Species	# Non-hatchlings	# Hatchlings	Total #	# Recaptured	% Recaptured
Northern water snake	1	-	1	0	0%
Eastern ribbon snake	2	-	2	0	0%
Northern redbelly snake	2	-	2	0	0%
Northern scarlet snake*	2	-	2	0	0%
Timber rattlesnake**	6	-	6	0	0%
Black rat snake	12	-	12	0	0%
Eastern garter snake	14	-	14	5	36%
Rough green snake	14	-	14	2	14%
Eastern milk snake	23	-	23	5	22%
Eastern hognose snake	37	58	95	4	4%
Eastern king snake	92	110	202	43	21%
Northern black racer	213	10	223	39	17%
Northern pine snake*	327	401	728	109	15%
Corn snake**	484	860	1344	282	21%
Total Number	1229	1439	2668	489	18%

RARE SNAKE MONITORING

Enduro events are permitted from October 15th - April 15th
NJDEP F&W asked about the timing of snake activity





34% of corn snakes and 23% of pine snakes on the surface October 15th – April 15th
Concentrated near their hibernacula, cold, sluggish and more vulnerable

RARE SNAKE MONITORING

Spring Emergence

iButtons are small electronic devices that measure temperature and store the data

External iButtons at hibernacula

Internal iButtons inside snakes

RARE SNAKE MONITORING

Program iButton and download temperature data through the snake

RARE SNAKE MONITORING

Tea Time Hill Wildfire

Wharton State Forest
Started July 4, 2024
Burned 4,300 acres

Burned our plywood snake cover
Burned up all known shed logs
Burned out stump hole hibernacula

RARE SNAKE MONITORING

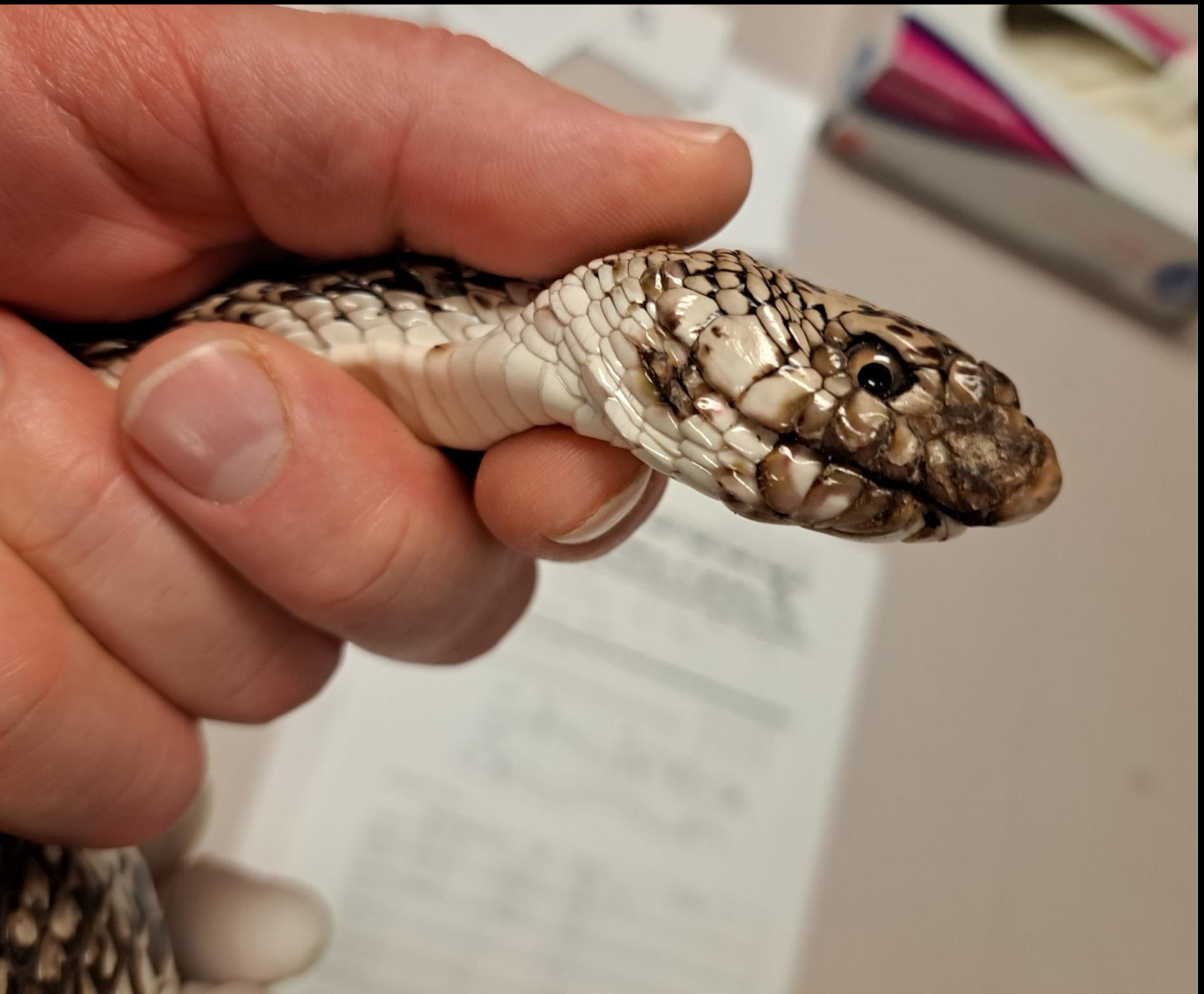
RARE SNAKE MONITORING

Melted 61 hibernacula corrals

All corrals have been repaired

RARE SNAKE MONITORING

SNAKE FUNGAL DISEASE MONITORING



Caused by a fungus

Ophidiomyces ophiodiicola

Collaborating separately with Rutgers/HA

and Virginia Tech

WHY? To better understand impacts to rare snake populations

SNAKE FUNGAL DISEASE MONITORING

Rutgers/HA

Excavate several pine snake hibernacula every winter

~40 years

In 2018, we began swabbing the snakes for SFD

SNAKE FUNGAL DISEASE MONITORING

Four papers published to date

1. Campbell, L.J., J. Burger, R.T. Zappalorti, J.F. Bunnell, M.E. Winzeler, D.R. Taylor, J.M. Lorch. 2021. Soil reservoir dynamics of *Ophidiomyces ophidiicola*, the causative agent of snake fungal disease. Journal of Fungi 2021, 7, 461. https://doi.org/10.3390/jof7060461

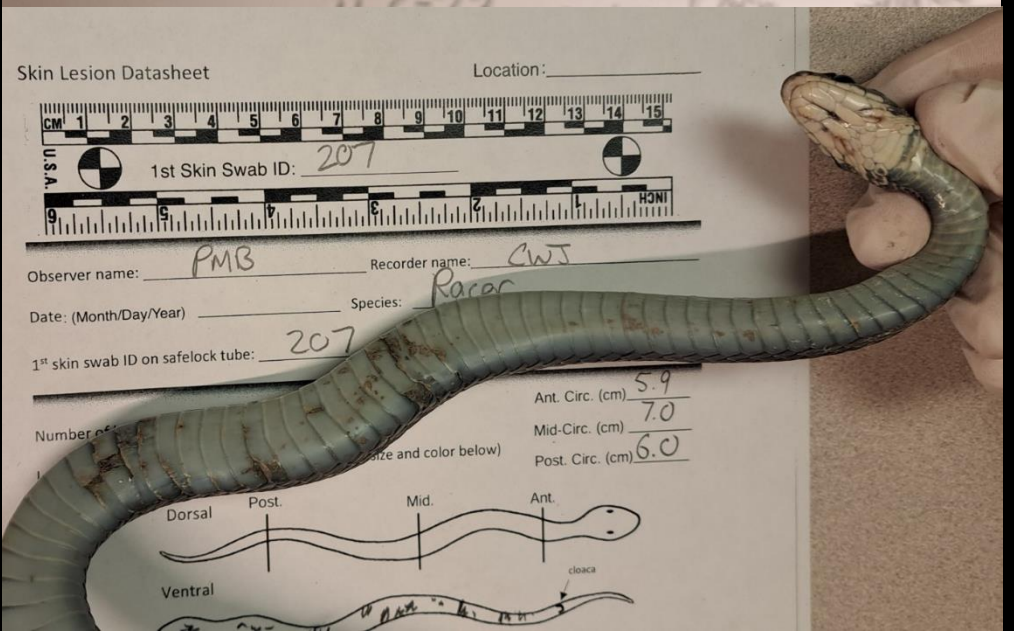
2. Burger, J., M. Gochfeld, R. Zappalorti, J. Bunnell, C. Jeitner, D. Schneider, K. Ng, E. DeVito, and J.M. Lorch. 2023. Prevalence of *Ophidiomyces ophidiicola* and epizootiology of snake fungal disease in free-ranging Northern Pine Snakes (*Pituophis melanoleucus melanoleucus*) in New Jersey. Environmental Monitoring and Assessment, 2023, 195, 662. https://doi.org/10.1007/s10661-023-11259-w

3. Burger, J., C. Jeitner, R. Zappalorti, J. Bunnell, K. Ng, E. DeVito, D. Schneider, and M. Gochfeld. 2024. Snake fungal disease in free-ranging Northern Pine Snakes (*Pituophis melanoleucus melanoleucus*) in New Jersey: Lesions, severity of sores and investigator's perceptions. Journal of Fungi 2024, 10, 125. https://doi.org/10.3390/jof10020125

4. Burger, J., C. Jeitner, R.T. Zappalorti, J. Bunnell, K, Ng, E. DeVito, D. Schneider, M. Gochfeld. 2025. Snake fungal disease (Ophidiomycosis) in Northern Pine Snakes (*Pituophis melanoleucus melanoleucus*) in New Jersey: Variations by year, sex, and morphological sampling site. Journal of Fungi 2025, 11, 206. https://doi.org/10.3390/jof11030206

5. New manuscript submitted in 2026

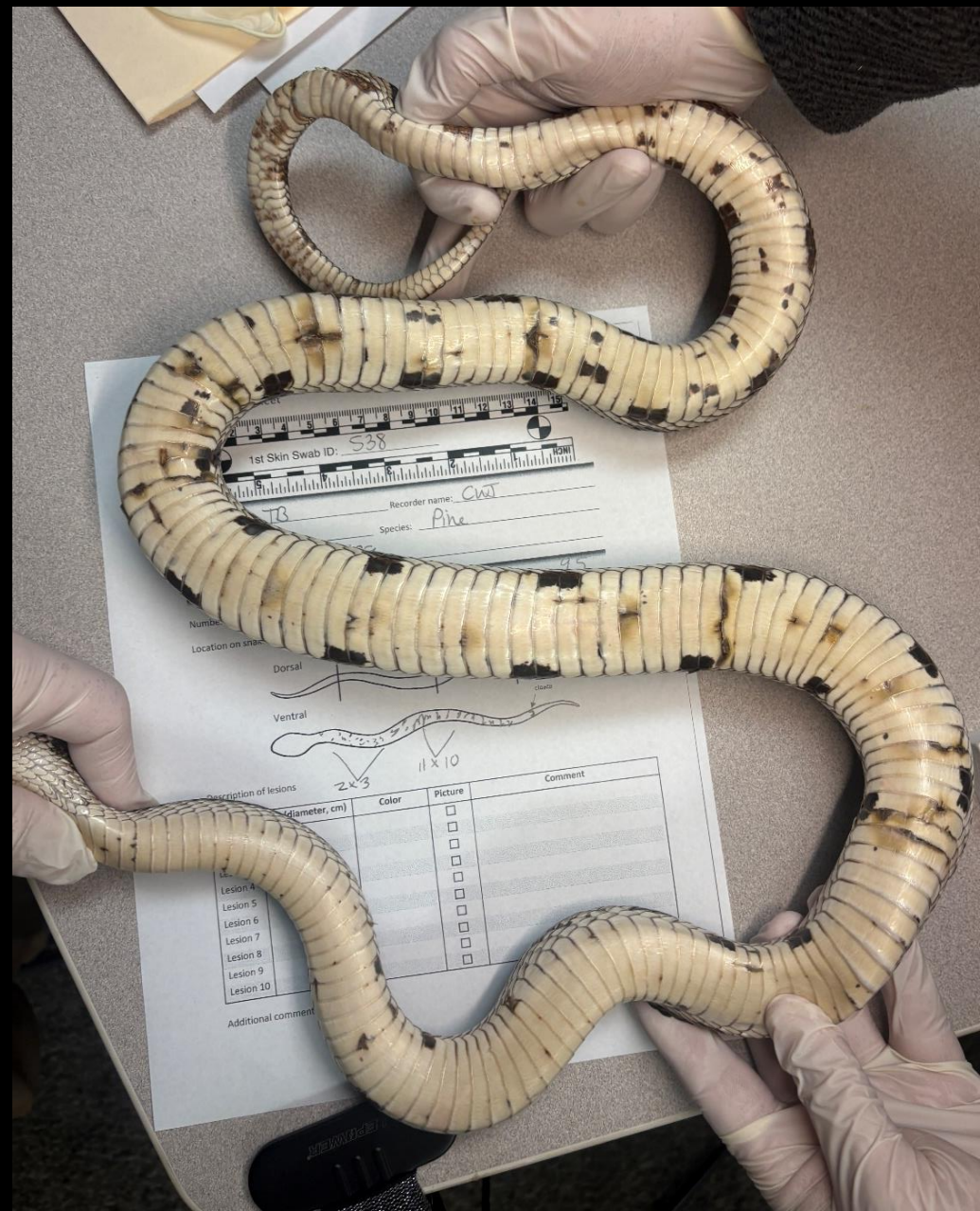
SNAKE FUNGAL DISEASE MONITORING



Virginia Tech

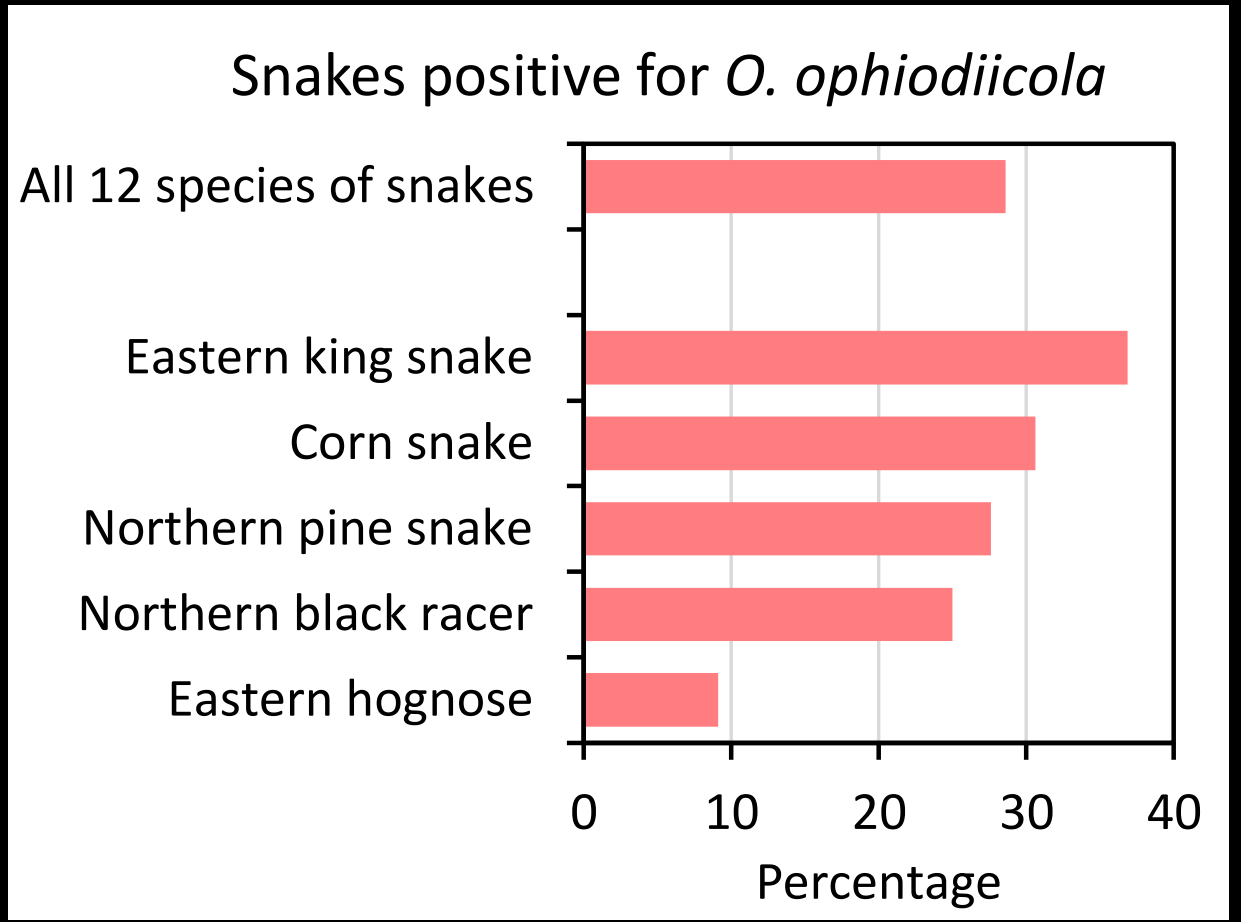
Swab every snake we find

Measure and swab lesions



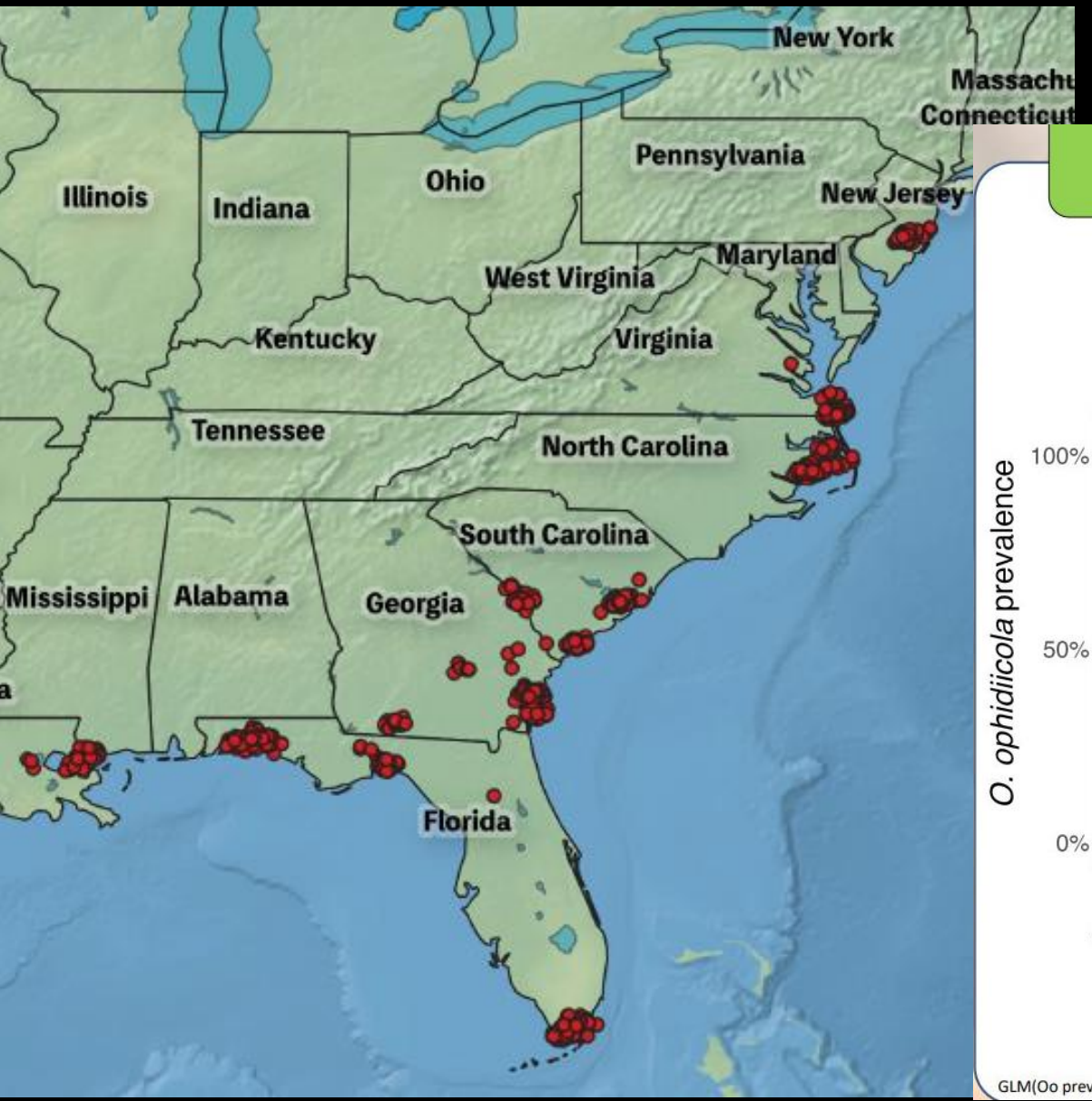
SNAKE FUNGAL DISEASE MONITORING

Results for 2023 - 2024

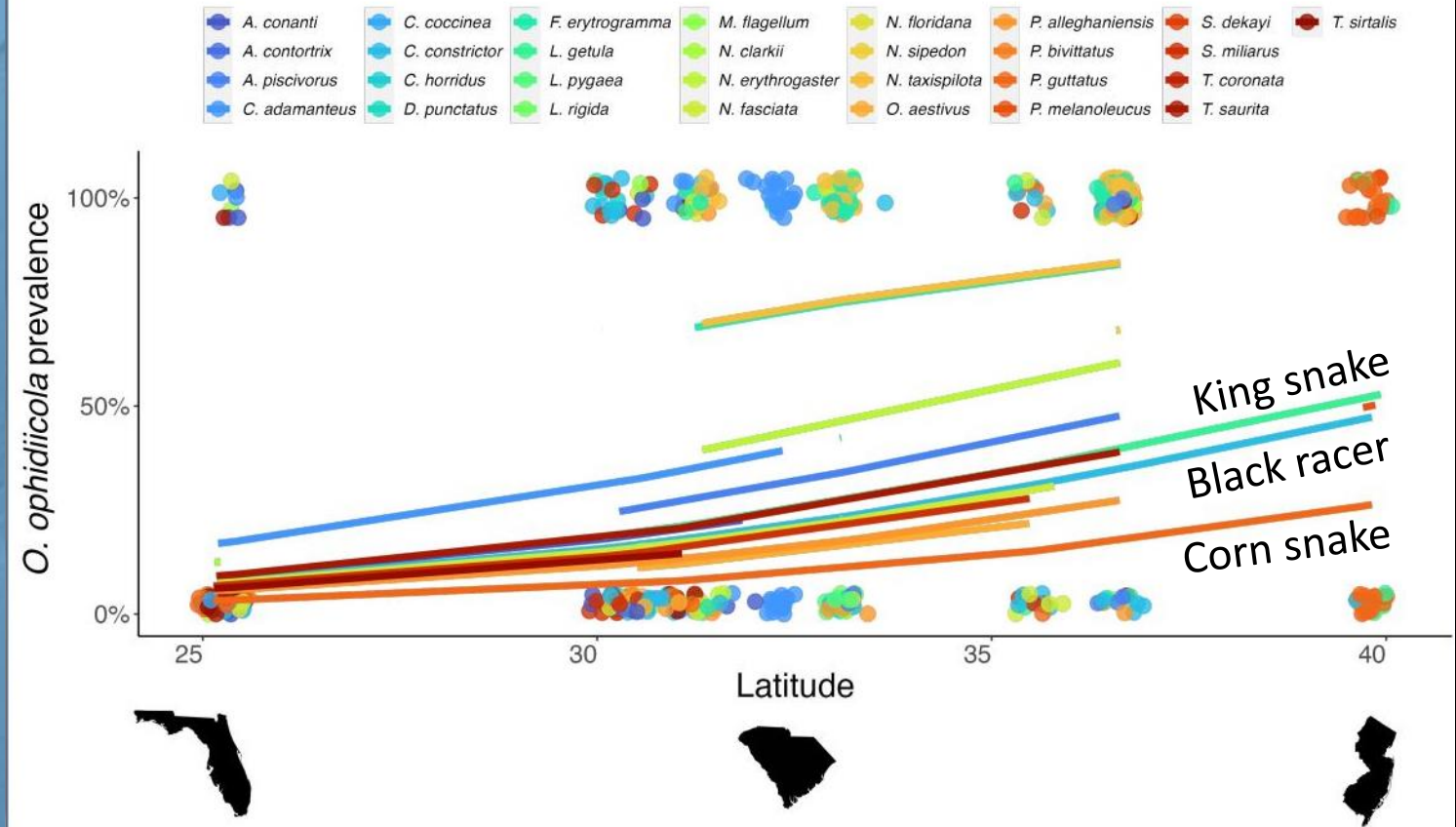


SNAKE FUNGAL DISEASE MONITORING

Prevalence of O.o. increases with latitude from Florida north to New Jersey



Geographic variation



GLM(Oo prevalence~Latitude+Species, Binomial distribution), Latitude effect = coeff: 0.143±0.035, P<0.0001

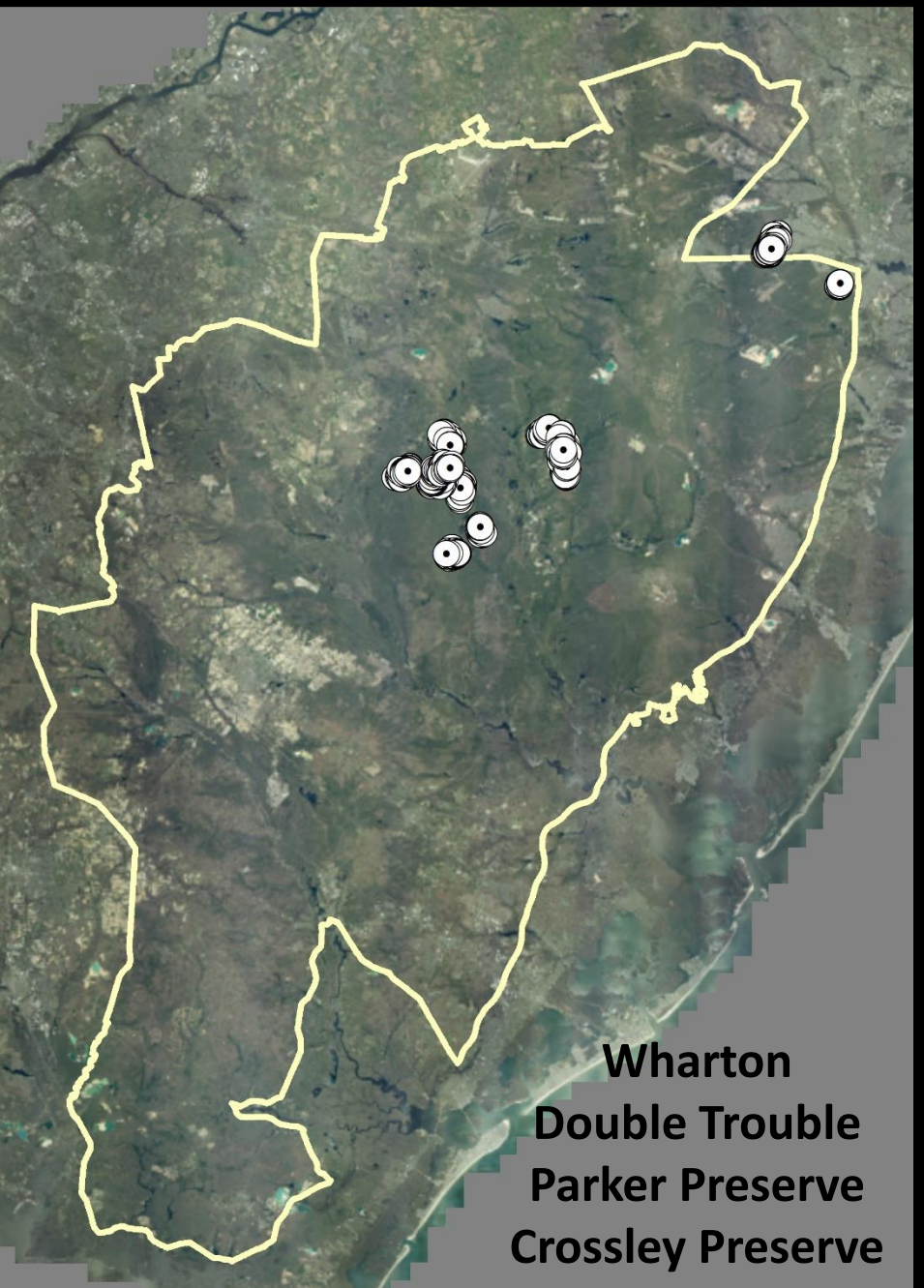
EASTERN KING SNAKE STUDY

WHY?

Listed as a Species of Special Concern

Threats, regional declines, and unknown status in NJ

EASTERN KING SNAKE STUDY



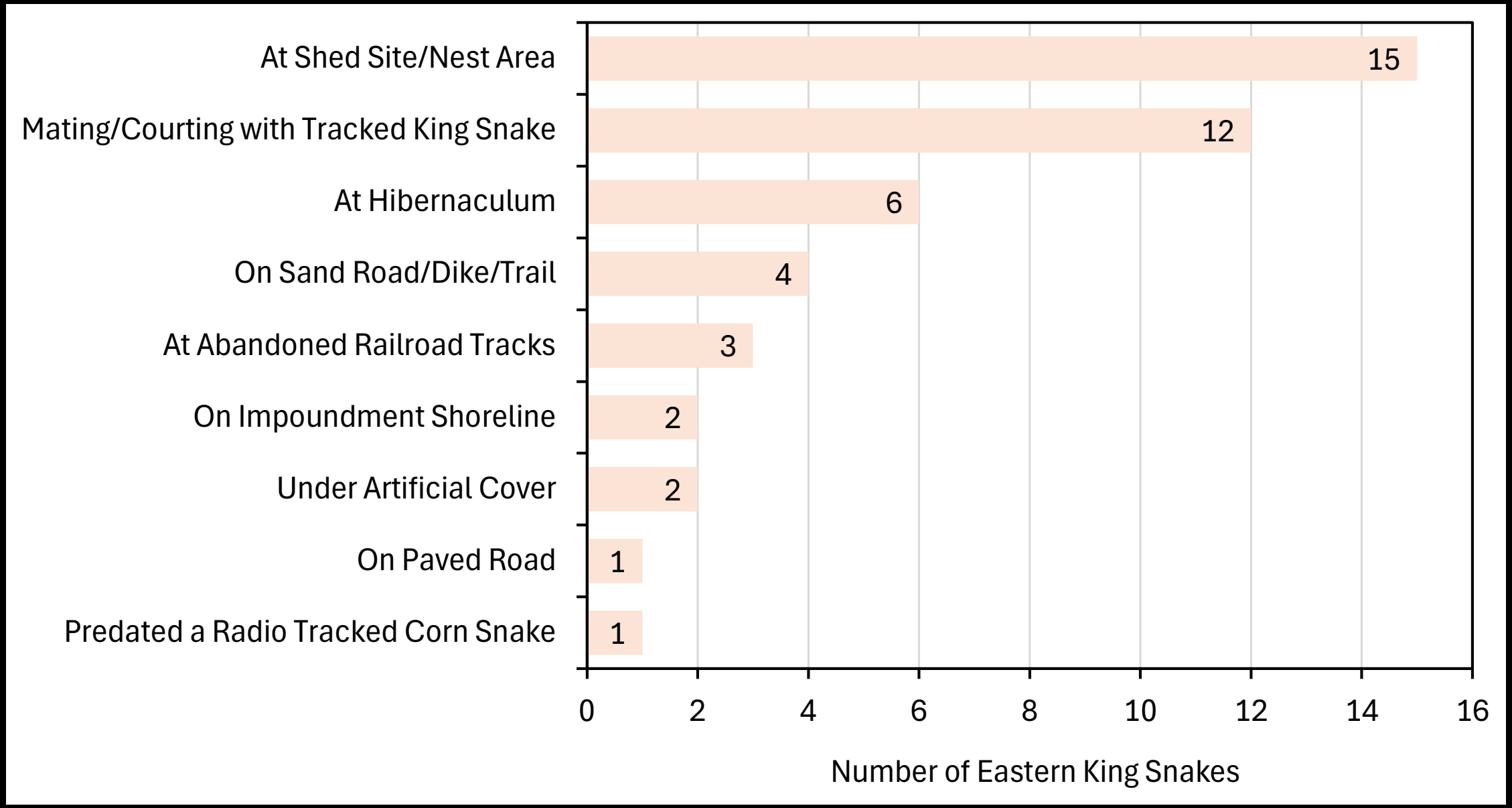
Radio telemetry

Activity range, habitat use, and timing

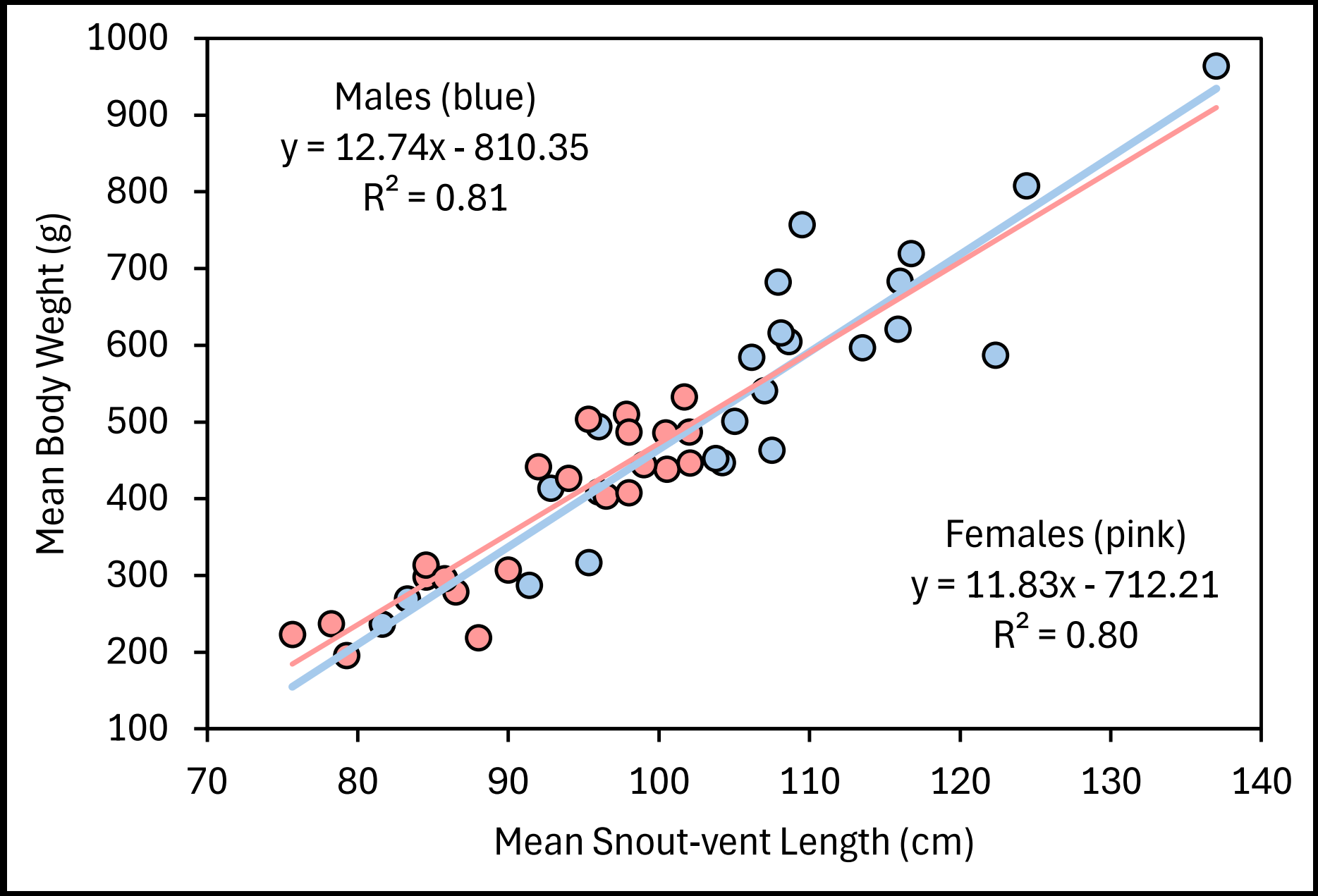
Tracked 46 kingsnakes over four-year period

24 males, 22 females

EASTERN KING SNAKE STUDY



EASTERN KING SNAKE STUDY

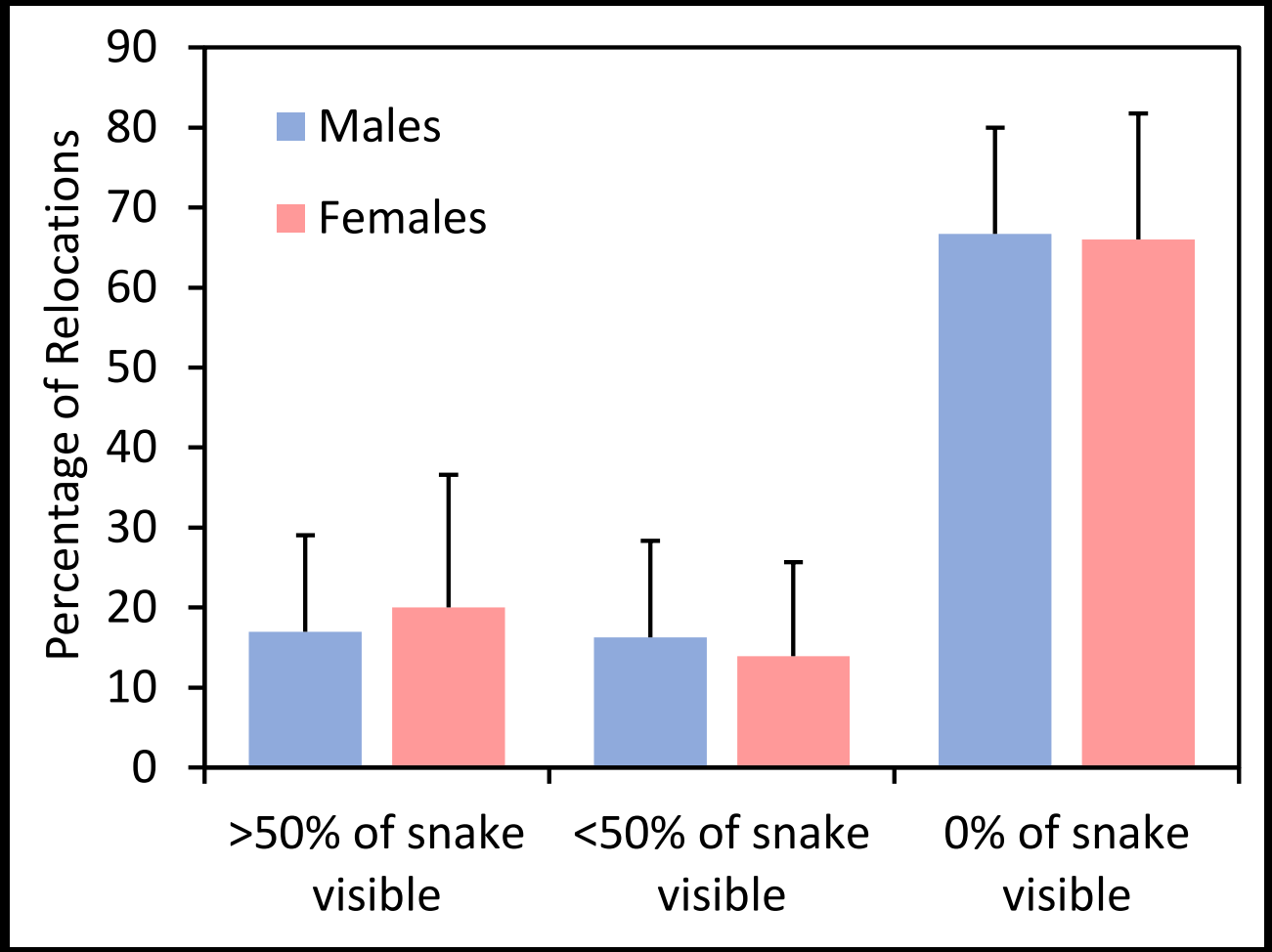


Strong relationship between body length and weight

Males significantly larger than females

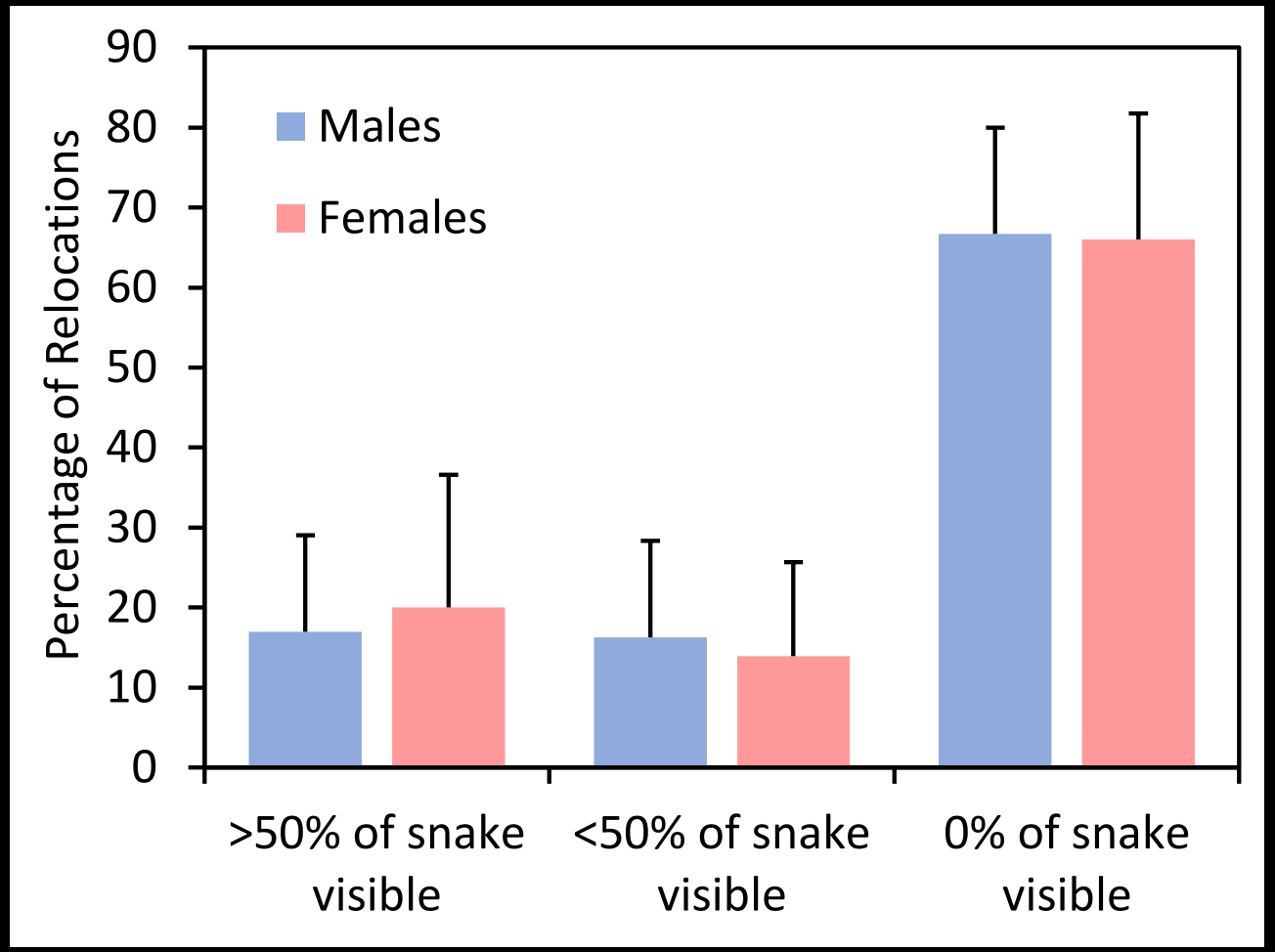
EASTERN KING SNAKE STUDY

King snakes are usually concealed from view

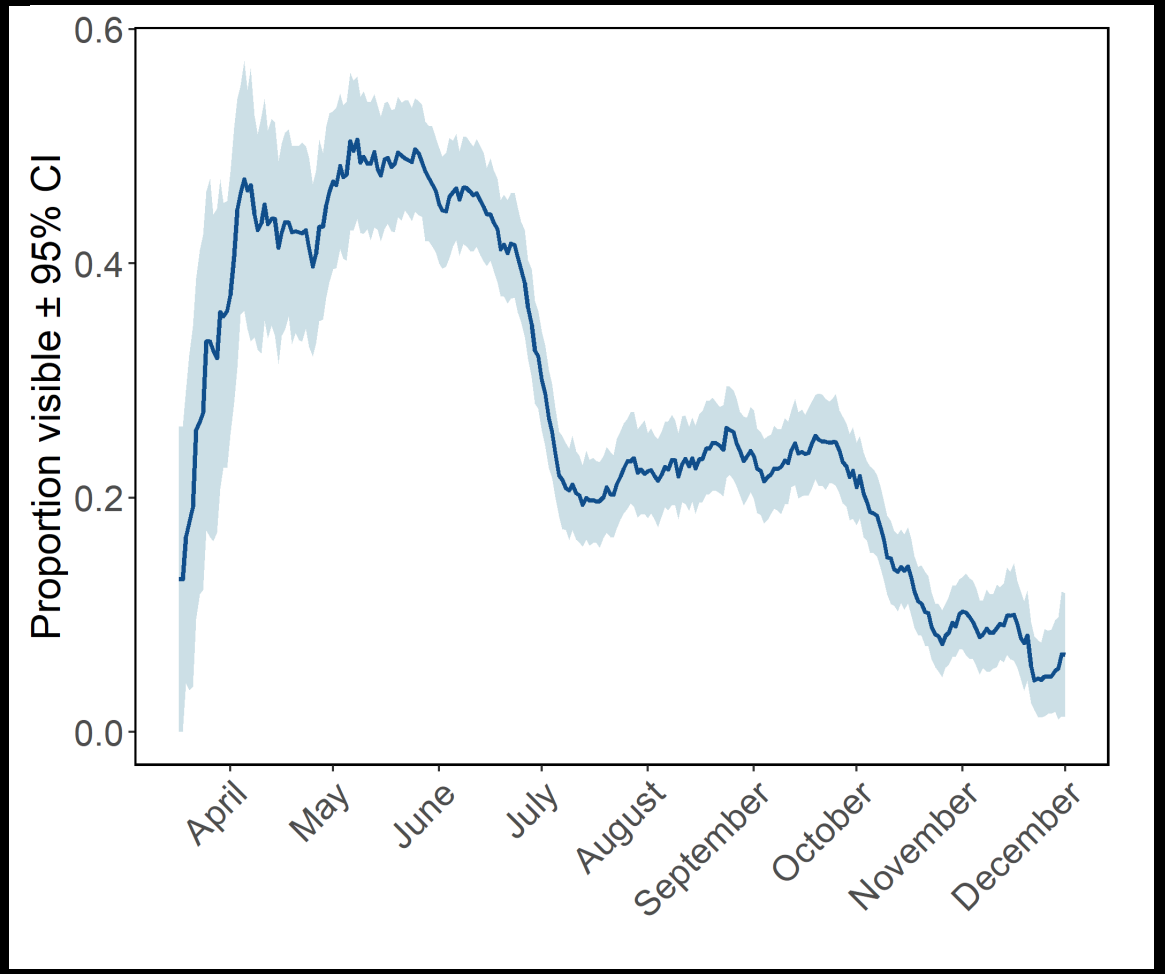


EASTERN KING SNAKE STUDY

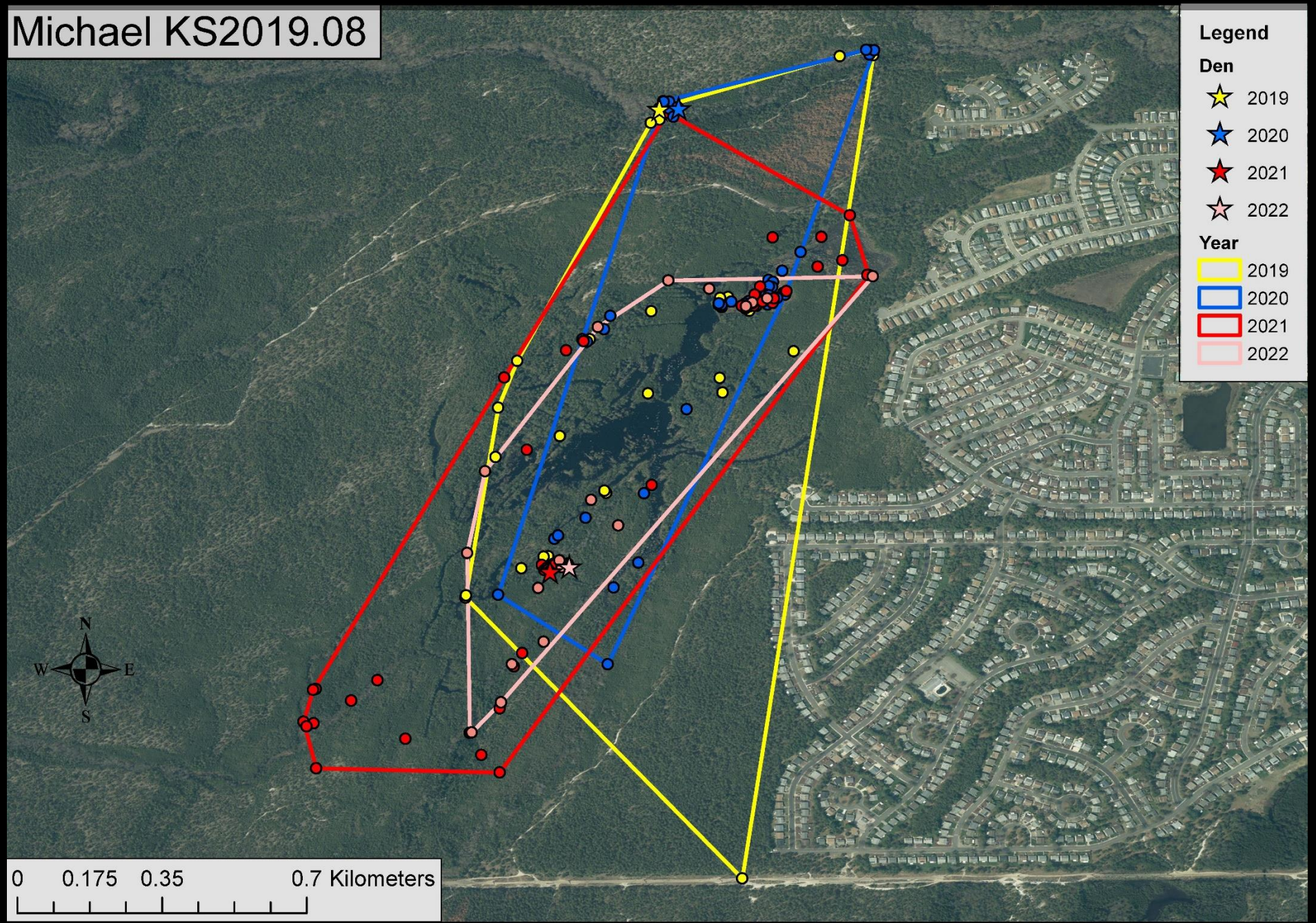
King snakes are usually concealed from view



Snake visibility varies by time of year



EASTERN KING SNAKE STUDY



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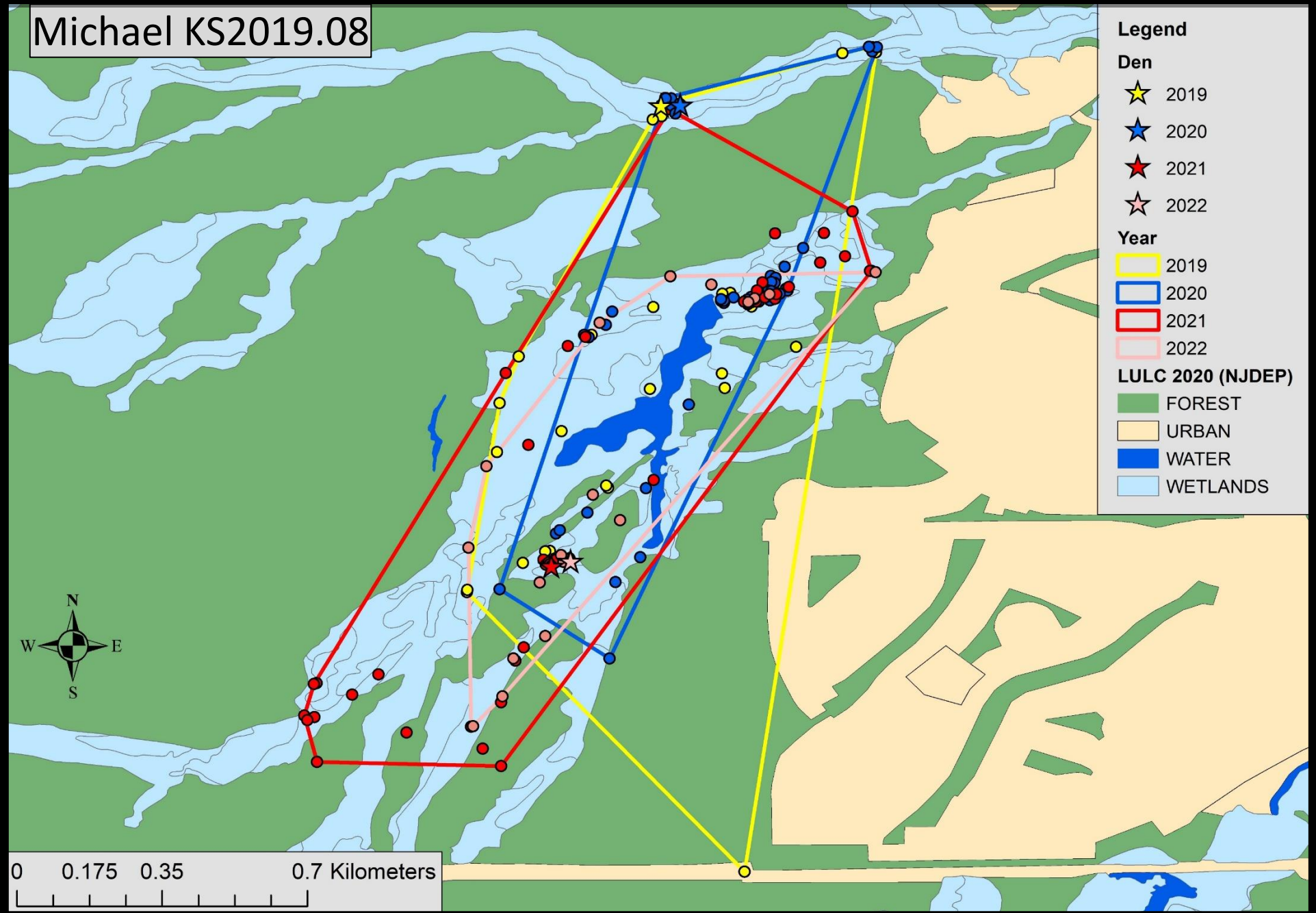

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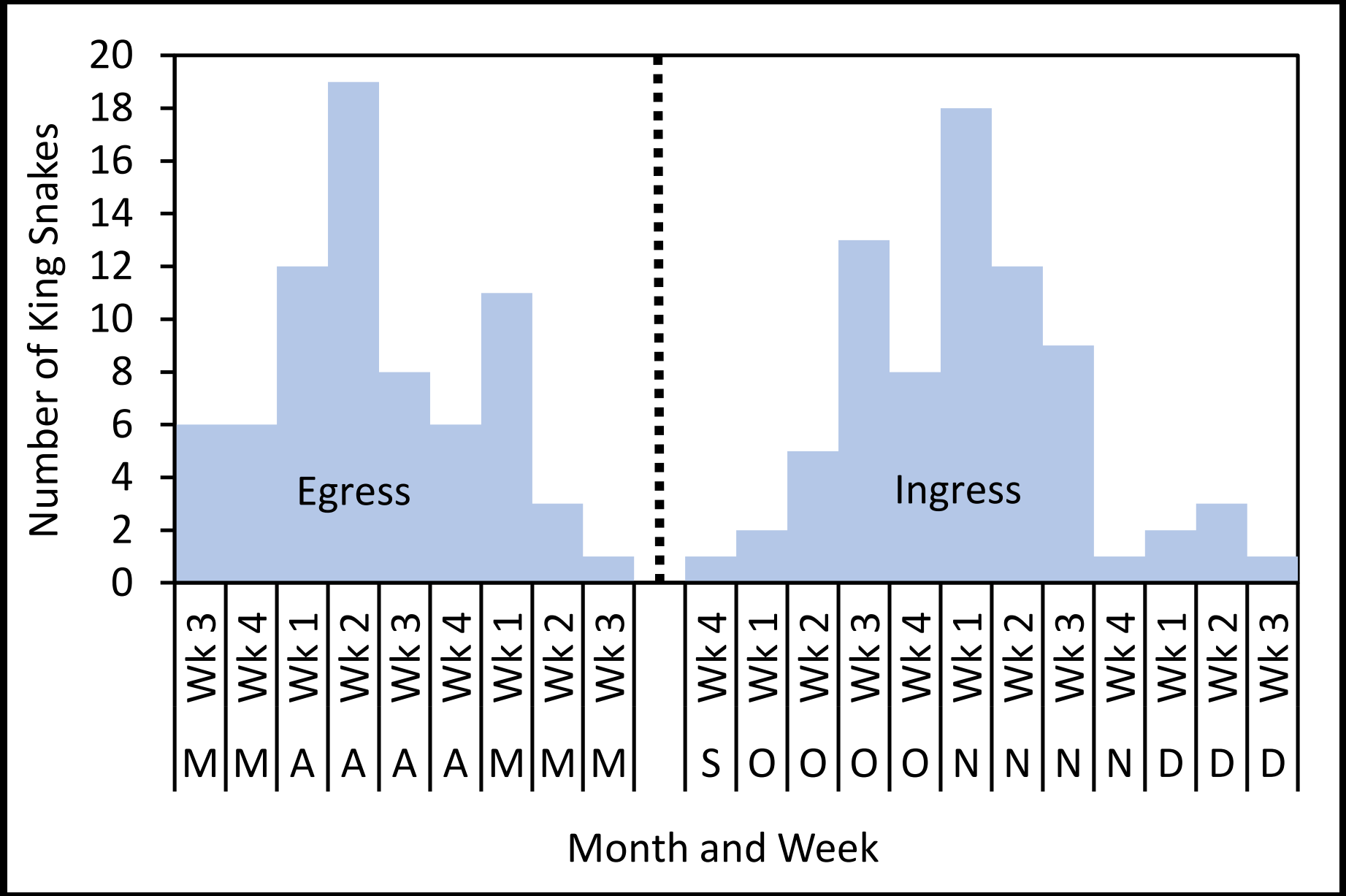

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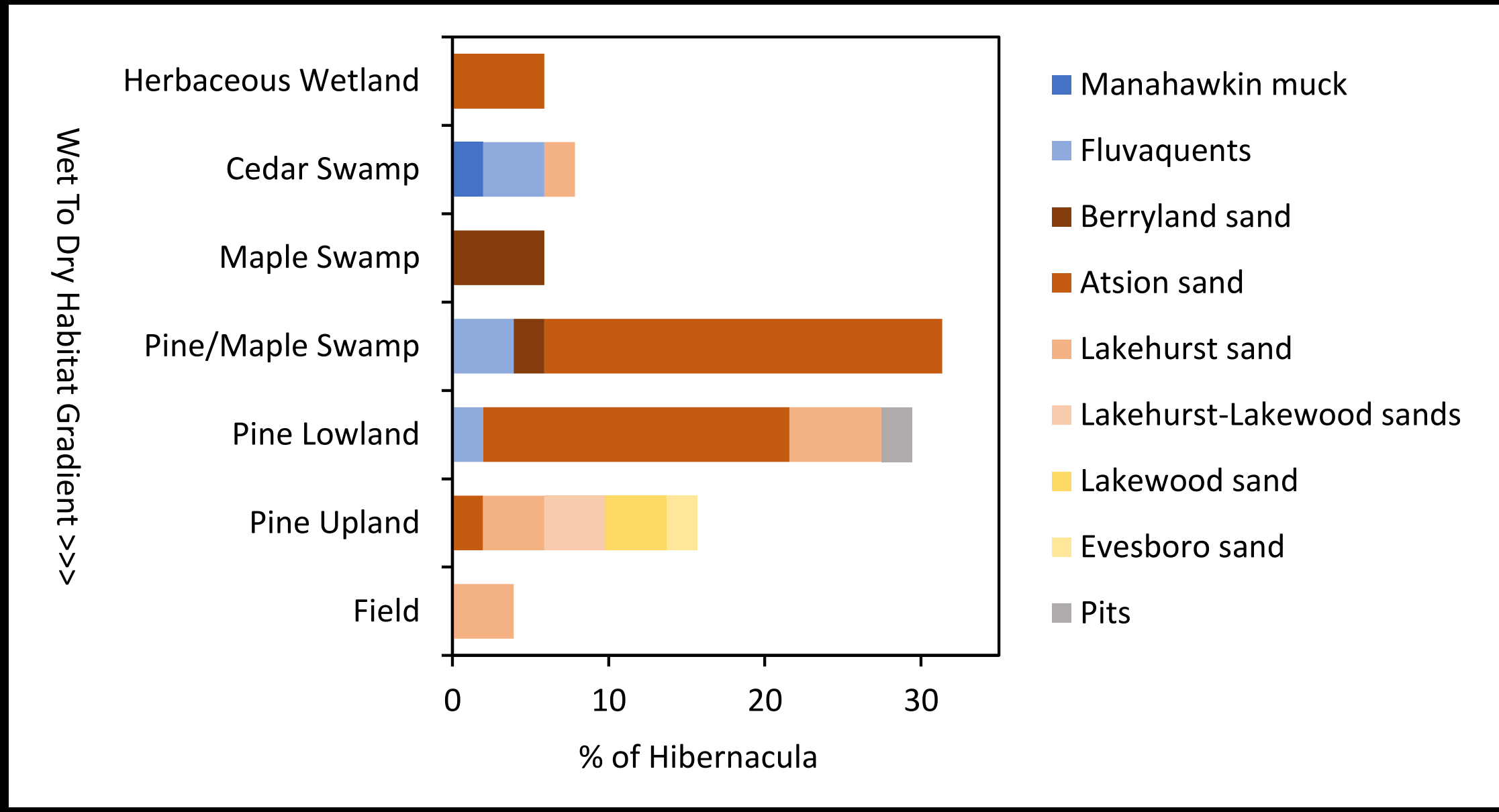

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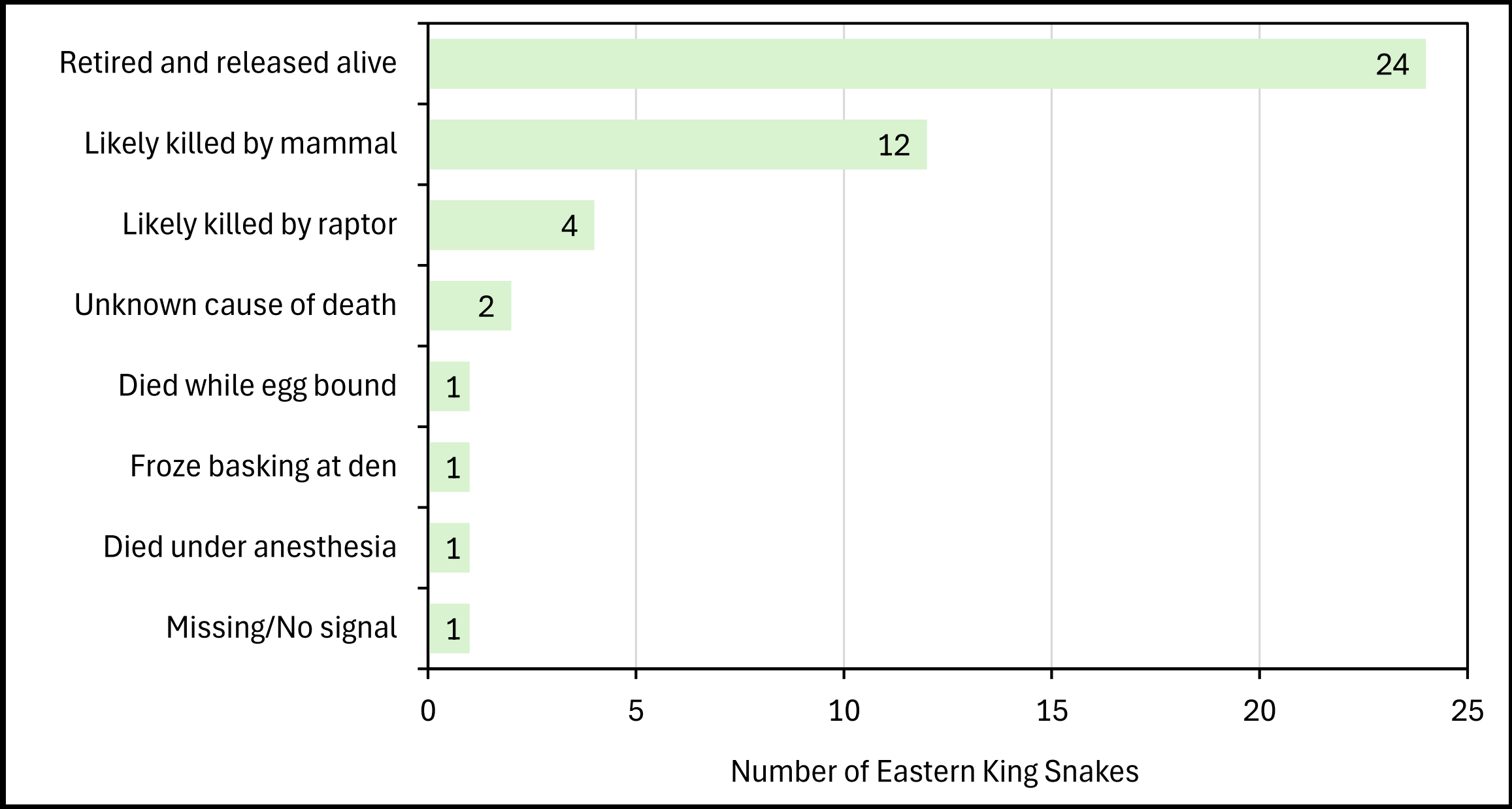
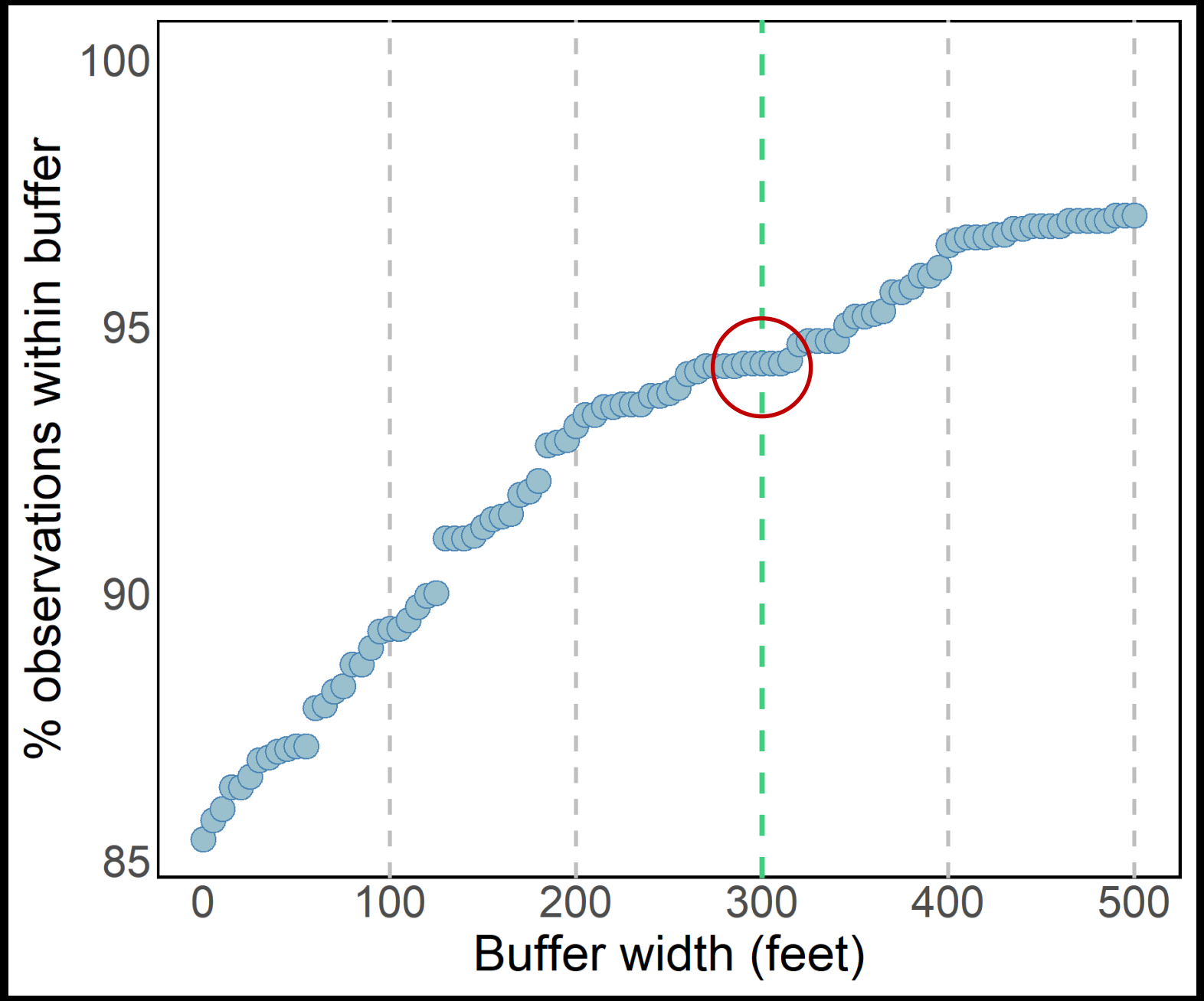


EASTERN KING SNAKE STUDY



1,839 king snake relocations from snakes with complete active seasons

85% of relocations were within wetlands

94% of telemetry relocations were within a 300-foot buffer to wetlands

EASTERN KING SNAKE STUDY

Currently analyzing the data and writing a final report for EPA

EASTERN BOX TURTLE STUDY

WHY?

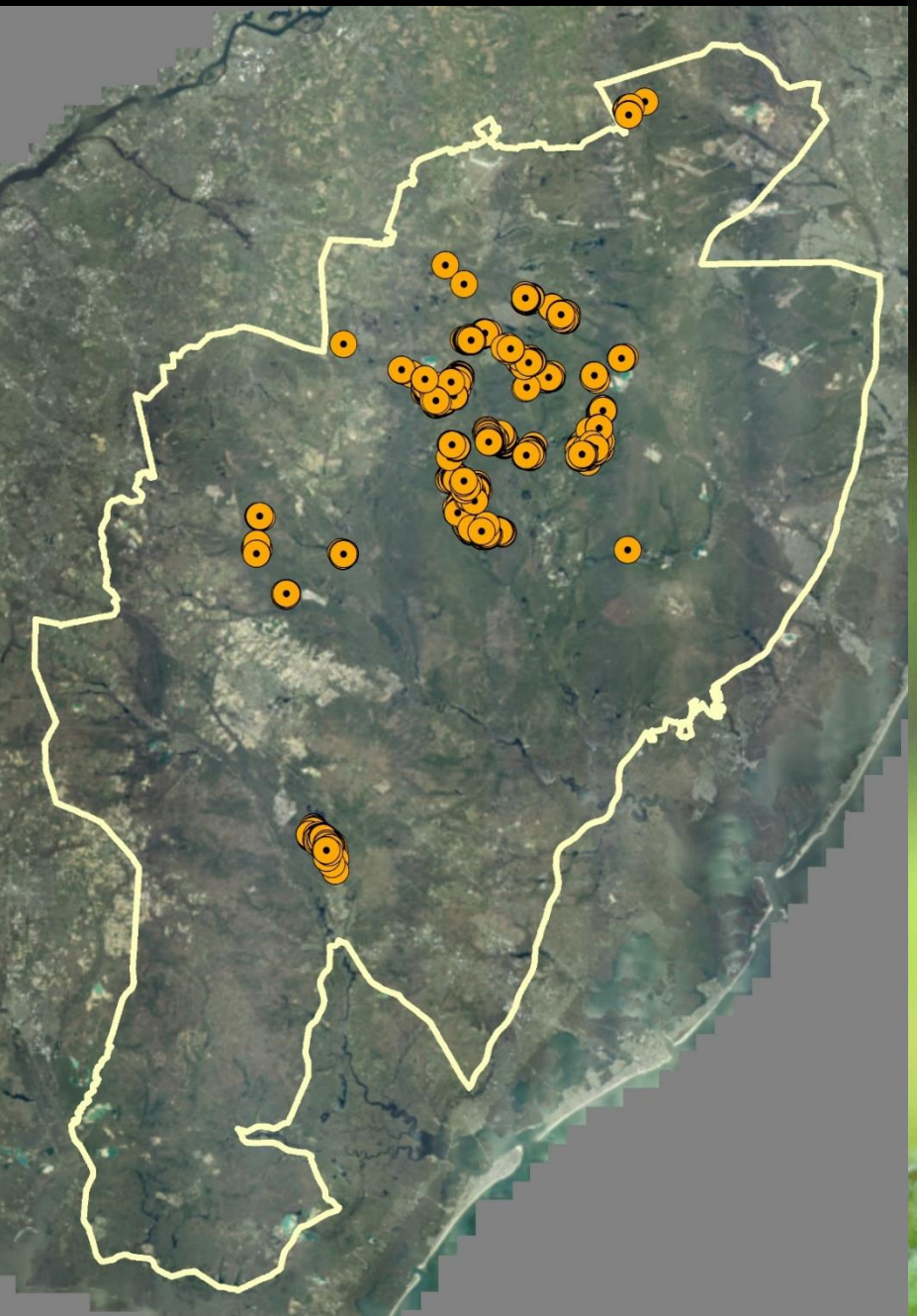
Listed as Special Concern in NJ

Threatened by habitat loss, collection, mowers, motor vehicles,…

Declining in the northeast states

Unknown status in NJ

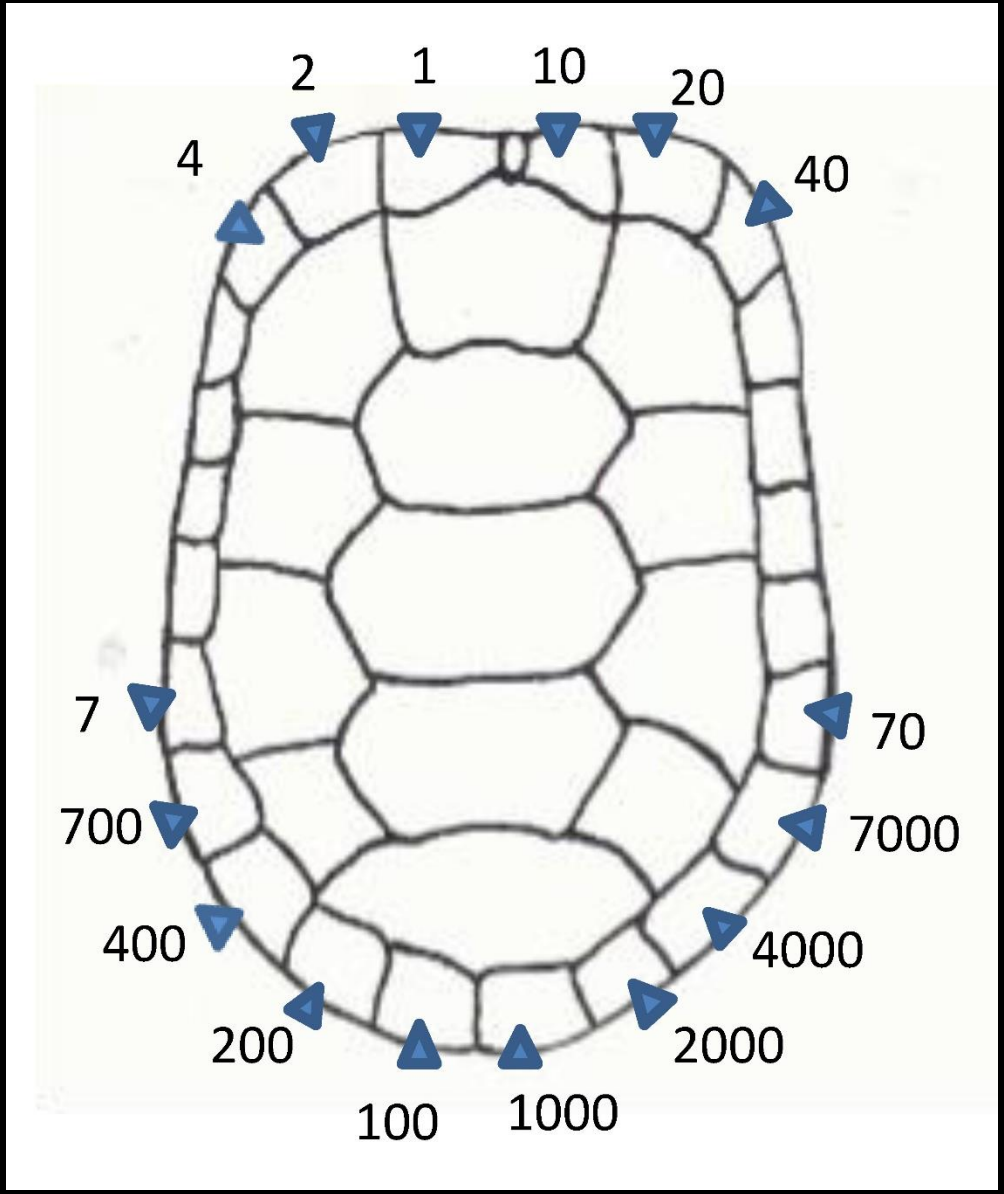
EASTERN BOX TURTLE STUDY



Wharton, Brendan Byrne, Makepeace, Colliers Mills

Parker Preserve, Huber Preserve, South Park Gun Club, Cutts Brothers, Pine Island

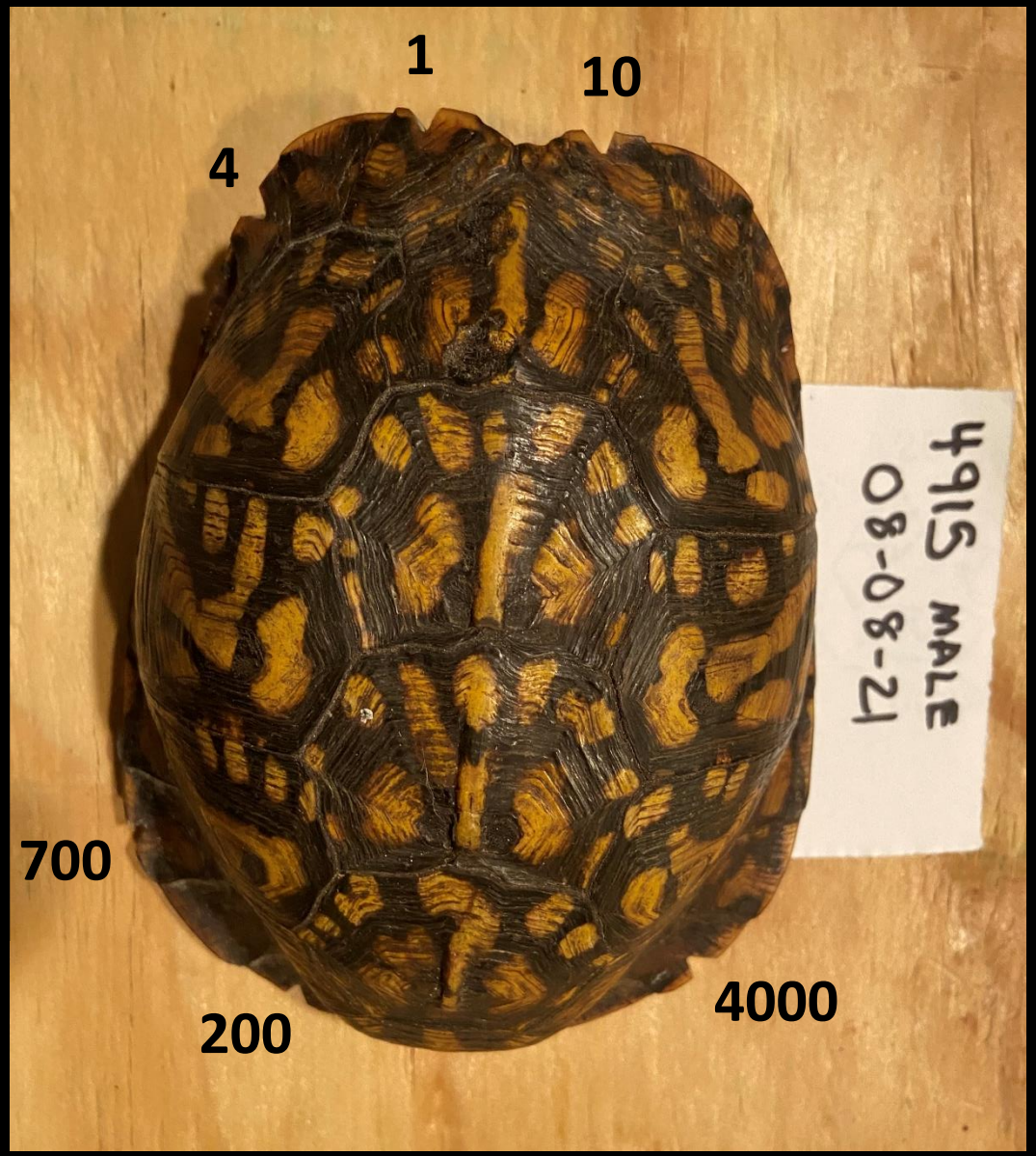
EASTERN BOX TURTLE STUDY



Weigh, measure, and sex them

Shell formation, damage, and health

Notch the shell with a file for permanent identification



EASTERN BOX TURTLE STUDY

2021 – 2025,
captured 143 turtles

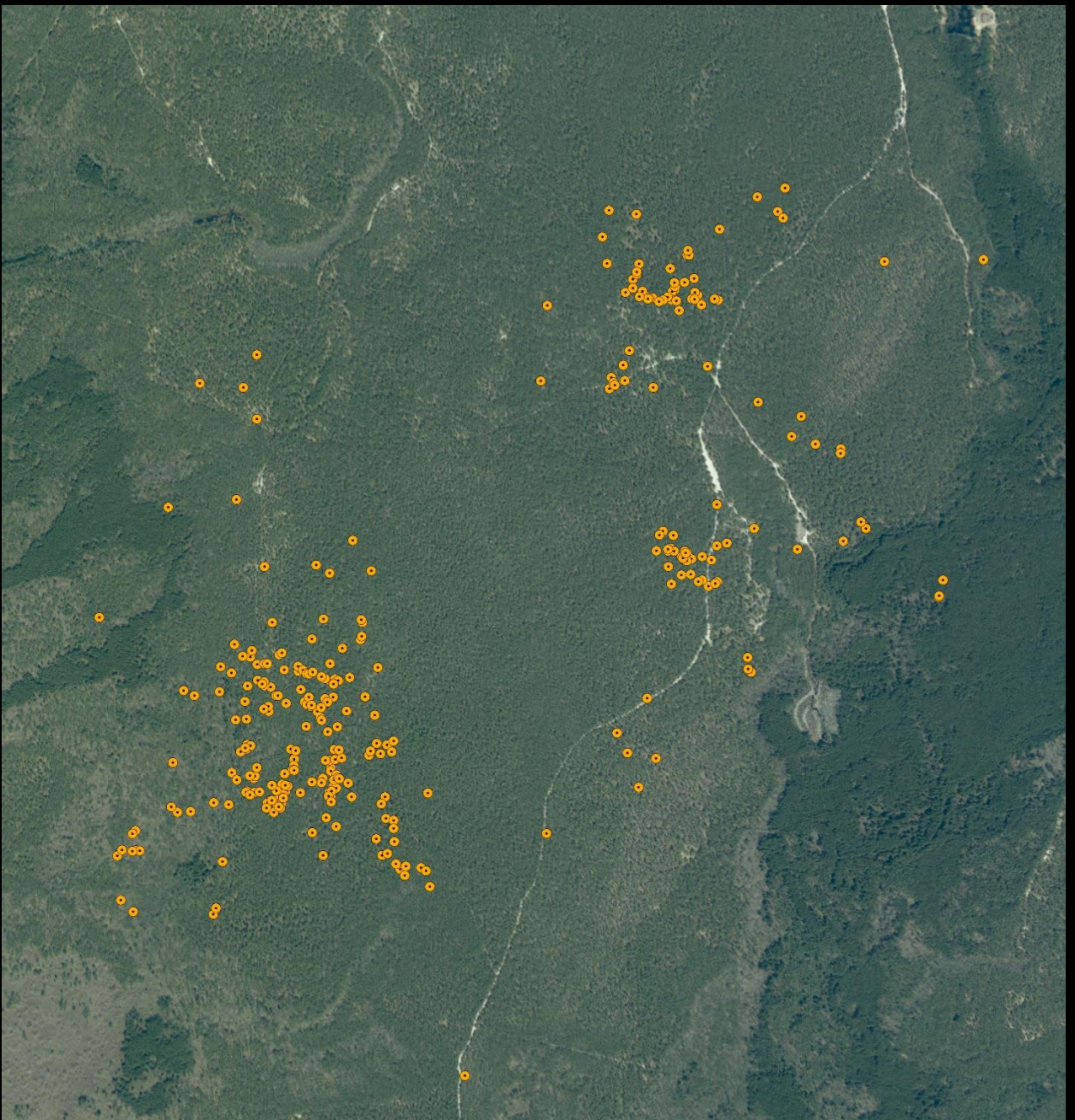
Glued radio
transmitters to the
back of shell

Currently tracking
101 turtles

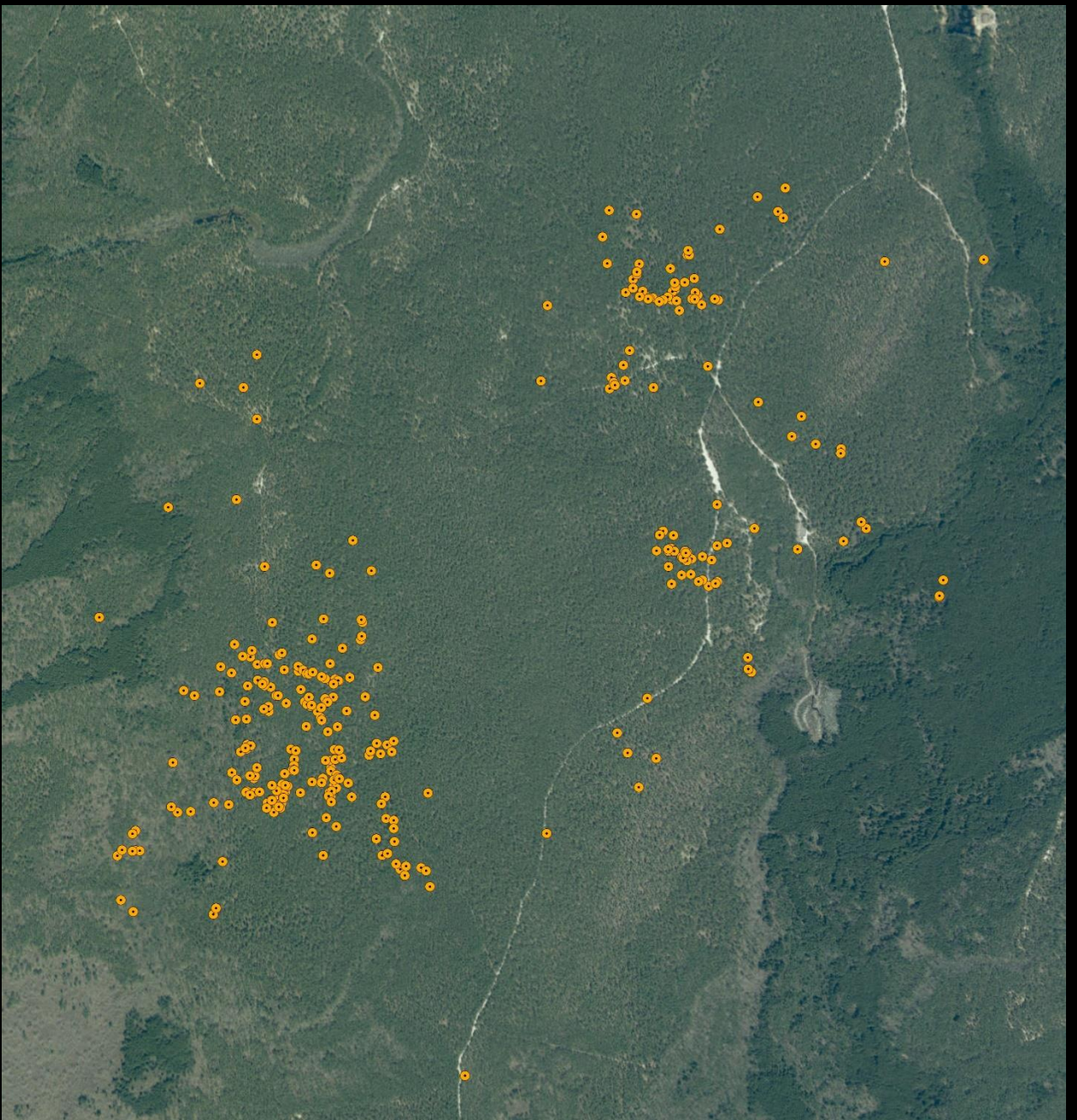
Activity range,
habitat use, and
hibernacula

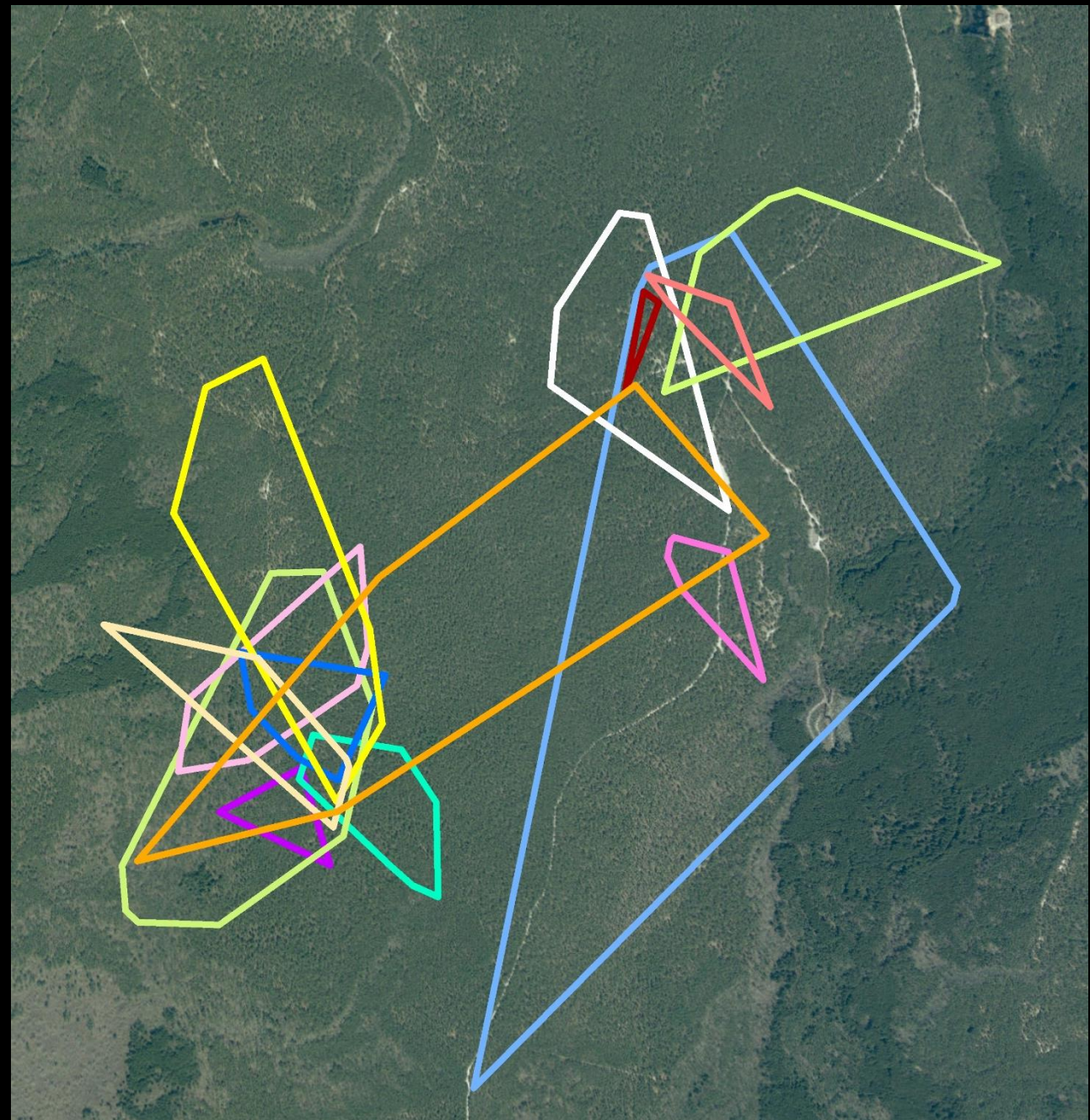
Relationship
with fire

EASTERN BOX TURTLE STUDY



EASTERN BOX TURTLE STUDY





EASTERN BOX TURTLE STUDY

Upland habitat types

Old field

Upland pine

Upland oak

Upland pine-oak

EASTERN BOX TURTLE STUDY

Wetland habitat types

Shrub wetland

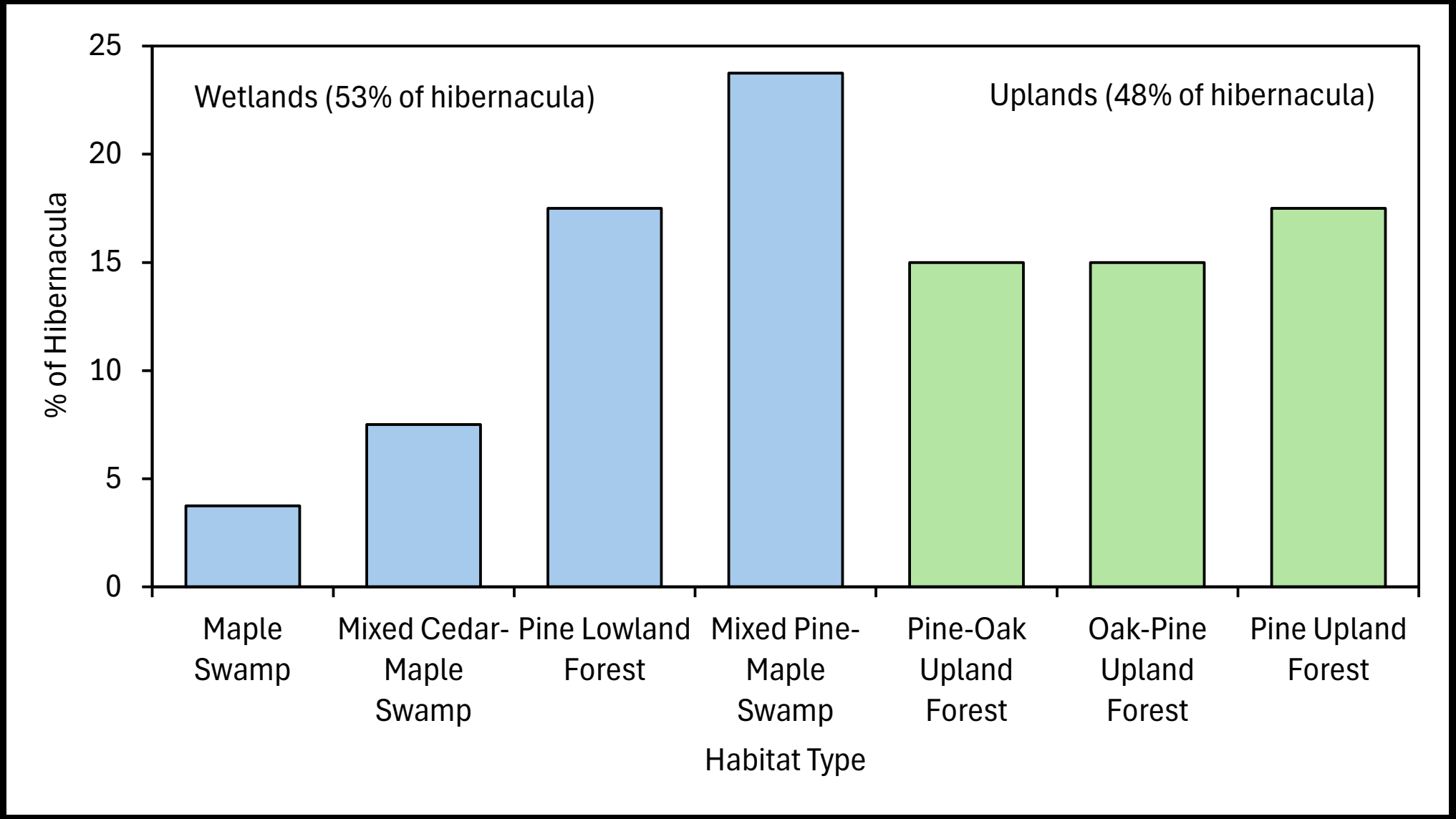
Herbaceous wetland

Maple swamp

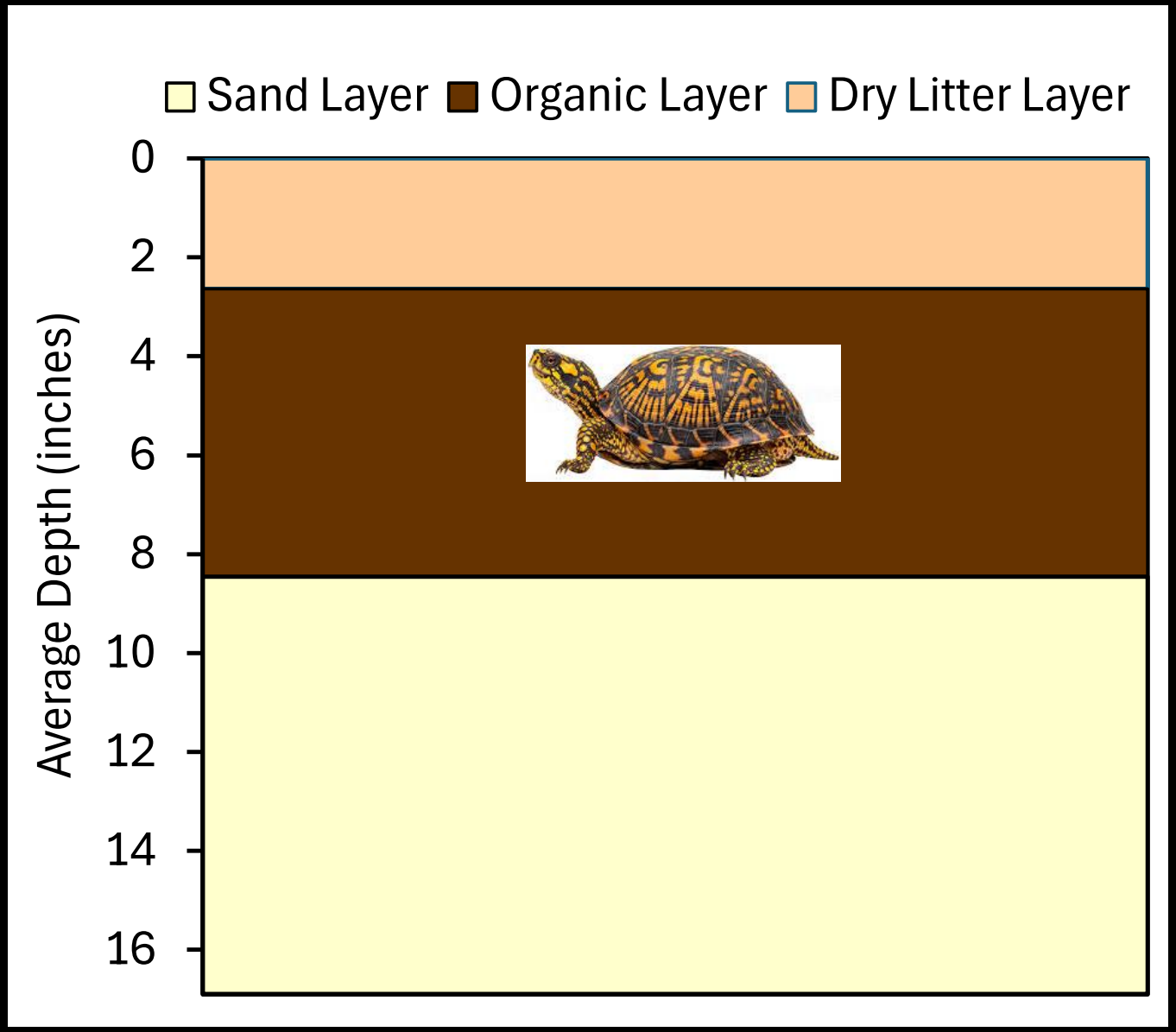
Cedar swamp

EASTERN BOX TURTLE STUDY

Hibernacula



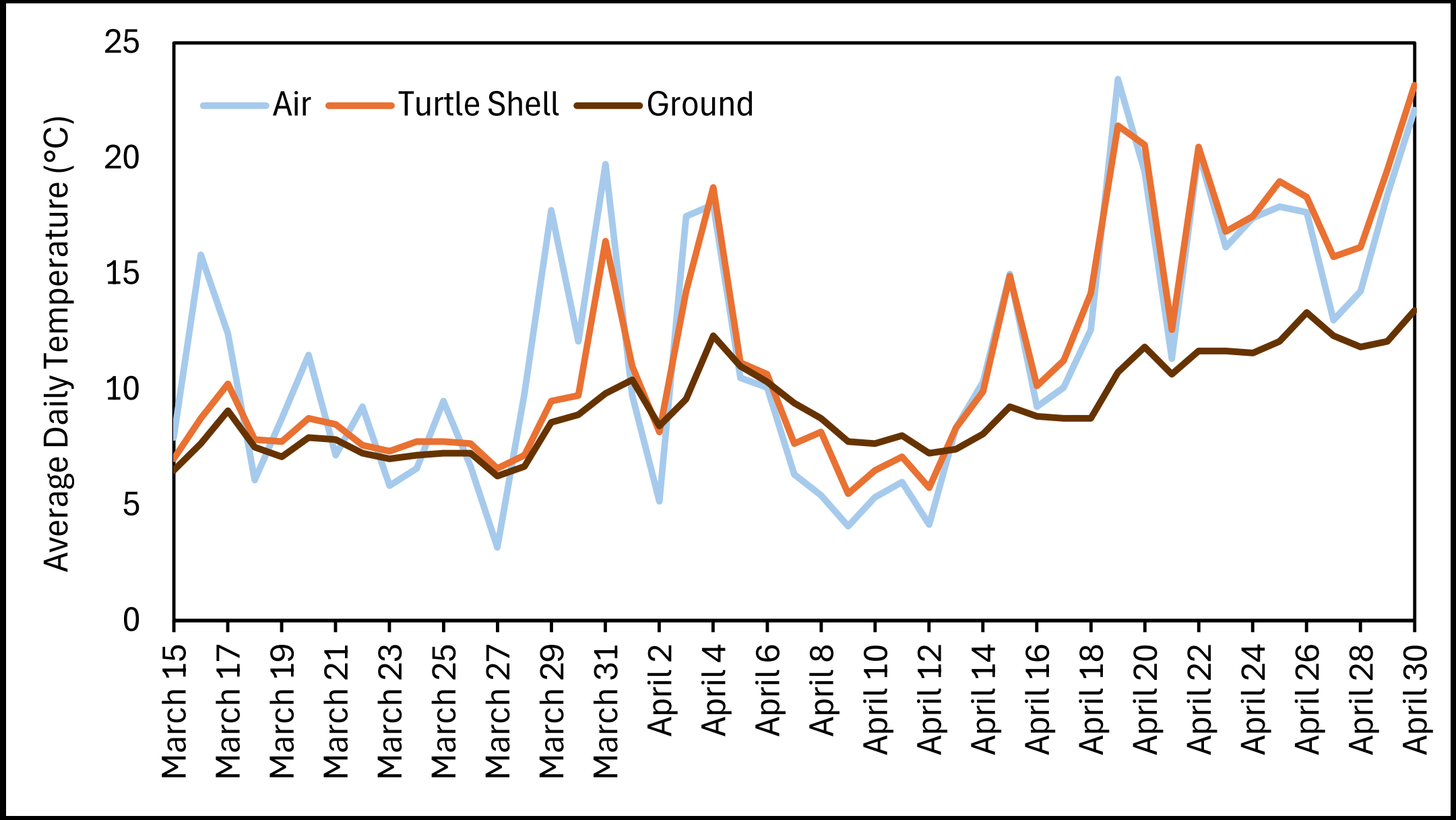
EASTERN BOX TURTLE STUDY



EASTERN BOX TURTLE STUDY

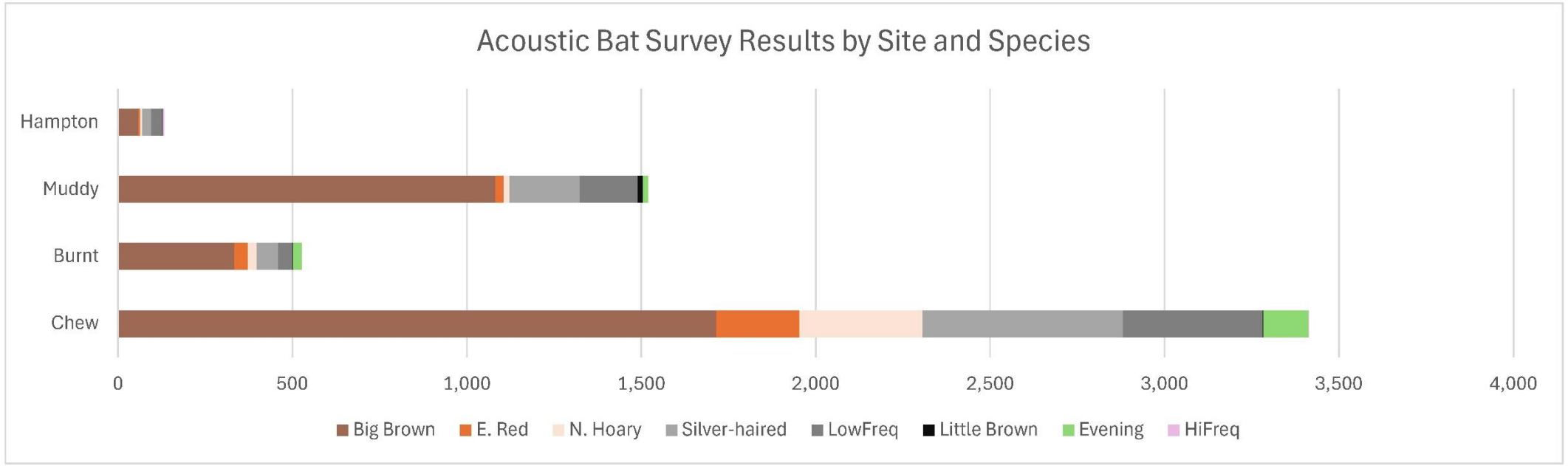
iButtons for temperature logging

EASTERN BOX TURTLE STUDY



RARE BAT SURVEYS

Collaborated with NJDEP ENSP staff
Acoustic surveys at LTEM ponds for rare bats
Targets: Northern long-eared bat and Tricolor bat



TIMBER RATTLESNAKE MONITORING

Capture gravid females to give birth in captivity
Weigh, measure, and PIT tag females and neonates
Swab adults and neonates for SFD

TIMBER RATTLESNAKE MONITORING

Attach external transmitters to females to find their dens
Corral the dens for long-term population monitoring

QUESTIONS?