

INDIGO

magazine

ALL about INDIGOS

ORIANNE WANTS YOU
...IN THE FIELD!

FIRE ECOLOGY
OF THE
Southeastern Coastal Plain

OCIC:
A Facility with a
Novel Approach
Reptiles &
The Rockies
...and more!



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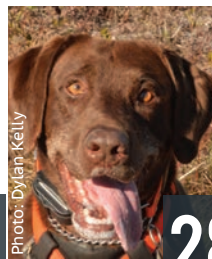


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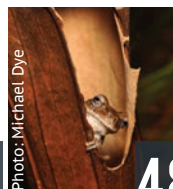


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These days at The Orianne

Society, we are in the midst of an incredible era, an era where our programs are expanding beyond our origins in the Southeast. Our work is expanding onto the rocky ridges and into the dark hollows of the Appalachian Mountains, working to conserve species such as Timber Rattlesnakes and Hellbenders. Internationally, our work is taking us into the rainforests of Costa Rica and Panama where we are searching for one of the world's rarest snakes. Partnerships with nonprofits, governments and local communities are being formed.

All of this work has me traveling more than ever. I love the opportunities I have to see animals as amazing as Spotted Turtles, Fer-de-lance and Crocodiles in the wild. I also love the opportunities I have to meet the passionate people working to conserve these animals.

However, on a recent drive through South Georgia, I was brought back to the origins of The Orianne Society. I crossed a blackwater creek and ascended the sandhill on the other side. Through my windshield I could clearly see a change in the vegetation and even spotted a tortoise burrow. It brought me back to when we were Project Orianne, a family foundation focused solely on the range-wide conservation of Indigo Snakes.

It was an amazing time; the creation of an organization. We visited properties throughout South Georgia looking for the perfect one to purchase and protect as the Orianne Indigo Snake Preserve. Once we had purchased one of the best remaining examples of Indigo Snake winter habitat, we began the process of developing a land management team that could conduct the important work of restoring and managing Indigo habitat.

We partnered with Auburn University to begin the process of reintroducing Indigo Snakes to Alabama. We also broke ground on a state-of-the-art facility



Photo: Pete Oxford

focused on captive breeding of Indigos. Watching Dan Speake (a retired Indigo Snake biologist) release the first Indigo into the wild was one of the greatest moments I have experienced in my career. Simultaneously, we were working with The Nature Conservancy and the U.S. Forest Service to restore additional sites in Florida as future reintroduction sites. The work at these sites has paid off, as we are preparing to begin releases at our first Florida site in the next couple years.

Given my recent trip through Indigo Snake habitat and the history of The Orianne Society, it is fitting that much of this issue is focused on Indigo Snakes. It is important that we remain vigilant

and focused on our efforts to save this amazing species, especially in an era of such expansion. I want to thank all our members for supporting us in our efforts to maintain our focus on Indigo Snakes and all the species and habitats we are working to save. 🐍

Sincerely,

Dr. Christopher Jenkins, CEO

SPECIES spotlight

by Amanda Newsom



SOUTHERN HOGNOSE SNAKE *Heterodon simus*

Southern Hognose Snakes are an endearing yet declining species best known for their impressive defensive displays including hissing, blowing, flaring their neck and head, and rolling over to feign death. Growing only 14 to 20 inches long, they are the smallest of the hognose snakes. Their characteristic upturned snout (for which they are named) comes in handy when digging up one of their favorite meals: toads. These fossorial snakes spend much of their time burrowed underground in sandy soil, often in inconspicuous areas, which they have generally excavated for themselves.

Also known as the Spreading Adder or Puff Adder, Southern Hognose Snakes are on the decline and are considered one of the rarest and most threatened snakes in North America. They can be found in xerophytic upland habitats in the Coastal Plain from eastern North Carolina to southern Florida, but they are believed to be rare or extirpated in historic ranges of Alabama and Mississippi. The main cause for Southern Hognose declines is habitat loss and fragmentation, but other factors such as collection for the pet trade, human persecution, pesticide use and invasive red fire ants are contributors. However, because these snakes are secretive in nature, studying them can be difficult, so much is still left to learn about them for conservation purposes.

The Oriante Society is collecting data on Southern Hognose Snakes as part of our Snakes of the Longleaf Pine citizen science project. You can learn more about the project and submit your observations at www.oriannesociety.org/snakes-longleaf-pine.

6-14

Clutch size is 6-14 eggs, with clutches laid in late spring or early summer.

14-20

H. simus grow to 14-20 inches, making them the smallest of the hognoses.

F > M

Female Southern Hognose Snakes are larger than males.

???

Because of their secretive nature, there is still much to learn about *H. Simus*.



MEMBER spotlight

by Amanda Newsom

— SHARON YOMTOB & MANDY JOHNSON —



Photo: Amanda Newsom

Sharon Yomtob (right) photographs a salamander held by her twin sister, Mandy Johnson (left), found at PYNH 5 in Waynesville, NC last fall.

This spring we're putting the spotlight on twins Sharon Yomtob and Mandy Johnson who have been members since August 2013. At just 20 minutes apart, they were born in England but have lived in the United States since 1972.

Their shared love of reptiles—snakes in particular—was instilled in them from

a young age by their father who was fascinated with snakes and would often keep them as pets. Sharon and Mandy both regard hognose snakes as their favorite species to come across in the wild, stemming from fond memories spent in nature with their father. Mandy also recalls the hognose being the first snake she was

allowed to handle on her own without adult supervision.

Sharon has been more of a life-long avid herper, keeping snakes as pets and bringing them to show and tell. Her heart was broken around age nine when she realized that not everyone has snakes, lizards, turtles, frogs, etc. as pets. She



Mandy holds an Eastern Indigo Snake, circa 1968.



Sharon holds a Southern Hognose Snake, circa 1973.



Mandy holds a sign showing her support for The Orianne Society for our fall member challenge.

also kept them in a lab she worked at for 25 years. Mandy's interest was renewed when she began working as a kayak tour guide educating people about the value of reptiles and amphibians in our world.

Though their interest in herping may have been different over the years, one thing hasn't changed since they were

children. "I am usually the one that picks up the snakes. Once they have calmed down, [Sharon] will then handle them. All our life she has pretty much told me what to do, and I do it... including picking up snakes," says Mandy.

In addition to birding, hiking, camping and kayaking together, these sisters enjoy

herping at Orianne events. Sharon says these activities are "an integral part of our relationship, and it prevents us from killing each other." They first attended Places You've Never Herped (PYNH) 3 and have attended all of the PYNH events since then as well as both Indigo Days events. When asked about her experiences as a member, Mandy says, "The Orianne Society has re-opened the joy that I felt as a child exploring and discovering our natural environment."

Both sisters seem to love the comradery of the Orianne events as much as herping at them. Mandy says PYNH 3 was the most fun she's ever had in her life with a group of strangers, and Sharon is encouraged and amazed at the young herpers who are so enthusiastic and knowledgeable at such young ages. Plus, Sharon says, "It is also fun to sit back and watch the young'uns do the catching, digging, diving, climbing, capturing and—my least favorite part of herping—getting bitten."

When asked what species they haven't come across yet but hope to find one day, their answers differ. Mandy hopes to find a Glossy Crayfish Snake. "I should be able to find them in my line of work as a kayak guide in the swamps of South Carolina, but they have still eluded me." Sharon's answer is more diplomatic. She says that "each find, whether frequently seen or a lifer, is equally exciting for me."

Along with meeting new friends, getting the chance to be a part of our conservation efforts, particularly at our citizen science events, is one of their favorite things about being Orianne members. "Not only am I learning about different species and their environments, I am helping The Orianne Society in their mission to conserve reptiles and amphibians in the wild," says Mandy.

The Orianne Society is grateful for our dedicated members like Sharon and Mandy who support our conservation efforts of imperiled species! 🐍



MY ADVENTURES AS AN ORIANNE VOLUNTEER

by Matt Moore

It was overcast and drizzling rain as we arrived on the South Georgia sandhill on that December morning. It didn't look like the best weather for finding snakes crawling on the surface, but I was soon to realize my negative outlook on our chances of finding North America's longest native snake was unfounded. Within what seemed like moments of driving onto the sandhill road bisecting the pristine habitat I was fortunate enough to find myself on, there he was. Orianne's Fire Forest Initiative Director Dirk Stevenson motioned for me to look off

to our right at what his sharp eyes had just witnessed. There, laying near a tortoise burrow, was what is affectionately known by field herpetologists as a "monster male" Eastern Indigo Snake.

The snake, an old acquaintance of Dirk's, had been measured previously at a massive seven feet three inches. The snake looked regal and dominant over his environment with his head and neck raised off the ground, staring at us as we approached. His freshly shed skin was lying just a few feet away from him, and his coat of scales was shiny black speckled

with drops of rain. Dirk generously gave me the honor of catching the snake for our data collection purposes. Nothing compares to the surreal experience of catching such a massive, native wild snake that looks as if it is too big to have evolved outside of some exotic jungle. Yet these rare and federally-protected snakes do indeed live here in the Southeast.

The Eastern Indigo Snake is the flagship species of The Orianne Society. Known to have reached sizes well over eight feet in length, these nonvenomous and typically docile giants are the kings

of their dwindling habitats. They feed on any animal that they can swallow. They are largely immune to the effects of pit viper venom and therefore often prey upon Eastern Diamondback Rattlesnakes, Cottonmouths and Copperheads. Currently they are only found in natural populations in Georgia and Florida.

The sandy upland habitat dotted with Gopher Tortoise burrows that are essential to their survival has been chipped away at by humans for many decades until precious little of it now remains. The Orianne Society is dedicated to preserving and restoring this habitat and the unique wildlife that depend on it for their survival.

While Eastern Indigos are a large focus of The Orianne Society's conservation efforts, these snakes are certainly not their sole focus. There are many other reptiles and amphibians that they are dedicated to helping. In fact, it is specifically The Orianne Society's conservation efforts of native southeastern herpetofauna that fueled my interest and desire to volunteer with them. They do great conservation work outside of this region as well, but I am particularly drawn to helping wildlife that is native to the area where I grew up and live.

Some of the native animals I have worked with as an Orianne citizen scientist include Florida Pine Snakes, Southern Hognose Snakes, Gopher Tortoises and Spotted Turtles. As a volunteer, my duties have included assisting with reptile and amphibian field surveys, snake road cruise surveys, drift fence surveys and public education events.

But my favorite volunteer opportunities with The Orianne Society are the field excursions. Whether it is helping lead students out in the field or combing a beautiful habitat for an elusive snake or turtle alongside a seasoned expert herpetologist, those are the moments I look forward to the most. Encountering a rare or elusive reptile or amphibian in the wild is an experience I cherish. Since beginning my Orianne volunteer work, I've accumulated a myriad of these cherished field experiences, but there are a few standout moments that come to mind.

One exceptionally-memorable field experience was on a sunny day in March 2013 when I again joined Dirk Stevenson on a field survey excursion in South Georgia. We were walking into a freshly-burned sandhill and decided to flip over

some artificial cover off the side of the trail, and I looked down to see a beautiful adult Eastern Coachwhip basking in the sun. Just minutes after coming upon the Coachwhip, we both heard a solitary squeak in an unburned area of nearby Wiregrass. We both knew that was the sound of a small mammal that had just been nabbed by a predator, so we fanned out in the direction of the squeak in search of its source.

It was when I focused on the base of a clump of Wiregrass that I knew my long search for my very first Florida Pine Snake was finally over. There, just a few feet away, was the pretty female Pine Snake coiled tightly around a rat she had just come across. Immediately, we knew that this was the source of the squeak we had just heard. We paused to take pictures of the rare encounter and later went home with a memorable story to share.

That same month on a chilly day, The Orianne Society had generously agreed to host a group of high school students from New Hampshire for several days of reptile and amphibian field excursions in South Georgia. I was asked to help some of the Orianne staff lead the group through parts of the most well-maintained sandhill habitat remaining in Georgia. This particular sandhill was also home to one of the healthiest populations of Indigo Snakes found in the area. We soon realized that none of us would be disappointed in our search on this day!

We broke up into clusters of search groups upon reaching the pristine habitat that morning. I was helping search with some of the students while staff members Chris Jenkins, Dirk Stevenson and Kevin Stohlgren led others throughout the beautiful terrain.

I had the first luck of the day with a nice six-foot Eastern Indigo that I spotted three-fourths out of the mouth of a tortoise burrow. Dirk quickly came up with two more together at another burrow.



Photo: Matt Moore



Photo: Dirk Stevenson

One of the two Indigos he found was an infrequently encountered juvenile of this species! Meanwhile, Kevin reported back with a nice Eastern Coachwhip that he and his group had come upon. All in all, it was a great experience for everyone. It was especially memorable for these New England students who had a rare opportunity to encounter these amazing animals in the wild so far away from their home state.

I have also had the opportunity to volunteer seasonally for a citizen science project working with the beautiful Spotted Turtle. Last March I began assisting Dirk in trapping Spotted Turtles as part of a population study at a protected wetland in South Georgia. We set specially-designed traps throughout the wetland in order to get an understanding of their population in the area.

The work we do is very strenuous at times due to the knee-deep mucky water habitat that is guarded in areas by formidable briars and stumble-inducing

submerged logs and limbs. However, the payoff is certainly worth the effort of working in this terrain. When we pull up the traps, it is like scratching off a biological lottery ticket. You never know what you are going to get! Sometimes (albeit infrequently) there is nothing but a crayfish or two. Other times a little Eastern Mud Turtle or juvenile Common Snapping Turtle will be waiting for us in the traps. But frequently we pull up the traps to find exactly what we were hoping for: the elusive and adorable Spotted Turtle!

These turtles, only about five inches in carapace length as adults, are both gorgeous and docile. This affable little turtle has not been well-studied in Georgia, and The Orianne Society is working hard to better understand the remaining Georgia populations of this species. I am thrilled to be a part of this ongoing research, and I am looking forward to this March when we resume setting our traps again.

A wonderful bonus to working in

the field with such experts is that I have the chance to learn more about these fascinating animals and the environments they live in. Dirk has shared his extensive knowledge with me over the years in a way that no textbook could ever approach—these are cherished moments that cannot be duplicated anywhere else. Field guides and textbooks are nice, but to me it is essential to get these first-hand experiences in order to fully learn about the wonders of the natural world.

Volunteering with The Orianne Society has been highly meaningful to me. Working with rare animals that I am passionate about with seasoned herpetologists in pristine examples of dwindling habitat over the last couple of years has given me some of the best experiences of my life. I look forward to a long relationship of helping with Orianne conservation efforts for so many amazing reptiles and amphibians that call the southeastern United States home. 🐢



REPTILES THE AND ROCKIES

by Ben Stegenga

This past July my family decided to take a vacation out to Estes Park, Colorado. My brother Nathan was working at the YMCA camp, so we decided to join him before school started back. It was a family vacation, but I was determined to squeeze in as much herping as possible, even during pit stops along the way.

My first finds of the trip came on one such stop outside of a gas station in western Kansas. I took a couple minutes to explore a nearby ditch that was filled with cattails. There I spotted scores of Plains Leopard Frogs along the water's edge. Minutes later, I glimpsed a carapace and a flash of red and yellow as a Western Painted Turtle abandoned its basking spot and vanished beneath the submerged leaf litter. I gave chase but was too slow. I was amazed that it disappeared so easily in such shallow water. I had let my first lifer of the trip slip away, but it was an encouraging start to the week.

It was raining when we arrived at the YMCA camp. We located Nathan and finalized our lodging arrangements for the night. The rain continued through the next day. Nathan gave us a tour of the camp and showed us some spots that had exceptional wildflowers and bird activity. We braved the miserable conditions and were rewarded with several bird species we could add to our life lists. Later Nathan, my dad and I planned a hike for the following day. We had originally wanted to tackle Longs Peak, the only fourteener in Rocky Mountain National Park, but finally decided on a series of four slightly lower and less-trafficked peaks instead: Flattop Mountain, Hallett Peak, Otis Peak and Taylor Peak.

We rose before sunrise the next day, packed our cameras, lunches and extra layers, and headed out to the trailhead. The sun was just beginning to rise as we pulled into the parking lot.

Minutes into our hike it began to rain, but once we reached the tree line, the skies had cleared. From then on, most of our route would be through alpine tundra.

One would think that such a harsh environment could not support much wildlife, but it was surprisingly full of life. Dozens of wildflower varieties dotted the landscape. Cryptic white-tailed ptarmigans were actively foraging among the lichen-covered rocks. Moths, beetles and the webs of small black spiders could be found among the talus. Butterflies and caterpillars inhabited the blankets of moss-like plants and wildflowers surrounding the occasional alpine pool. Everywhere we heard the sharp squeaky calls of American pika, and occasionally a yellow-bellied marmot would be spotted basking in the morning sun or scrambling effortlessly through the talus. Both of these curious mammals seemed to be quite accustomed to the presence of hikers. At the summits, they would sneak up on resting hikers to investigate the contents of any unshouldered backpacks.

The climb up Taylor's Peak was grueling. It was clear we hadn't fully acclimatized to the high elevation yet. We eventually reached the summit (13,158 feet) and were rewarded with a stunning vista. I ate the last of my lunch, snapped some photos and then we began our descent. From there it was all downhill. We glissaded down Andrews Glacier and then started the final stretch to the trailhead. The last several miles of trail skirted an alpine lake and followed Andrews Creek through a surreal coniferous forest. At one point we passed right through a herd of elk that were grazing along the trail. They barely seemed to notice us as we took photos. It was all so beautiful, but we were running out of daylight and could not stop to enjoy it for more than a few minutes. We finally arrived back at the trailhead just as

the last bit of daylight disappeared.

With the alpine hike under my belt, I was now eager to do some Colorado herping, but I really had no clue where to go. The only herper I knew in the state was Cameron Young, the director of the Center for Snake Conservation. I went ahead and e-mailed him, asking if he could point us towards some good spots.

In the meantime, I decided to explore a nearby pond. Soon I had spotted two wandering gartersnakes. One quickly retreated into a small burrow, but the other remained coiled on a rock in the sun. The conspicuous lump in the snake's midsection made it evident that he had recently enjoyed a large meal. Not wanting to disturb his digestion, I kept my distance and only snapped a few photos. Later that evening I received Cameron's response. He had offered to personally take us to some of his favorite spots. I was thrilled! We quickly made plans to meet up the following evening.

The next day was spent at the camp playing disc golf and birding. We agreed

to meet Cameron about a half-hour east of Boulder, and from there he would take us to his spots. On the way to meet him, we spotted a chocolate-colored black bear sitting atop a cabin along the Big Thompson River. It had brought traffic to a near standstill, giving us a brief opportunity to take some photos before continuing on.

Upon meeting Cameron I quickly introduced my parents and then we all piled into his car and took off for our first destination: his favorite coverboard site. In the past this site has produced a wide variety of colubrids and the occasional Prairie Rattlesnake. The Prairie Rattlesnake was at the top of my list, but I was eager to see any snake since almost everything would've been a lifer for me.

I flipped our first herp of the night, a juvenile Northern Prairie Lizard seeking refuge under a board. My dad soon flipped another, that one being an adult female. Just minutes later I flipped a large chunk of concrete to reveal my lifer Eastern Yellowbelly Racer. Despite being in a

shed cycle, it was a handsome snake and much more tolerant of handling than the Northern Black Racers I was accustomed to. We got some photos and returned him to his cover. Twenty more minutes of flipping revealed nothing besides the occasional mouse, so we decided to get back on the road. Not 10 minutes later, we came across a large DOR bullsnake. This is one of the snakes I had really wanted to see, especially since it evaded me last year in Wyoming and Nebraska.

Twenty minutes later, a snake appeared in our headlights just as it was crawling off the road. Cameron quickly stopped the car, and I flew out the door and into the ditch. I returned to the road triumphantly with my quarry in hand. It was a stunning Western Plains Gartersnake. It wasn't a lifer, but it was by far the prettiest gartersnake I had ever seen. We passed it around, took photos and then placed him back on the far side of the ditch.

Next, Cameron took us to some sandhill habitat. There we soon found my lifer Plains Spadefoot Toad. The



A stunning view in Rocky Mountain National Park, Colorado.



A Texas Horned Lizard (*Phrynosoma cornutum*) found in the Red Hills of Kansas.



A Plains Spadefoot (*Spea bombifrons*) cruised in some Colorado sandhills habitat.

temperature was dropping rapidly though, and our chances of finding more snakes were dwindling. However, there was no shortage of Ord's kangaroo rats and black-tailed jackrabbits. The abundance of prey on the roads had also attracted predators. My parents and I were delighted to spot our first burrowing owls. We saw quite a few of these miniature raptors as they patrolled the roads for insects and young kangaroo rats. The fence posts lining the roads also seemed to have an infinite amount of great horned owls and the occasional barn owl.

It was getting late and cooler by the minute, so we decided to try one last road. Cameron suddenly hit the brakes hard and hopped out of the car. I hadn't seen anything on the road, but sure enough, right in the path of our front right tire sat my lifer Barred Tiger Salamander. What a perfect way to end the night!

The rest of our time in Colorado was spent in the mountains, so there weren't any more good opportunities for herping. However, I had arranged to do some herping in the Red Hills of Kansas on the way home. We met up with my friends Brittany Elfering and Nyssa Hunt as well as our guide, Larry Miller. Larry is a long-time herper and photographer who is very familiar with the Red Hills region of Kansas.

After a quick supper at our campsite, we visited the spillway on the lake located in the campground. We spotted dozens of Red-eared Sliders and a handful of Plains Leopard Frogs but nothing else. The sun was getting low, so everyone agreed to try our luck at some cruising. In addition to snakes, I was hoping to spot a porcupine on the roads, as Larry said they were quite common in the area. We spent a good hour and a half on the road, but we didn't see a thing. Most everyone was tired from a long day and went to bed as soon as we got back.

However, I decided to go on a little



A stunning Western Plains Gartersnake (*Thamnophis radix*) cruised in eastern Colorado.

Photo: Ben Stegenga

night hike before bed. I fruitlessly searched for about an hour before eventually returning to camp. As I was walking over to my hammock, I saw movement in the grass. It was a rather large Leopard Frog. As I approached it, something else caught my eye. "Snake!" I quickly snatched it up. It was a gorgeous Red-sided Gartersnake! It appeared as if the snake was out hunting frogs. I took some photos then bagged it to show everyone in the morning before releasing it.

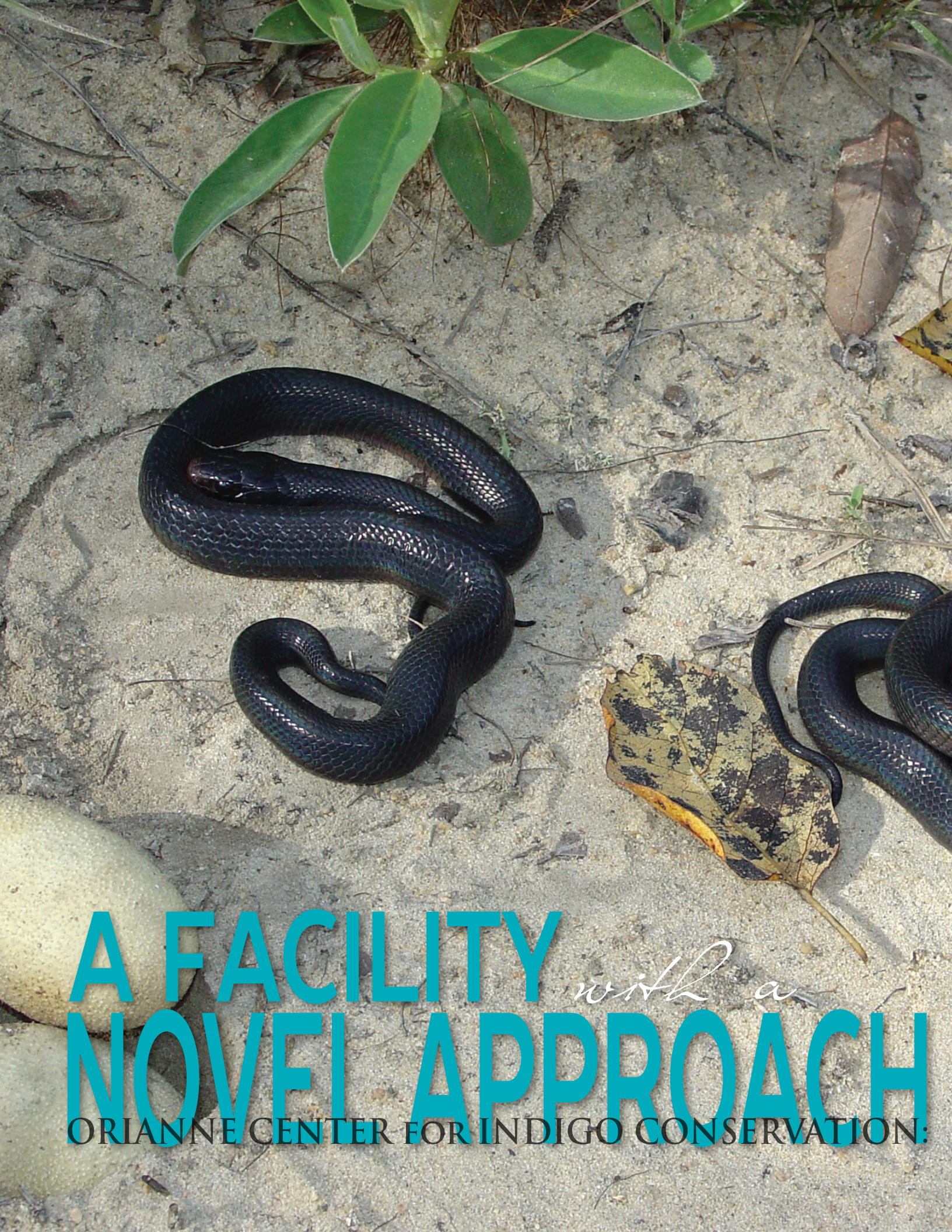
We got an early start the next day. Larry wanted to cover a lot of ground and to do it before the midday heat. The plan was to explore some private ranches that Larry had been given access to. So we hit the road, and it wasn't long until we struck gold. Lying in the road in front of us was my lifer Prairie Rattlesnake! It was a beautiful specimen, stretched out across the dirt road in the morning sun. It had clearly just dined on a kangaroo rat or similarly-sized prey item. I could've sat there and watched it all day, but we had a lot more ground to cover. I got my photos, and then we gently escorted it off the road.

Not long after that, Larry spotted a Texas Horned Lizard as it scurried off the road. Everyone jumped out of the cars and began scanning the ground.

Someone finally spotted the lizard again and easily scooped it up. We passed the bizarre creature around and then, in true herper fashion, crowded around it to get photographs. Our next notable finds were birds. We spotted several scissor-tailed flycatchers perched on the fence lines and a greater roadrunner cruising through a pasture.

Immediately following the roadrunner, we caught a glimpse of a Western Coachwhip as it sped across the road and vanished into the vegetation. We searched for it in vain, but before we got back to the cars, Larry spotted a Prairie Racerunner. Unfortunately, this vibrant green lizard was quite uncooperative for photographs. In the following hours we stopped at a couple cattle ponds where we found hundreds of Blanchard's Cricket Frogs, bullfrogs and a deceased lined snake. My dad also spotted a watersnake, but it vanished before we could get a positive ID.

At that point it was early afternoon, and time for us to say our goodbyes and continue our drive back home. It had been a great trip, full of friends, wildlife and incredible scenery. I had added dozens of species to life lists, but I knew I had only just scratched the surface of these amazing wild places. 🌿



A FACILITY *with a* NOVEL APPROACH

ORIANNE CENTER FOR INDIGO CONSERVATION:



For over 40 years the Eastern Indigo Snake (*Drymarchon couperi*) has been listed as a threatened species throughout its range in the southeastern Coastal Plain. This magnificent species is America's longest snake and is now only found in southern Georgia and peninsular Florida.

Increasing pressures on Indigo populations include habitat loss, habitat fragmentation and the decline of Gopher Tortoise communities of which Indigos are strongly allied for use of their burrows as winter dens. Reduction of prey animals and an increase in predators (feral hogs, coyote, raccoons and fire ants destroying their eggs) also impact their survival.

In 2008 The Orianne Society and partners embarked on a multidisciplinary approach to the recovery of this iconic species. The combination of field studies and scientific assessments, a lands program focused on habitat restoration and creation of the Orianne Center for Indigo Conservation (OCIC) comprised a novel approach to Indigo Snake conservation.

Opened in 2012 the OCIC, located on 25 acres in central Florida, is home to a Health Care Center, Herpetarium (indoor reptile facility), administrative office and support facilities. The OCIC is the premier and only captive breeding facility for the Eastern Indigo Snake whose mission it is to re-establish this threatened species into its former range. Originally created and established by The Orianne Society for the purpose of breeding Eastern Indigo Snakes for reintroduction programs, the OCIC is now operated totally by the Central Florida Zoo and Botanical Gardens.

All buildings at the OCIC are specifically designed to facilitate a comprehensive approach to long-term captive breeding programs for Indigo Snakes and other snakes of conservation importance. Currently a colony of over 100 Eastern Indigo Snakes is managed for genetic and demographic diversity. Snakes

produced at the OCIC are available for use as reintroduction stock in regions where historic populations have disappeared. To accomplish this noble vision and multifaceted undertaking, partnerships with non-governmental organizations (NGOs) and regulatory agencies combine both expertise and resources to reach program goals. Through partnership diversity, a far-reaching and comprehensive approach will promote success for snake conservation initiatives.

A New Approach to the Propagation of the Eastern Indigo Snake

Historically, captive propagation of the Eastern Indigo Snake has not been an easy task. Early studies in the 1980s at Auburn University found that both growth and reproductive rates of Indigo Snakes in the wild surpassed those of captive snakes. Compounding the problem was that after only a few years in captivity, female reproduction dropped dramatically. Clearly Indigos were receiving important physiological cues or other environmental advantages not traditionally found in captive environments. In order to establish a long-term reproductive colony, defining these crucial elements and how they could be provided in a captive setting had to be answered.

To this end the OCIC has embarked on a nontraditional approach to maintaining Indigo Snakes in captivity that would promote reproductive health. Rather than attempting to replicate conditions found in the wild in an indoor setting, we approached the problem early on from an environmental perspective. The result was the construction of sophisticated outdoor snake enclosures which would offer exposure to all the natural conditions and seasonal cycles found in the wild.

The OCIC is located in the center of historic Indigo range and is able to offer natural environmental conditions

Photo: Dirk Stevenson

BY FRED ANTONIO

to its inhabitants. The most important element in our outdoor enclosures is the opportunity for thermoregulation (the ability of an organism to keep its body temperature within certain boundaries, even when the surrounding temperature is very different) with year-round access to underground bunkers. In the summer these “dens” provide cool retreats from the mid-day sun, and during cold winter months, the dens are heated to replicate temperatures that Indigos commonly seek

opportunities for physical exercise and behavioral enrichment also supports the psychological wellbeing of snakes maintained outdoors. Our first set of 12 outdoor enclosures was completed in the summer of 2012, and many of our successful breeders are entering their third winter of being maintained outdoors. An additional 16 enclosures are currently being completed via a matching grant awarded by the American Zoo Association Conservation Endowment Fund. These

southern Georgia over a four-year period (2008 to 2012) as a joint partnership of The Orianne Society, Auburn University and the Alabama Heritage Program. Following capture, female Indigos were maintained at Auburn University until oviposition (egg laying) and were then returned to the wild at their previous point of capture. The OCIC received at least one individual from 18 clutches during this time. This strategy provided an impressive genetic diversity in which to

“Last summer the OCIC hatched 67 Eastern Indigo Snakes, a record not seen previously anywhere.”



Fred Antonio marks newly-laid eggs for data processing. Eggs are weighed, measured and set up for artificial incubation.

in Gopher Tortoise burrows. In addition to matching the thermal conditions found in nature, snakes also have the ability to bask in the sun and receive the benefits of ultraviolet radiation, important in calcium metabolism. This could prove vital to appropriate circulating blood calcium levels, egg shell calcification and smooth muscle contraction associated with the egg laying process.

Seasonal weather changes and temperature cycles also support normal physiological rhythms in temperate snakes which may be crucial to long-term reproductive success. Exposure to these climactic elements year round may promote essential physiological changes not previously appreciated. Increased

28 outdoor environments house the primary members of our adult Eastern Indigo Snake reproductive colony.

Success is in the Numbers!

The largest challenge to establishing programs for endangered and threatened species is genetic diversity. Often populations of wild animals become genetically “bottle-necked” as their numbers drop and populations become isolated. To overcome this problem, the OCIC fortuitously linked with a developing reintroduction project for Conecuh National Forest in southern Alabama. Permitted by the Georgia Department of Natural Resources (GADNR), field collection took place in

develop our Indigo colony. These captive-hatched Indigos were raised at the OCIC for our future reproductive colony while Zoo Atlanta raised an impressive number for the Conecuh reintroduction program.

Last summer the OCIC hatched 67 Eastern Indigo Snakes, a record not seen previously anywhere. This cohort was the result of breeding 10 female Indigos with non-related males. This fall 16 females have been bred, so expectations are high for the 2015 hatch! This success has allowed us to now establish a second reintroduction site in the Florida panhandle. With the Conecuh program in its fourth year of releases, this new site will help fortify a region where Indigos have largely disappeared. Reintroductions

are guided by the Eastern Indigo Snake Reintroduction Committee, comprised of partners and stakeholders involved with Indigo Snake conservation. The committee's direction and support will help insure success in a multidisciplinary approach for Indigo conservation. OCIC staff also maintains the Eastern Indigo Snake Studbook and manages the Species Survival Plan for the Association of Zoos and Aquariums. This zoo population serves as education ambassadors for

are designed to promote public education and to foster tolerance of snakes in our natural communities. Conservation messaging is also conducted by traveling to meetings and events and by presenting various programs including "Saving the Eastern Indigo Snake" and "Snakes of Central Florida." In addition, our on-site program "Explore the Orianne Center for Indigo Conservation" is an impressive, first-hand experience where participants learn about conservation strategies. Of

and Wildlife Festival by bringing 20 live adult rattlesnakes for exhibit. During the weekend we presented snake conservation talks and hosted a booth to personally interact with festival visitors. Rattlesnake round-ups are traditionally kill events (snakes killed for meat and hides), but for the third year in a row, no rattlesnakes were harmed in this unique conversion from "rattlesnake round-up" to "rattlesnake festival."



Eastern Indigo Snakes breeding in December in their new outdoor enclosures.



The clinic room in the OCIC Health Care Center is used as a "walk-in incubator." Indigo eggs are incubated around 77°F, cooler than most snakes eggs.

Indigo Snakes and other imperiled species of the upland ecosystem.

Conservation Education: Make it Personal!

The OCIC serves to complement and enhance the Central Florida Zoo's already diverse conservation education programs. From kids to adults, conservation education aimed at developing an appreciation of snakes can be the most challenging due to preconceived ideas and "lessons" often times not based on fact. The OCIC's rural location is an ideal environment to teach conservation and an appreciation of Florida's natural communities while immersing students in nature. All snake programs at the center

course the highlight is always an Indigo "meet and greet" with lots of pictures and smiles of excitement, a tradition which goes back over 75 years in Florida history (Ross Allen and Bill Haast, for our more mature readers!).

In addition to our Eastern Indigo Snake propagation initiative, the OCIC maintains and manages additional captive programs in support of the zoo's mission. A large collection of Eastern Diamondback Rattlesnakes (*Crotalus adamanteus*) contribute to our commitment to end traditional rattlesnake round-ups in the Southeast. During the last three years, in a partnership with GADNR and the Evans County Wildlife Club, the OCIC participated in the Claxton Rattlesnake

Into the Future

The OCIC remains eager to work with partners to achieve the long-term vision of restoring robust Indigo populations across their historic range. At the OCIC, original research promoting long-term individual health and reproductive viability will be key to consistent future success. Further scientific studies will be identified to evaluate and understand the interplay of environmental and neuroendocrine control of reproduction, along with a better understanding of Indigo social behavior, blood values, hormonal influences, thermal biology and energetics, and nutrition. 🐍

ALL ABOUT

Photo: Dirk Stevenson

INDIGOS

by Dirk Stevenson



ENroute to my study site, I cross a great river. The water is calm and glass-smooth, making it appear as if this giant is barely moving. Small clouds of steam hover over the blackwater like puffs of smoke. A provocative scene and a powerful nature vista, it prompts me to reflect on my seven years with The Orianne Society and my experiences with an incredible reptile: the Eastern Indigo Snake.

THE HABITAT

I observed my first-ever Indigo in the Everglades, where these imperiled snakes have plentiful red-orange on their chins and throats. In this subtropical milieu under a sharp sun, unusual and striking birds abound. Mahogany and Gumbo Limbo Trees sport epiphyte-heavy limbs and trunks adorned with colorful tree snails and lichens. A giant snake of a purplish hue seems to belong. After all, *Drymarchon couperi* comes from tropical stock with most of the described Indigo species and subspecies occurring in Mexico, Central America and South America.

I saw the snake on the dappled floor of a forested hammock surrounded by Sawgrass, the quintessential Everglades setting. He seemed to be foraging and might well have been drawing a bead on the scent trail of one of those beautiful orange ratsnakes that thrive in this habitat. This was 25 years ago. I can't help but wonder how their great-grandkids are

faring today (both the Indigo and ratsnake) in what is now a landscape heavy with Burmese Pythons, among other invasive species.

Indigos are not that common in much of the Everglades region and likely never were. Remember, this is an upland species that may forage near wetlands, not a wetland snake that occasionally seeks high ground. The snake isn't aquatic—when Indigos do swim, it's on the surface. (Still, I should mention a riveting internet post of a fat Indigo filmed as it dunked its head and the first half of its body in a south Texas resaca—intermittently, the snake would pop to the surface with a squirming Leopard Frog in its mouth!) In an Indigo species account I read many years ago, I was struck by a succinct habitat description: "Indigos like xeric areas near water." Sounds oxymoronic, doesn't it?

The preferred habitats of the Eastern Indigo in southern Georgia and northern Florida are very different from the tropical hammocks of south Florida. Our Georgia

Indigo Snake research sites are open-canopied Longleaf Pine and Turkey Oak forests on ridges of deep, well-drained sand close to swamps and flatwoods. Here, the snake regularly uses the deep burrows made by the Gopher Tortoise.

The beauty of these sandhill habitats is subtle—these are austere environments that take some getting used to. Many plants are stunted and spiny. Botanists have described these habitats as "deserts in the rain," and there are patches of bare white sand between clumps of Saw Palmetto, Yucca and Cactus. The late summer wildflower display in sandhills is intoxicating and certainly on par with the autumn foliage of Appalachia, albeit on a smaller scale. September sandhills are rich in diversity of asters and mints with scarlet, lavender, pink and yellow flowers standing out against the white sands.

Some sandhills are dotted with fascinating wetlands known as cypress ponds or Carolina bays—small (usually three acres or less) round or oval wet-weather ponds that only hold water seasonally. These isolated, depressional wetlands are embedded in vast sand ridge landscapes and thus may be described as islands of swamp within a sea of pinelands. They are easy to pick out on aerial photos. These quaint and easy-on-the-eyes ecosystems are bowl-shaped in cross section and have distinct, concentric zones of vegetation that appear to have been carefully barbered. In the winter, Maidencane growing in the pond basins fades to blond, and the red berries of Myrtle Hollies provide a holiday touch.

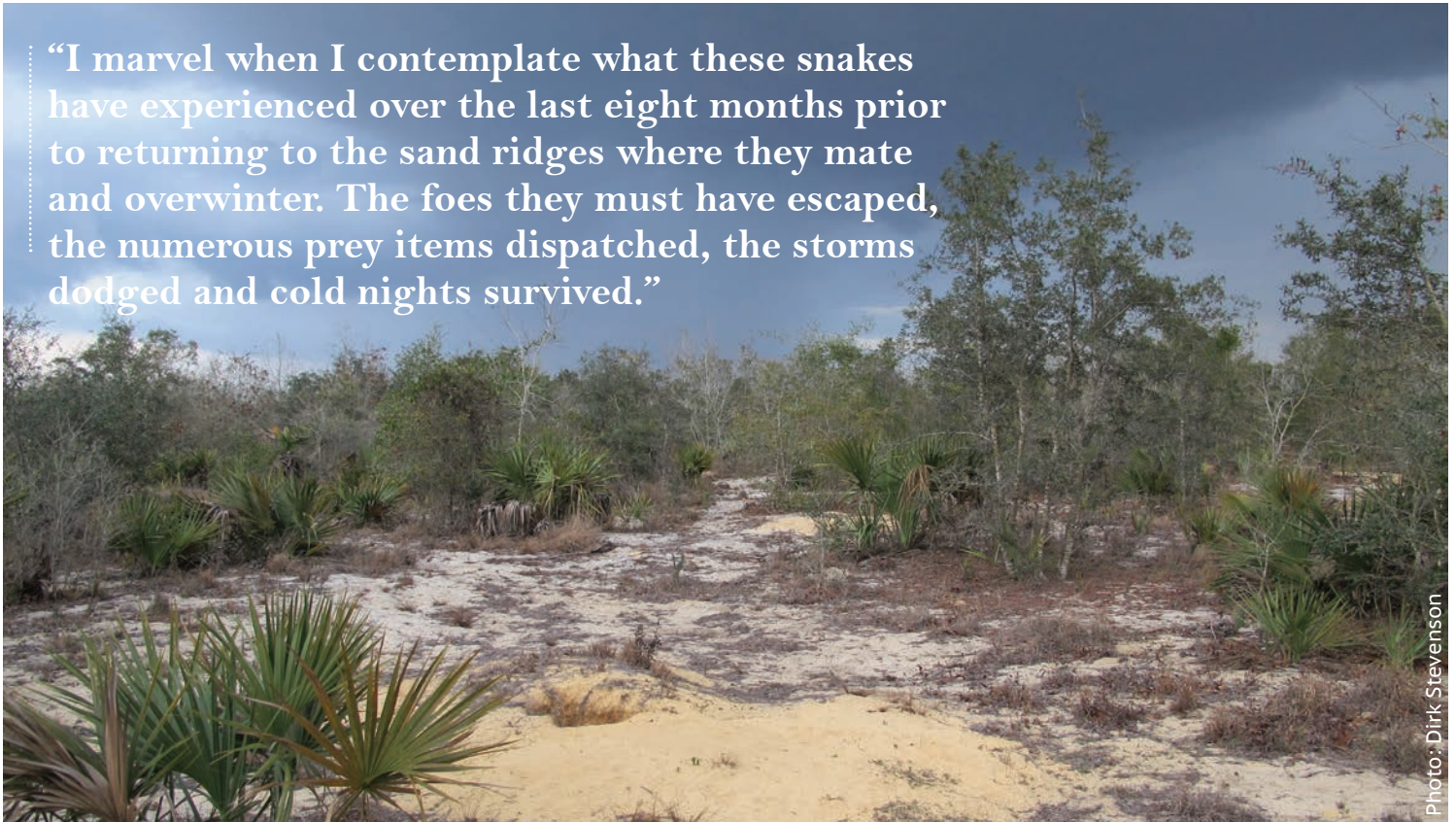
Isolated wetlands in sandhills support a number of rare and declining amphibians like Tiger Salamanders, Barking Treefrogs, Striped Newts, Ornate Chorus Frogs and Gopher Frogs. Indigos may visit them to feed. A cypress pond in good condition, not long after it ponds with "new water," will contain many hundreds of hollering frogs.



Photo: Dirk Stevenson

The Eastern Tiger Salamander (*Ambystoma tigrinum*) often shares cypress pond breeding sites with Ornate Chorus Frogs and Gopher Frogs.

“I marvel when I contemplate what these snakes have experienced over the last eight months prior to returning to the sand ridges where they mate and overwinter. The foes they must have escaped, the numerous prey items dispatched, the storms dodged and cold nights survived.”



This Oak Scrub habitat, located on the Lake Wales Ridge of south-central Florida, is inhabited by Eastern Indigo Snakes, Florida Pine Snakes and Eastern Diamondback Rattlesnakes. Note the Gopher Tortoise burrow aprons.

SNAKE HUNT: A YEAR IN THE LIFE OF AN INDIGO

Indigo Snake surveys are long meditative walks punctuated by drama. Most of my Indigo Snake field work occurs during the autumn and winter when bird song is meager and insects are few—I get a lot of thinking done on a snake walk. I might visit hundreds of tortoise burrows on a given survey and find one or two snakes. Rarely a couple more, and often, nothing. After all, the joy is in the hunt, right? But when the form of a seven-foot Indigo or the pattern of a large Eastern Diamondback Rattlesnake materializes, for me (and for that matter all other warm-blooded hominids I’ve met, whether snake friend or foe) dramatic, instantaneous physiological changes result.

The quiet of winter belies just how much is going on with my study subject. Indigos are cool-season active and may

feed, bask, shed their skins, mate and move between burrow refuges when mild temperatures allow. I marvel when I contemplate what these snakes have experienced over the last eight months prior to returning to the sand ridges where they mate and overwinter. The foes they must have escaped, the numerous prey items dispatched, the storms dodged and cold nights survived. The good decisions or luck that has saved them from mishaps with vehicles and other human malfeasance. And just consider the sheer amount of ground covered. (In South Georgia, some large male Indigos radio-tracked by Natalie Hyslop dispersed up to four miles from the Gopher Tortoise colonies where they overwintered!) The myriad types of burrows and shelters used as retreats—from tortoise, armadillo and cotton-rat burrows to tunnels under forgotten camper shells and serpent-smooth-worn holes at the base of fallen

trees. An eventful year in the life of an Indigo, all before returning unerringly to the warm confines of the very same tortoise burrow used a year ago.

In April, driven by hunger and encouraged by longer photoperiods and warmer temperatures, the males—including those muscular seven-foot bruisers that cause grown Diamondbacks to experience heart murmurs—disperse from the sand ridges in search of richer terrain for foraging. They slither downslope until they find pine flatwoods, seepage-fed blackwater streams, grassy marshes and other habitats where potential prey (snakes, amphibians, rodents) are abundant.

In May and June, the adult females lay modest-sized clutches (four to 14) of what are quite sizeable eggs (almost three inches long) in sandy cavities near the entrances to tortoise burrows and similar sun-exposed microhabitats. Given

Photo: Andy Day; Background Photo: Kevin Stohlgren



their profound investment in the next generation, post-oviposition the females are ravenous and, like the males did one to two months earlier, disperse to lower grounds in search of prey.

Meanwhile, juvenile Indigos still in their first year (i.e., those that hatched the previous September) are becoming search-and-destroy foragers, too. Having hatched at around 18 inches in length and overwintered at two feet, they will put on another two or more feet this year—assuming they are successful in avoiding a plethora of predators, including Eastern Kingsnakes, raptors and bobcats.

Summer is hot, thunderstorm season. Indigos of both sexes and all sizes are especially vagile before or after rains or early in the morning when temps are less severe. Sadly, we are brought quite a few Indigo Snakes found DOR (dead-on-road) during the summer and fall months. The all-you-can-eat mentality (an Indigo found near Savannah by Alabama herpetologist Bob Mount contained a juvenile Gopher Tortoise, a Southern Hognose Snake, a toad and a Pigmy Rattler) continues

extending into November. Hard-earned fat stores will provide much-needed energy for the autumn breeding season and for surviving the winter cold. Ecdysis (the process of shedding) prompts opaque snakes to enter tortoise burrows or similar secure refuges where they hole up, sedentary for about three weeks.

And then the fun begins. Indigos are polyandrous—both male and female snakes potentially mating with multiple individuals during the same breeding season. Our genetics research has borne this out. Adult male snakes we find in November, December and January often bear scars from bite wounds from combat with other males. Large males engage in combat for the right to occupy the shelter (often a tortoise burrow) holding a sexually-receptive female.

If it's hard to imagine how snakes slug it out without limbs, this might help: raising their heads and the first foot or two of their bodies off the ground, they intertwine. With what appears to be considerable exertion (I have heard hissing and heavy breathing during combat!), both snakes continue wrestling, simultaneously lifting their heads skyward in an effort to “top” and press the other contestant to the ground. Biting can occur. It's a fascinating scene, since the snakes pretty much writhe continuously while remaining intertwined, reminiscent of the fluid stripes on a barber pole. Indigos found fighting by a deer hunter last year in southern Georgia at 4:00pm in the afternoon were still at it almost three hours later in the dark.

COMMENSALS: LIFE IN A TORTOISE BURROW

A unique frog, an endemic mouse, a blood-thirsty tick and an imperiled snake live in the Gopher burrow. So do scarab beetles and robber flies found nowhere else on the globe. Hanging upside down from the roof of most burrows are gopher crickets, their absurdly long

antennae twitching in the dark. These fellow associates in the burrow are called commensals. A commensal is an animal species that depends upon the burrow for some aspect of its life history. For some invertebrates the relationship is obligatory, meaning they occur in no other except for Gopher Tortoise burrows. Eastern Indigos are known to use the burrows for a wide variety of reasons: to avoid predators, fire and temperature extremes and for egg-laying, foraging, mating and denning prior to shedding.

Go beyond the butter-colored spoil marking the entrance to the burrow (the apron), stick your head just inside and draw a breath. You can almost taste an elephantine odor, the smell of slowly-decomposing tortoise dung.

The genus *Gopherus*, restricted to North America, first appears in the fossil record in the late Eocene (circa 35 million years ago). Our southeastern Coastal Plain *Gopherus polyphemus* (Gopher Tortoise) has been around ca. 20 million years. More than adequate time for a number of animal species to specialize and develop lifestyles wherein, they have become dedicated commensals. Some invertebrate species that have invaded tortoise burrows have, over evolutionary time, lost pigment—a characteristic of cave forms. In the case of the Eastern Indigo, its natural history and ecology is so closely tied to the tortoise burrow that in parts of its range it is known as the Gopher Snake.

The burrows of adult Gopher Tortoises are, on average, about 15 to 25 feet long and six to 10 feet deep. We know from scoping them with our burrow cameras, used to confirm the presence of a tortoise or Indigo Snake, that most burrows have one or more prominent curves as they descend. The temperature at the end of the burrow is fairly constant and is cooler (22-26°C) or warmer (16-21°C) than surface temps during the summer and winter, respectively. This

lends the burrows a thermal stability coveted by many species, including the Indigo Snake.

The bottom of the tortoise burrow where dung accumulates is the origin of a food web. Tortoise feces, composed of a compact mass of undigested grasses, are similar in appearance to a large plug of tobacco—some herpetologists call them “field cigars.” Tortoise dung is processed by several species of scarab beetles and anthomyiid flies. These species may be extremely abundant in some burrows.

The aforementioned gopher crickets are generalized scavengers, while a shiny black hisster beetle with an artistically-sculpted carapace is an invertebrate predator. Another obligate commensal, a robber fly species, hunts insects in the twilight zone near the mouth of the burrow. The big-eared Florida mouse (*Podomys floridanus*, also known as gopher mouse) and the wide-mouthed Gopher Frog (*Lithobates capito*), both frequent guests of the burrow, consume arthropods and are in turn eaten by Eastern Coachwhips and hognose snakes. And Indigos are known to prey on both of these snake species.

There are gemstones aplenty in historical accounts of commensals, both by accomplished naturalists and former presidents. For example, in 1894 entomologist Henry Hubbard was excited to be discovering insects new to science that lived only in Gopher Tortoise burrows. In a classic paper, “The Insect Guests of the Florida Land Tortoise,” he wrote lovingly of diaphanous forms that shun sunlight, hump-backed dung beetle larvae and coprophagous caterpillars:

“This interesting association of messmates and parasites of the gopher tortoise forms a distinctly subterranean fauna, in which the genesis of true cave life is very instructively shown.”

And, following a 1917 visit to Florida, during which he fished for “devilfish,” President Theodore Roosevelt wrote:

“The ‘gopher snake’ (Spilotes corais couperi)

goes in and out the burrows, no doubt on friendly terms with the owners, and the ‘gopher frog’ (Rana aesopus), also on friendly terms, sits in the doorway at dusk and hides in the retreat if an enemy appears.”

Last winter within the space of a week, I observed Florida Scrub Lizards and a Bachman’s sparrow run into tortoise burrows. I chuckled as a yearling Gopher Frog, perched just outside the mouth of a burrow in mid-afternoon, swallowed a grasshopper before hopping into the gloom of the tunnel. An Eastern Diamondback encountered eating an adult cottontail retreated into a nearby burrow after his prodigious meal.

I suspect there were few subterranean refuges at this site ridge large enough to accommodate a snake almost basketball-sized in girth. Surveying for Indigos, I regularly see bobcat and coyote tracks on burrow aprons. And this January, our field technicians snaked the burrow camera down a tortoise hole on Trail Ridge in north Florida to find a mother otter with pups curled tightly in the bottom of the burrow.

RECENT STUDIES: DISTRIBUTION AND DECLINE

In 2013 my colleague Javan Bauder, herpetologist Kevin Enge of the Florida Fish and Wildlife Conservation Commission, ecologist Matt Elliott of the Georgia Department of Natural Resources (GADNR) and I published a significant paper in *Herpetological Conservation and Biology*. “The Historical and Current Distribution of the Eastern Indigo Snake.” For this paper we mapped all Indigo Snake records we could locate based on museum specimens, photographs and credible sightings. We compared the species’ original distribution with its current range and determined where the species was still present and doing well versus where it has declined.

Today, Indigo Snake populations are still widespread in portions of the Florida peninsula (one of the most rapidly-growing portions of the United States in terms of human population) and southeastern Georgia. The Altamaha River basin of southeastern Georgia, our focal study area and home of the Orianne Indigo Snake Preserve, remains

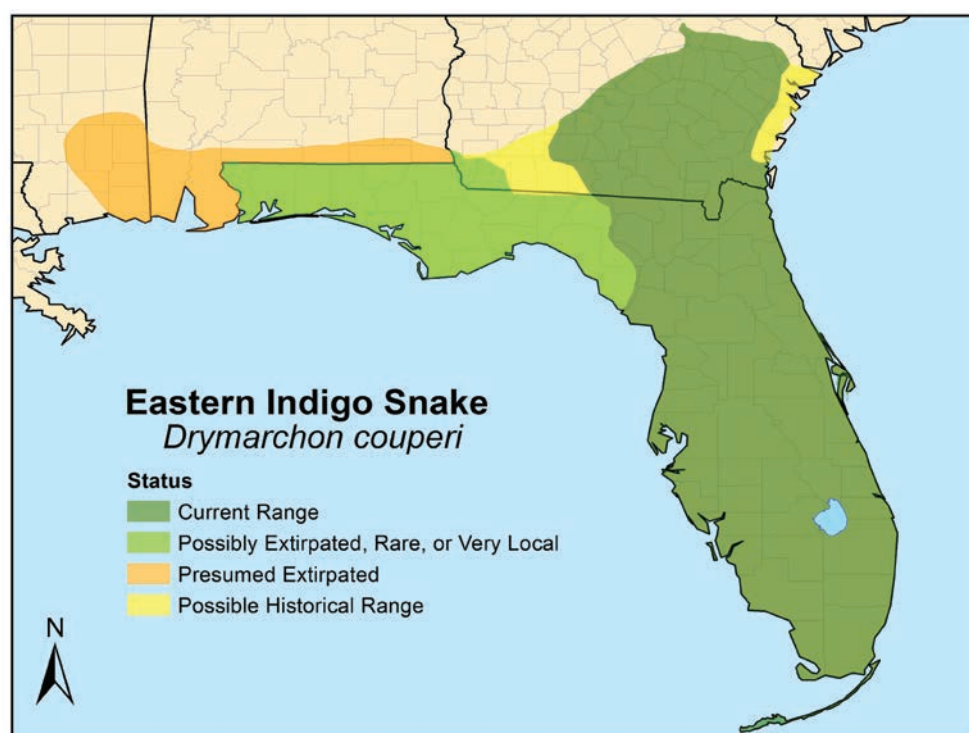




Photo: Dirk Stevenson

The Gopher Tortoise is the primary host for the tortoise tick (*Amblyomma tuberculatum*), one of the largest tick species in the New World.



Photo: Dirk Stevenson

The primary prey of Eastern Indigo Snakes is comprised of snakes, anurans (frogs and toads), rodents and small turtles.

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“I am mystified by the disappearance of Gopher Tortoises from the panhandle—for a tortoise junkie like myself, it is absolutely eerie to traverse the extensive sandhills from Tallahassee west to Pensacola and see so very few tortoise burrows.”

a population stronghold for the snake. Indigos have, however, disappeared from vast expanses of their historic range. They are no longer in Mississippi or in Alabama (although an experimental reintroduction effort is underway in the Conecuh National Forest).

And the species has gone missing from almost the entirety of the Florida panhandle and almost all of the Florida Keys. It's likely that habitat fragmentation and roads with high traffic volumes decimated Indigos on most of the main keys (the lone population currently known is on a road-less key) and on Sanibel Island where the last Indigo Snake observation is of a specimen run over in 1999 by a bicycle on a trail called Indigo Trail. A status review by the United States Fish and Wildlife Services (USFWS) in 2009 determined that, due to population declines, the Indigo should continue to be federally listed as Threatened. The decline

of Indigos in the Florida panhandle is especially troubling since state and federal-protected sandhill landscapes are vast in this region.

What happened? We think it's due to a major decline, historically, in the Gopher Tortoise population. I am mystified by the disappearance of Gopher Tortoises from the panhandle—for a tortoise junkie like myself, it is absolutely eerie to traverse the extensive sandhills from Tallahassee west to Pensacola and see so very few tortoise burrows.

A gold nugget of natural history writing may provide the answer. In the same 1917 article by Teddy Roosevelt referenced earlier, he wrote of widespread human capture and consumption of Gopher Tortoises. He told of “experienced tortoise pullers” who were remarkably efficient at snagging tortoises from their burrows by probing long sections of “elastic grapevines onto which they

fastened blunt hooks” into the burrow depths. Roosevelt's article mentions that harvest regulations had only recently been state-legislated for the three westernmost counties of Florida: “by provisions of an act passed in 1909, it was unlawful to take or sell any gophers during the months of May, June and July, and taking or selling Gophers under nine inches in length was prohibited.” That regulation may have been implemented too late and/or wasn't rigorously enforced. At any rate, the Gopher Tortoise population has yet to recover.

FOOD HABITS

I teamed with a number of accomplished Indigo scholars to review the food habits of the Indigo. First, some background: Indigo Snakes are not constrictors, and although they may employ a body coil to press prey to the ground, they mostly dispatch it by mouth

using their exceptionally-powerful jaws to kill rodents and crush the skulls of snakes. Vipers are typically killed and eaten without the predator Indigo being bitten.

We compiled 143 Indigo Snake prey records of nearly 50 species of prey. From our own field observations, necropsies of road-killed specimens, dissection of museum specimens, and the gray and published literature, we deduced that anurans, Gopher Tortoises, snakes and rodents composed 85 percent of the diet. According to snake biologist Harry Greene, snakes in the genus *Drymarchon* feed on turtles more frequently than do any other types of snakes.

Florida herpetologist Paul Moler told me of a Florida Indigo he radio-tracked in the limestone rich Gulf Hammock. Fascinated, Paul watched from afar with binoculars as the snake wove its way along the margin of a depression marsh. It crawled slowly, weaving systematically and purposefully as if looking for something. It would abruptly twist or make a mad dash at prey bouncing from it, and then a wriggling frog was in its jaws. In the cabbage palms and live oaks of a nearby hammock, Paul watched another Indigo repeatedly probe, withdraw, then again probe its snout into root channels and stump holes of fallen trees, occasionally extricating a toad.

THE SNAKE: A DAY WITH PADGETT POWELL

Field biologists begin the day in an anticipatory mood, always excited at what the day might hold. "Oh, man, it feels like Coral Snake weather. Will I happen upon a large rattlesnake eating a squirrel today, or maybe bump into an Indigo Snake I marked five years ago? Will high water in the swamp keep me from getting to that diamond-of-an-island tortoise ridge? Why was the field vehicle making that noise last week?" And field days with author and University of Florida (UF) Professor

Padgett Powell are always surprise-heavy, if for no other reason than that Padgett is one curious cookie.

Padgett is enamored with and very eager to learn about Eastern Indigo Snakes. He has written a story about The Orianne Society and his Indigo experiences with me that appears this month in *Garden & Gun Magazine*. Like Orianne Kaplan, holding a captive adult Indigo as a child left an indelible impression on him. Between writing and teaching writing at UF, he explored public land in central and south Florida hoping to see an Indigo for 50 years. When he came to us for help, the quest was still unfulfilled. Remarkably, I felt I knew him before I even met him. In my youth, my mother, encouraging my interest in literature, gifted me his award-winning book *Edisto*. And 22 years later I still remember a line from the book, "Skinks are lizards built for speed."

Before we met, he visited Fred Antonio at the Orianne Center for Indigo Conservation at the Central Florida Zoo in Eustis, Florida, where seeing Fred's breeding colony of captive Indigos further whet his appetite for a wild encounter.

He left a message on my answering machine going something like this:

"Dirk, this is Padgett Powell. I got your number from Fred. From communiques sent by experts herpetological, I am hearing you may be able to show me an Indigo Snake in the wild. I am dubious inasmuch as I have looked for 50 years and haven't seen one. I am convinced they are extinct. So you cannot possibly fail me since I don't expect to see one. But I am willing to drive to the remote

wilds of South Georgia, and I will bring meat I have prepared for us to eat."

I had to listen twice.

Three days later he shows up at my door, and I take him to sandhills on several conservation tracts known to have snakes but we do not see an Indigo all day. Actually, it takes more than several field trips before I am able to show him a wild Indigo in the field. But it is worth the wait.

The snake we find is an impressive, robust female, over six feet and polished smooth as stone. She's perched atop a logging windrow, a mess of slash and debris, slathered with a growth of blackberries. At the base of the windrow are two tortoise burrows that more often than not seem to be occupied by Indigos. I gently capture her because Padgett refuses to do so, fearing he may allow the snake to escape. She has just emerged from her burrow lair and is cold, in a zone where our presence remains undetected. I walk over and simply pick her up and hand her to Padgett. She rests in his arms like



Padgett Powell with the fruit of a productive Indigo survey.

a kitten.

I find the PIT (passive integrated transponder) tag scanner in my backpack and pass the wand over the snake's body near the tail. It beeps. We have recaptured "Stacy," a snake marked at this site over five years ago. She was full-grown then, making her over 10 years old now. This is exciting.

"Just where did you find Stacy previously?" Padgett asks.

I point to the tortoise burrow about 20 feet away.

He gently touches a fingertip to one of her large smooth scales, leaving a dimple briefly. Padgett is on another planet.

We release Stacy a few feet from her burrow. The beauty of an Indigo is magnified when we see them as they are, in their milieu on their terms. Where the sun strikes the snake just so, a wonderful iridescence dances above her. After a few seconds, she gets her bearings and glides slowly into the hole. I explain that Indigos appear an iridescent bluish-black in sunlight because of cellular properties of the snake's skin. You'd need an electron microscope to see this, but undulating lines on the surface of the skin produce this play of colors through diffraction of reflected light. In gray light on cloudy days, Indigos appear black.

Padgett and I ride and talk, hike and talk. About snakes and life. With adjectives, we anthropomorphize the native serpent fauna. I classify greensnakes as innocuous and dainty and cottonmouths as curious. Padgett, who caught snakes wading ditches as a boy, paints kingsnakes as imperturbable and ratsnakes as personable.

What about the Eastern Indigo? What words come to mind? I have invested lots of thought here over the years—how about docile, muscular, indomitable, habitual, visual, handsome and predatory. And my favorite is regal. To come upon a seven-foot-long Indigo, motionless, head and neck held off the ground periscoping as

the snake takes in its surroundings, is a majestic and regal sight.

Padgett says, "They are intelligent; these are thinking snakes. There is something going on in there." Inclined to agree, I tell of an anecdote from an essay in Archie Carr's *A Naturalist in Florida* about the huge male Indigo kept by a Florida couple (this decades before the snake was protected). They often allowed the snake to roam free in their home where it commonly arranged furniture to its liking. After the birth of their child, the snake often rested its head upon the arm of the sofa while watching the woman breastfeed with seemingly intense interest in the proceedings!

WHY DON'T THEY BITE US?

In our talks about Eastern Indigos, we underscore that their historic popularity is due, in part, to their docile nature. I have freely handled hundreds of wild and captive Indigo Snakes and have been bitten once. We skirt the fact that, rarely, these snakes do indeed bite us. We don't mention the Chicago zookeeper who was bitten by his captive male that, mistaking his rodent-odor-rich hand for a rat, attacked his palm, held on and gator-rolled repeatedly. Fifteen stitches. As for my bite, in an Orianne newsletter piece I compared the pain as similar to that of a razor-blade-lined vice, tightening on my thumb.

Why don't they bite us? Last field season we attempted to scientifically address this question.

When we capture Indigos as part of our long-term mark-recapture population monitoring studies, we quickly and gently process them in the field. We measure their snout-vent and total-body lengths, weigh them and mark them by injecting a uniquely-coded PIT tag beneath the skin. During this flurry of attention, albeit brief (we process a snake in about 10 minutes), the Indigos are agreeable. They virtually

never bite, but they do exhibit a suite of defensive displays that could possibly deter a predator. These include releasing pungent musk, rattling their tails, hissing, flaring their neck scales vertically (a cobra does this horizontally), and rarely, allowing their bodies to go limp, feigning death.

Intrigued by the vast repertoire of defensive behaviors that wild Indigos may exhibit in lieu of biting, in the 2013-2014 field season we crafted a datasheet and kept careful notes on 72 Indigo Snakes that we captured a total of 104 times. We measured cloacal temperatures soon after capture using a quick-reading thermometer, predicting that snakes with warmer body temps would exhibit a greater display of defensive behaviors. In over 80 percent of our captures, the Indigo, warm or cold, exhibited some form of defensive behavior. The most commonly exhibited were musking, tail rattling and hissing. Statistically, warmer snakes were more likely to run than cooler snakes that often remained stationary until captured.

We posit that because of their large size, adult Indigo Snakes have few natural predators. Through a combination of flight (i.e., crawling away) and the varied defense displays they are capable of, they are probably able to escape from most predators. Remember, if a snake is to defend itself by biting, it risks serious injury to its mouth.

My colleagues and I attempted to list documented or suspected enemies of Indigo Snakes. Native predators of Eastern Indigos, at least of smaller sub-adult and juvenile snakes, potentially include raptors, especially the red-tailed hawk, red-shouldered hawk and great horned owl. The American Alligator, bobcat and the now-extinct red wolf also made our list. Of course ophiophagous snakes, especially the Eastern Kingsnake and the Coral Snake—both of which are documented prey for Indigos—may

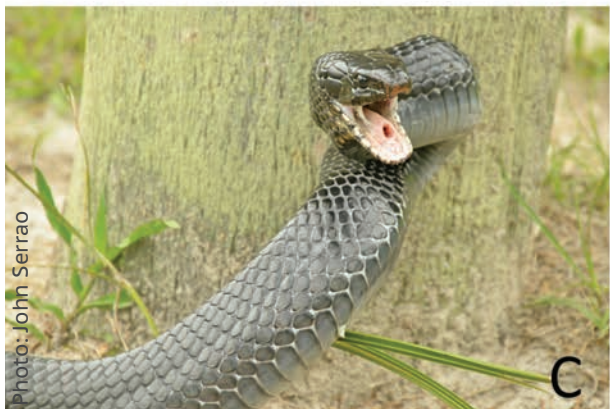
eat smaller Indigos. And a few instances of cannibalism have been documented. Bear in mind, we didn't consider foes like wild pigs, coyotes, fire ants, humans—or vehicles—to be natural (i.e., native) predators, although all of these are known or may be contemporary sources/causes of Indigo mortality.

My colleagues and I are understandably

Orianne members, from ongoing genetic studies (helping with the revision of the USFWS Indigo Snake Recovery Plan) to future Indigo Snake reintroductions, we continue to strive to do all we can to protect this imperiled and iconic snake.

In Georgia, we have actively worked with GADNR, The Nature Conservancy, the Department of Defense and private

how habitat fragmentation and landscape disturbance affect the viability of Indigo Snake populations. He is using genetics, population modeling techniques and data from 30 Indigo Snakes he radio-tracked to address this question. Meanwhile, in Alabama we continue to support efforts by the state and Auburn University to reintroduce Indigo Snakes to the Conecuh



Defensive displays and behaviors exhibited by Eastern Indigo Snakes in the wild include: A) flaring the neck scales vertically; B) hissing; C) gaping, then feint striking; and D) death-feigning.

proud of our numerous and varied accomplishments related to Eastern Indigo Snake conservation. From the gently rolling hills of southern Alabama, east to the great Okefenokee Swamp of Georgia, then south to white-sand scrubs of the Lake Wales Ridge, Florida, The Orianne Society continues to work toward protecting this iconic and imperiled snake. From long-term mark-recapture studies (we recently marked our 300th Indigo Snake) to our annual Indigo Days event for

landowners to identify, manage and monitor Indigo Snake populations and habitats in Georgia. I have known no better feeling in my career than developing a relationship with a landowner who reveres Indigo Snakes and Gopher Tortoises—one who wants us to do what it takes to conserve these species.

At Archbold Biological Station and nearby south-central Florida study sites, Javan Bauder (PhD candidate at the University of Massachusetts) examines

National Forest.

Orianne Kaplan put a name (and face) on the importance of saving the Eastern Indigo Snake, and with his very generous support, her father Tom got the ball rolling. Through our varied conservation initiatives using research, habitat management, land protection and education, the torch we carry holds a bright flame. Along with my colleagues, we dearly value the support of our members. Thank you. 🙏

following **CHARLIE** *into the field*

by Dylan Kelly and Josh Zajdel

Last November The Orianne Society's Indigo survey team gained a third member: a wildlife detector dog named Charlie. Charlie was flown all the way from Seattle, Washington, to join Josh Zajdel and myself in the search for Eastern Indigo Snakes. This would be his third project as an Indigo Snake detector dog. Charlie was rescued from a Washington state shelter and trained by the folks at Packleader Dog Training. Charlie's high energy level and ball drive are what made him a perfect choice for Packleader. As we would soon learn, Charlie can run all day long and will do anything to get his ball.

Charlie is not the first Indigo dog to be added to the Orianne staff. Along with Charlie, there is CJ (who retired this year) and Kona. In 2010 CJ became Orianne's first detector dog and quickly showed how effective dogs can be in finding Indigos.

Packleader has also trained dogs to search out bats, jaguars, Javan rhinos and even right whales, all with great success. Barb Davenport came with Charlie to Georgia, and with her came Kona. Kona is early in her training to be an Indigo

Snake detector dog, so Barb thought it would be a great opportunity for Kona to gain some experience in the field.

Clearly there was something Charlie and the trainers at Packleader could bring to the table, and it came in the form of the canine nose. The heightened sensitivity of a dog's nose allows it to detect far more scents than humans—a dog's sense of smell is a thousand times more sensitive than a human's. Charlie quickly proved this in his first week in Georgia by finding pieces of an Indigo Snake shed on the Orianne Indigo Snake Preserve (OISP). This shed would have gone completely unnoticed by Josh and myself because it was hidden under a bush and fallen oak leaves. Having a detector dog also allowed us to cover more ground than we would otherwise. While Josh and I might cover three kilometers, Charlie's energy level allows him to cover nearly five times that distance.

Over the three weeks of my training to become Charlie's handler, I learned to recognize the different behavioral queues Charlie gave for specific scents. His behavior for an Indigo when compared to

his behavior for a non-target species, like a coachwhip, became easily discernable. When Charlie smells an Indigo, his head immediately points in the direction of the scent, his ears perk up and his tail goes wild. However, when he smells another snake species, he barely reacts at all. Along with Charlie's behavior, I had to learn how to read air currents.

Unlike my usual surveys where I pay close attention to the ground and Gopher Tortoise burrows looking for tracks that Indigos leave behind, I had to learn how to direct Charlie so that he had the best chance of picking up a scent. Charlie tends to run anywhere regardless of the wind, and while he may cover a lot of ground this way, he may miss a scent if he spends too much time up wind. So Charlie relies on me to pay attention to the wind for him and give him the best chance of getting a find. I learned the commands and corrections that would keep Charlie sharp and focused.

I also learned to care for a dog with an extremely high drive and intensity level. Charlie, the seven-year-old Chocolate Labrador Retriever, is a wrecking ball



on four legs. “If Charlie had a motto, it would be CHARGE,” says Barb Davenport. Barb calls dogs like Charlie “brush breakers.” When Charlie catches the scent of an Indigo, he follows the scent taking the shortest route to pinpoint it. Shrubs, thorns and fallen trees do not register as obstacles to him. In order for Charlie and I to operate as an effective handler and dog team, I had to develop a strong relationship with Charlie.

It was Josh’s job to be the orienteer. His main task as part of the team was to handle navigating around the survey sites and catching the Indigo Snakes Charlie found. His assistance was crucial, as it allowed me to focus on Charlie’s behavior and the wind.

This season Josh, Charlie and I have visited three sites in north Florida with limited to no recent records of Indigo Snakes and several sites on the Georgia Coastal Plain. We were tasked with discovering whether Indigos are present on the properties. These sites often contain gorgeous habitat, and several sites have high biodiversity. At one site alone near Jacksonville, Florida, we mapped over 500 Gopher Tortoise burrows and have found coachwhips, glass lizards, gartersnakes, racers and box turtles.

Unfortunately, despite all of this habitat and biodiversity, evidence of Indigo Snakes recolonizing the site eluded us. The same could be said of the other two Florida sites near Pensacola, despite the fact that one of the sites is home to the critically-endangered Flatwoods Salamander. The Georgia sites, on the other hand, have shown great promise for the future of Eastern Indigo Snakes. On the OISP, Charlie found several sheds across the property and has put us on the trail of several snakes.

To make things a little more interesting, Josh pit his eyes against Charlie’s nose... a tall order considering on Charlie’s first official survey, he found four Indigo

“Charlie, the seven-year-old Chocolate Labrador Retriever, is a wrecking ball on four legs. ‘If Charlie had a motto, it would be CHARGE,’ says Barb Davenport. When Charlie catches the scent of an Indigo, he follows the scent taking the shortest route to pinpoint it.”

Snakes and one shed. Over the course of the season, Josh found 11 snakes while Charlie found six snakes and nine sheds. One of the sheds Charlie found was over a year old, and all that was left of the shed were six belly scales. Charlie was adamant that he had found his target, but Josh and I couldn’t find anything. It took Charlie digging at the ground to unearth the few scales. This was the great advantage of Charlie’s nose. In areas that have limited records of Indigos, Charlie’s super sensitive nose would be able to find even a single scale to confirm that Indigos were present.

Charlie was in high demand during his time with us in Georgia and Florida. My training as his handler ended just before Indigo Days. This gave Charlie and I the chance to demonstrate his abilities to a large group of Orianne Society members.

While down in Jacksonville, Josh and I had the opportunity to showcase Charlie’s talents to members of the United States Fish and Wildlife Services (USFWS). We were able to show how our team performed in the field and how effective Charlie was at finding his targets. The hope was that USFWS would see the benefits of using detector dogs for their own research in central Florida. Charlie also got to show off his talents to Don Becker and the creators of Herp Mapper (a crowd-sourced database for creating reptile and amphibian records around the world).

As Charlie’s time in Georgia came to a close, he has more than proven himself to Josh, myself and many other members of the research community. I developed a strong bond with Charlie. I learned to read his behavior, to tell when he needed a break, and to keep him happy, healthy and at 100 percent. I learned to care for a high-energy, high-drive dog whose talents and training were nothing short of remarkable. 🐾

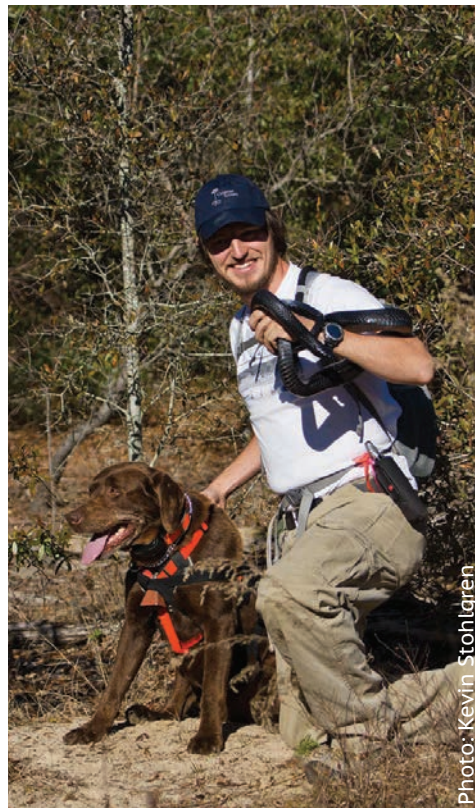


Photo: Kevin Stohlgren



ORIANNE WANTS YOU...

in the field!

Photo: Pete Oxford

by Heidi Hall, Stephen Spear & Kevin Stohlgren



The Orianne Society has long been interested in citizen science. For those of you unfamiliar with this term, citizen science is the participation of the general public in data collection for scientific research. Citizen science accomplishes many things: it allows for greater education outreach about the project, it engages the public to give them a sense of ownership of the project, and it allows for faster and wider-spread data collection. Our Citizen Science Initiative includes two field events: Places You've Never Herped and Indigo Days, which offer opportunities for Orianne Society members to spend time in the field with Orianne staff. In addition, this initiative has several focused data collection projects where citizen scientists are encouraged to find target species on their own and submit their observations.

PLACE-BASED EVENTS

PLACES YOU'VE NEVER HERPED

Have you ever wondered if there were other people out there that like to look for herps? Have you ever wanted to try herping but didn't know where to start? You are not alone! It was with this in mind that we created the Places You've Never Herped (PYNH) event series, a friendly field herping competition where you can learn the ropes, meet like-minded individuals and do your part for conservation while collecting valuable data. These citizen science events are more than just a friendly field herping expedition—they are invaluable to our organization by maximizing our data collection efforts for various research projects. It helps that they are also a very good time!

Our pilot PYNH event was held in southeastern Georgia in 2012. Forty-seven herping competitors ages 12 to 60 showed up for this one-day event which encompassed numerous Wildlife Management Areas (WMAs) within the Altamaha River Corridor in South Georgia.

To describe it: awesome, but not without a few hiccups. We learned a few things; for instance, we needed more time—one day was not enough. Secondly, we needed to encourage more young herpers to join us. This was a wonderful family event, and it was awesome to see such young herpers, as these guys and gals herped harder than anyone! Lastly, we needed to scout out the camping area a bit better. Though nestled amongst numerous WMAs, the train going through the campsite was a bit of a downer! However, these were lessons learned, and despite these little setbacks, we managed to find over 37 species of reptiles and amphibians.

PYNH 2 and 3 went more smoothly and took place in the beautiful North Georgia mountains and in the Bladen Lakes region of North Carolina. These events were a bit different in that they amounted to much more than a competition. As most of you know, one of the fastest-declining groups of animals—reptiles and amphibians—cannot be conserved without conserving their habitat. Being such, in 2012 The Orianne Society partnered with JJ

Apodaca of Florida State University (now with Warren Wilson College) to identify crucial habitat for reptiles and amphibians called Priority Amphibian and Reptile Conservation Areas (PARCAs)—think Important Bird Areas—in the states of Alabama, Georgia, Florida, North Carolina and South Carolina. Once the PARCAs were outlined, we needed to survey these areas on the ground to determine if they did indeed support high densities of herpetological diversity or rare species.

Cue PYNH!

We put out a call for help from our friends to survey the PARCAs in Tallulah Gorge, Georgia, and Bladen Lakes, North Carolina, in the form of PYNH 2 and 3 in June and August 2013. Over 40 participants showed up to the Tallulah Gorge area ready to get dirty and hunt for some herps, and 36 showed up in Bladen Lakes with their headlamps blazing for two evenings of night herping. These groups documented 85 species, contributing valuable on-the-ground data for the PARCA project.

In April 2014 we held PYNH 4 in the wild and amphibian-reptile-rich Red Hills region of northern Florida at the Dixie Plantation, a wonderful conservation tract owned by the Tall Timbers Research Station. The Dixie Plantation (9,111 acres) is a mosaic of Longleaf Pine sandhills and clayhills and wetlands. Wetland habitats on site include cypress swamps, riparian floodplain swamps and depression marshes—the ephemeral waters of these depressions provide habitat for many pond-breeding salamanders. PYNH competitors brought their sunscreen and their competitive spirit and found over 42 species for Tall Timber Research Station to enter into their monitoring database.

PYNH 5 was held in October 2014 in the Waynesville Watershed of North Carolina, an area with over 8,000 acres of undisturbed land with plentiful wildlife. This watershed is owned by the city of Waynesville and is gated off from public access. Because of this, the area had had no significant herpetological surveys done, and our inventory was of great interest to the city and to the state Wildlife Resource Commission. It was a pretty cold and rainy two days, but still successful!

Fall is a great time to be in the southern Blue Ridge—not only for the beautiful fall colors, but also for the amphibians and reptiles that can be found there. This area has among the highest diversity of salamanders in the world, and fall is one of the best times of year to find them. Over 36 individuals participated and contributed to finding and documenting 24 species, over half of them salamanders, for the city of Waynesville and the state Wildlife Resources Commission.

During our PYNH events, you get the chance to meet people that have the same interests as you. You contribute valuable data to conservation projects. And like many of our attendees, you learn more and more about something you are passionate about while making lasting

friendships and connections.

We announce these events to our members (PYNH are members-only events) via e-mail and also advertise on our social media sites. PYNH 6 is scheduled for June 6-7, 2015, in South Carolina. Watch for the registration announcement, get your game face on, and join us—you never know what will you find!

INDIGO DAYS

Indigo Days is an annual event that started in 2013 as a way to show our appreciation to our members by inviting them to our Orianne Indigo Snake Preserve in Telfair County, Georgia, to be a part of our Indigo Snake surveys. Indigo Days is always in the winter to correspond with our Indigo field season, and event participants get the chance to search for Eastern Indigo Snakes and Eastern Diamondback Rattlesnakes in the field alongside our staff.

Members break up into groups amongst the staff and head out into the field with mirrors in tow to look down Gopher Tortoise burrows, to scour the landscape for blue-black scales, and to listen for the tell-tale rattle of the Eastern Diamondback or the scuttle of a Gopher Tortoise.

And though the Indigo Days event was not set up as a team competition, the competition between our staff as to who can produce more animals for their group gets pretty heated, with good natured ribbing and lightly-barbed zingers (which we have heard is very entertaining). Indigo Days is a two-day event, with participants camping at Horse Creek Wildlife Management Area or Little Ocmulgee State Park. In the evening of the first day, we all meet at the lodge of the State Park and enjoy some good food, some gentle bickering about who found what, and a few presentations on the natural history of the area and species within it.

Indigo Days is a time for our members

to get up close and personal with the mission of The Orianne Society, a mission they are part of and support. We enjoy this time with our members and get great satisfaction from showing you what we do on the ground. Indigo Days is announced via e-mail to our members and also on our social media. We usually have to limit sign-up to a certain number of individuals that we can safely take out in the field, and registration fills up fast, so make sure you watch for the announcement and come see what you make happen with your loyal support!

CITIZEN SCIENCE DATABASES

One of the most common ways that organizations have collected citizen science information is by compiling individual animal observations that are sent in directly by the citizen scientists. Typically, this involves an online form or mobile app in which all the information gets put into a central database that can then be used for different types of scientific analysis. It's a really efficient way to collect a lot of information from a wide area that individual researchers alone couldn't cover. And when it's done right, it's really fun for people to do. One of the best examples is the Cornell Lab of Ornithology's eBird app and online form. eBird has not only generated millions of observations that the Cornell lab is using to address such questions as where species occur, migratory patterns and changes in breeding times, but it also allows birders to track where and when they've seen birds and to develop life lists. There are a number of other similar databases and apps for a variety of taxa including herpetofauna.

When The Orianne Society initiated our citizen science program with Places You've Never Herped, we knew that a similar database program would be important for citizen science projects.

"WHEN THE ORIANNE SOCIETY INITIATED OUR CITIZEN SCIENCE PROGRAM WITH PLACES YOU'VE NEVER HERPED, WE KNEW THAT A SIMILAR DATABASE PROGRAM WOULD BE IMPORTANT FOR CITIZEN SCIENCE PROJECTS. HAVING AN ONLINE SUBMISSION FORM WOULD ALLOW US TO CONNECT WITH MEMBERS AND OTHER INTERESTED PEOPLE WHO WANTED TO CONTRIBUTE TO REPTILE AND AMPHIBIAN CONSERVATION BUT WHO WEREN'T ABLE TO COME TO A PYNH EVENT."



Photo: Dylan Kelly

Orianne members stop to get a group shot at Indigo Days 2014.

Having an online submission form would allow us to connect with members and other interested people who wanted to contribute to reptile and amphibian conservation but who weren't able to come to a PYNH event. We also knew that it would allow us to address even more questions relevant to herp conservation beyond what we could do with our own scientists. With that in mind, we decided to begin collecting observations around two specific projects that we were interested in. The first revolves around breeding times for two common amphibians, Spotted Salamanders and Wood Frogs,

and the second targets any observation of a suite of rare snakes associated with the southeastern Longleaf Pine ecosystem.

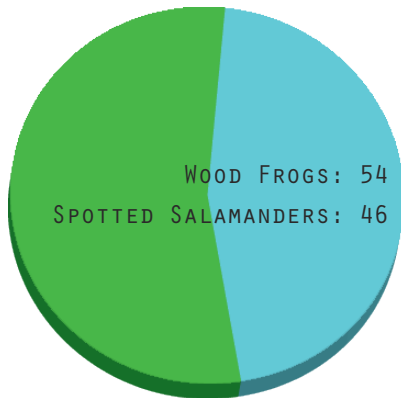
SNAPSHOTS IN TIME

We officially launched Snapshots in Time: Tracking Wood Frog and Spotted Salamander Breeding in late January 2014. We had two important objectives in choosing this project to launch our database efforts. First, we wanted to focus on species that were wide-ranging and easy for interested people to locate. The ranges of Wood Frogs and Spotted Salamanders together cover the entire

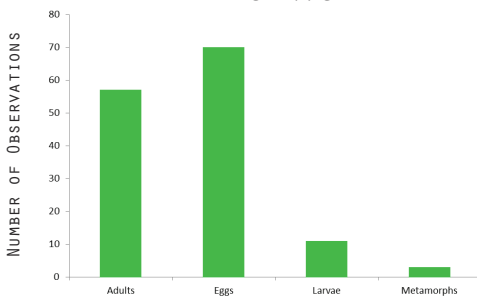
eastern part of North America and most of the northern half, as well. Furthermore, Wood Frogs and Spotted Salamanders are easily observable at wetland sites during the breeding season, and relatively little training is needed to positively identify adults and eggs of both species (larvae can be a little trickier).

But the second important reason why we chose these species is that they have the potential to be the "canaries in the coal mine" for how climate change might affect more threatened amphibian species. Specifically, we can see if the timing of when frogs and salamanders breed is

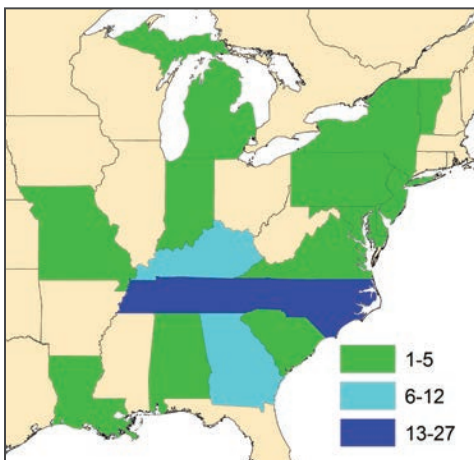
NUMBER OF OBSERVATIONS



OBSERVATIONS BY LIFE STAGE



LOCATIONS OF OBSERVATIONS



changing across years. The study of the timing of species activities is known as phenology.

So why do we care about the phenology of amphibians? One expectation of future climate is that warming will create earlier spring-like conditions, but that weather will be much more variable, too. So, for instance, a change to warmer weather in the winter may trigger amphibians to start breeding earlier than usual, but then the weather may quickly shift to freezing conditions which could kill all the adults or eggs already in the pond. Or because these species breed in temporary wetlands, warmer, drier conditions could lead to pond drying before the larvae can transform. And there are probably some scenarios that could happen that we can't even imagine yet—nature tends to be complex and complicated like that. So you can see why monitoring amphibian phenology can be really useful: we can catch problems in the early stages before they become too big.

MEET THE AMPHIBIANS

As we've mentioned, Wood Frogs and Spotted Salamanders are good candidates for a phenology project because they have large ranges and are recognizable to many people. The Wood Frog ranges the furthest north of any North American amphibian, even above the Arctic Circle. Their most obvious characteristic is a black eye mask that extends across the side of the head. Their color is tan-brown, and they have ridges on each side of their body. Wood Frogs also have a distinctive call that sounds very much like the quacking of a duck.

Spotted Salamanders do not occur as far north or west as Wood Frogs but are still found over most of eastern North America. Spotted Salamanders are easily recognized by yellow or orange spots that form two irregular rows on each side of the body, with the rest of the body black

or grey. Both species lay eggs in masses that float on the surface of the water and have algae that colonize the eggs, often giving them a green appearance. The main difference between the two species is that Wood Frogs tend to lay their eggs all in the same spot, leading to a big cluster of eggs, while Spotted Salamanders are less likely to have large clusters of egg masses in the same spot.

Wood Frogs and Spotted Salamanders occur together in a lot of wetlands, particularly in the mid-Atlantic and northeast regions. They also are both early breeders—in the South Spotted Salamanders will start breeding in December or January, and both species will begin breeding as soon as ice starts to melt in northern areas. In the coldest areas, breeding may not begin until May or June. The fact that the species are found together and breed at the same time gives us another advantage for understanding how changing conditions affect breeding because we are controlling for a lot of things, such as location of the breeding site and time of year. In other words, if we see Wood Frogs and Spotted Salamanders both responding in the same way across many locations, we can have more confidence that something broader like climate is causing it.

SNAPSHOTS: SEASON 1

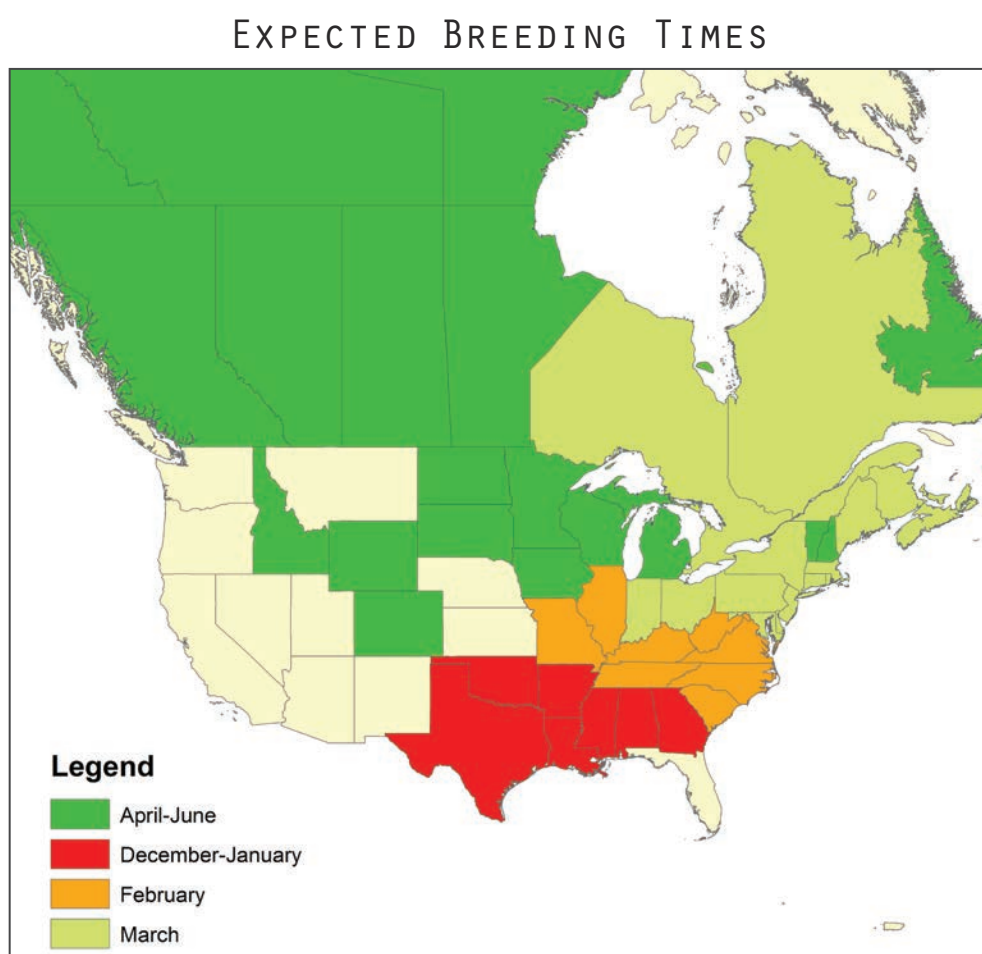
Our first "season" of Snapshots generated an even 100 observations, with most observations in February, March and April but some before and after that time. We had slightly more observations for Wood Frogs than Spotted Salamanders, and eggs and adults were by far the most common type of observation. In comparison, larvae and metamorphs made up less than 15 percent of total observations. The differences in life stage observations are not surprising at all. Although adults are generally at the breeding wetlands for short periods

of time, they are recognizable and are often seen moving across roads to get to wetlands. Eggs are also very recognizable and, because they do not move, can often be seen for a longer time. Larvae are harder to identify from other species and are harder to see without more invasive methods such as dipnetting. Finally, metamorphs are recognizable but are only around to be seen for a very short time; once they leave the breeding site, they usually disappear from view.

Another pattern that we saw was that most of our sightings were concentrated in the South, with North Carolina, Tennessee, Georgia and Kentucky providing the most observations. All other states had less than five observations, and we lacked records from several northeastern states and all Canadian provinces. We were not especially surprised by this either, as The Orianne Society is based in the Southeast and likely so is a large proportion of our membership and followers. But a future goal is to maintain our high level of southern observers while bringing in more observations from the northern states.

SNAPSHOTS: SEASON 2 AND BEYOND

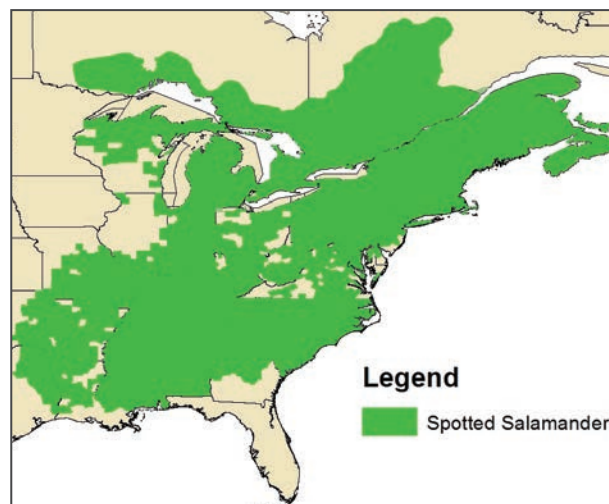
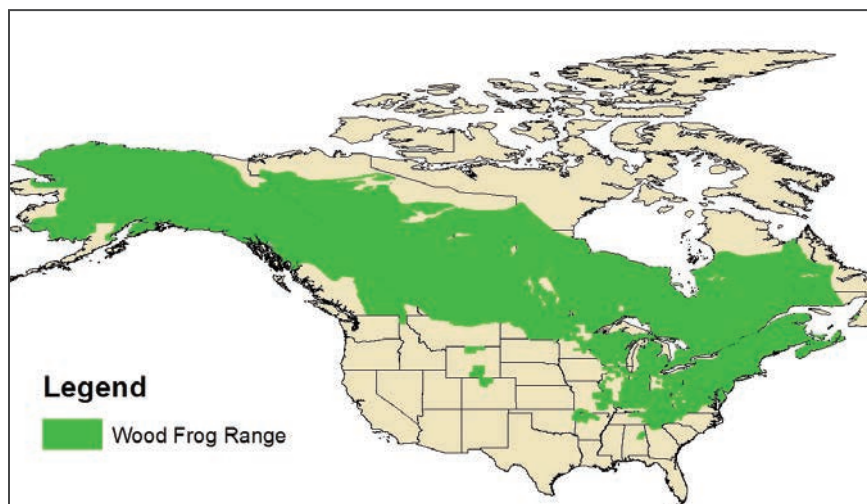
We are in the midst of another season of Wood Frog and Spotted Salamander breeding. We are excited for another round of observations from citizen



scientists, both returning and new. While we welcome all observations of the two species no matter the time or location, we do have some goals for this season.

First, we really hope that everybody who contributed last year can go out to the same sites to see when the amphibians are breeding this year in comparison to

last year. Having records from the same sites at the same time of year across multiple years is going to provide us the best data for understanding change in phenology. Second, if your favorite breeding site is near where you live, it would be fantastic if you monitored that site continually throughout a season,





WOOD FROG (*LITHOBATES SYLVATICUS*)

Photo: Todd Pierson



SPOTTED SALAMANDER (*AMBYSTOMA MACULATUM*)

Photo: Pete Oxford

starting with when adults arrive all the way to metamorphosis. This would not only provide detailed information on each life stage, but it would also tell us if breeding is ultimately successful. Third, we'd like to recruit the North. If you live in the Northeast or Canada or have friends there, please spread the word. For many species, northern areas are the first wave of climate change effects, and amphibians probably follow this pattern, as well.

Submitting your observations is easy—just go to our website (www.oriannesociety.org/snapshots-time) and fill in the information about your observation on our online form. We also really encourage photographs so that we can confirm the species identification. Furthermore, we are exploring possibilities for adding a mobile app to the project—stay tuned!

THE FINE PRINT

There are a few things we should mention that citizen scientists do need to consider when looking for these species. First, please do not trespass on private land, no matter how cool a wetland might be on someone's property. And know the regulations on public land areas—for instance, there might be restricted areas that are off-limits to the general public. We also ask that unless you have a special permit, you only look for and photograph animals and do not use more invasive methods such as dipnetting or trapping. We realize that this will probably reduce the chance to observe larvae, but it is better to be low-impact to these amphibians (not to mention it could save you a scolding or a ticket from the local land manager).

Finally, and this is important, disinfect your boots and any other gear when moving between wetlands. Disease is a big problem for amphibians, and we don't want to be making the problem worse. There's a good protocol for disinfecting gear that Northeast Partners in Amphibian

and Reptile Conservation put together that can be found at this site:

www.northeastparc.org/products/pdfs/NEPARC_Pub_2014-02_Disinfection_Protocol.pdf

LONGLEAF PINE SNAKE SPECIES: OBSERVATIONS WANTED!

Following our launch of the Snapshots in Time project, Orianne Society biologists realized that there was another way that citizen scientists could help our conservation efforts. We had been contracted by the Georgia Department of Natural Resources (GADNR) to help provide status assessments for three snakes: the Eastern Diamondback Rattlesnake (*Crotalus adamanteus*), the Florida Pine Snake (*Pituophis melanoleucus mugitus*) and the Southern Hognose Snake (*Heterodon simus*). As part of these assessments, we were conducting our own internal surveys. But unlike the Wood Frogs and Spotted Salamanders, finding these snakes is really hard—like the proverbial needle in a haystack. We knew we could use some help.

WHY THESE THREE SNAKES?

Beyond being difficult to find, there is a commonality to these three species of snake: they all occur in the Longleaf Pine ecosystem. The following will sound familiar to long-time Orianne Society supporters, but it bears repeating.

The Longleaf Pine forest once stretched from southern Virginia, almost continuously all the way to eastern Texas. It is an open-canopied forest with dense groundcover of extremely high plant diversity. The forest is reliant upon frequent fires that kill or stunt competing trees, such as Oaks, and keep them from filling the canopy. Development, logging and agriculture have relegated the Longleaf Pine forest to less than five percent of its historic range, and what

remains is extremely fragmented by roads and degraded by the removal of fire from the landscape. The loss of this important habitat has caused declines in many species of plants and animals.

The three species of snake we are focusing on are also thought to be declining, but their secretive nature makes determining their status difficult. However, due to these apparent declines, all three species were petitioned in 2012 to be listed as Threatened under the Endangered Species Act and are currently being reviewed by the United States Fish and Wildlife Service (USFWS). The USFWS needs state-level data, which is why GADNR wanted us to help assess the snakes.

The Eastern Diamondback Rattlesnake generally needs little introduction, as it is the largest venomous snake in the United States, growing over six feet in length. They feed primarily on small mammals, such as mice and rats, but occasionally take prey as large as rabbits. They seek refuge in Gopher Tortoise burrows, armadillo burrows and stump holes in the winter. The diamond pattern on their back that gives them their name is perfect camouflage for the dense, grassy environments they inhabit. While they are certainly dangerous animals when approached, they much prefer to escape undetected and will generally not strike unless they feel cornered and threatened.

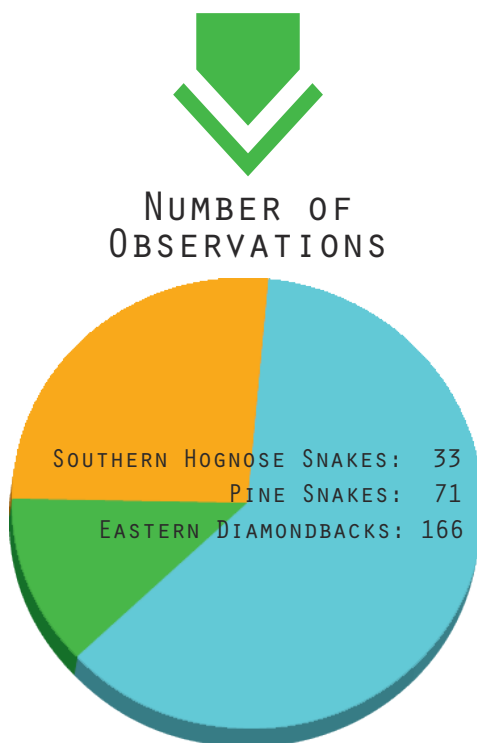
The Florida Pine Snake may be less familiar to most people but is a large, nonvenomous species growing over five feet long. They are highly fossorial, meaning they spend most of their time underground, and have an enlarged rostral (nose) scale that aids in digging. They feed on small mammals such as pocket gophers. When encountered they can put on an impressive threat display, rearing up off the ground and hissing loudly, but they are harmless to humans. In fact, many people confuse them for a venomous snake, but

in fact they pose no real threat to people.

The Southern Hognose Snake is a small species, typically less than two feet in length. Like the Florida Pine Snake, they also are highly fossorial and have a specialized rostral scale that aids in digging. The upward pointing scale gives them the name “hognose.” When threatened they can flatten their necks to look larger, and if pestered further, they will feign death by rolling over, evacuating their bowels and regurgitating anything they may have recently eaten. They feed primarily on frogs, toads and small lizards. They can be easily confused with the much more common Eastern Hognose Snake (*Heterodon platirhinos*). Southern Hognoses have more sharply upturned snouts, and their tail is the same color as the rest of the snake’s belly, which is not the case with the Eastern Hognose.

THE PROJECT SO FAR

In the past year we began compiling observations of these three species, including a launch of an online form



"IT IS A PRIORITY FOR US TO IDENTIFY NEW RECORDS FROM AREAS WHERE WE CURRENTLY HAVE EITHER NO OR FEW RECORDS RATHER THAN ADDITIONAL RECORDS FROM KNOWN LOCALITIES. THE BIGGEST GAP IN DATA FOR THESE THREE SPECIES IS IN THE SOUTHWESTERN REGION OF GEORGIA."

on The Orianne Society website (www.oriannesociety.org/snakes-longleaf-pine) in the summer. From all our sources, which include DNR observations, museum records and citizen scientist submissions, we have compiled 166 observations for Eastern Diamondback Rattlesnakes, 71 observations for Florida Pine Snakes, and 33 observations for Southern Hognose Snakes in southern Georgia. So far we have received 13 observations through our website (seven Diamondbacks, four Pine Snakes and two Southern Hognoses). The relative low numbers of these observations fits within what we would expect, considering how difficult the species are to detect, and also what we think are probably the relative population numbers for the three species. For instance, most southeastern biologists consider the Southern Hognose Snake to be one of the most imperiled snakes in the region.

Even at low numbers, locality data for these species provide us a lot of useful information. It gives us an idea of where these species currently occur as well as highlighting gaps where we lack records for the species. This lack of data could be because the species doesn’t occur there, or it could be due to a lack of survey efforts in the area. These data are also being used to create models that predict the amount of suitable habitat that remains for the species. These models will allow us to assess how much habitat has declined over historic levels and also to identify habitat that may harbor previously unknown populations. In the end, the models and records will be used to assess the

conservation status of these three species and will be shared with state conservation departments and the USFWS who can use them as part of their decision-making process about whether they should be listed.

NEXT STEPS

We plan to continue compiling records for these species to help monitor their status as well as to potentially identify new populations. It is a priority for us to identify new records from areas where we currently have either no or few records rather than additional records from known localities. The biggest gap in data for these three species is in the southwestern region of Georgia. This is likely due to the large amount of private land, making much of the area difficult to survey. For those citizen scientists who have already submitted records for any of these species, we challenge you to search for suitable habitat in new areas and to try to locate new records.

Finally, we plan to continue expanding our database projects beyond the two highlighted here. We recognize the value of having a mobile app available, and we are currently working to incorporate that into our projects. We also expect to launch other focused projects to collect citizen science data. For instance, we are currently brainstorming a project to collect observations of rattlesnake species.

Overall, we are really excited about the potential for citizen science to contribute to the conservation mission of The Orianne Society, and we hope you are, as well! 🌿

FLORIDA PINE SNAKE (*PITUOPHIS MELANOLEUCUS MUGITUS*)



Photo: Pete Oxford

SOUTHERN HOGNOSE SNAKE (*HETERODON SIMUS*)



Photo: Pete Oxford

EASTERN DIAMONDBACK RATTLESNAKE (*CROTALUS ADAMANTEUS*)



Photo: Pete Oxford

FIRE ECOLOGY

in the Southeastern Coastal Plain

by Brannon Knight

Fire has been a part of our landscape for millions of years. It has shaped and molded the terrestrial vegetative structure into an evolution of pyrophytic flora. It has been said to me that fire is as essential as soil and water. I did not quite understand why until seeing first-hand the power fire beholds. Witnessing fire used to mimic a natural process rebounding over a decade of fire suppression and altered invasive land-use practices was an incredible sight to behold.

Prescribed fire keeps the Longleaf Pine ecosystem in check and enables native flora and wildlife to thrive, but fire suppression in the past 100 years has left this diverse ecosystem in peril. After the Civil War, fire was still a part of the landscape, but a major physical change that was prevalent on the landscape was that the fire compartment size was significantly being reduced, mainly from agriculture. It was also around this time that free-range grazing was coming to an end, and spring burning slowly came to a halt. Later, state fire laws passed, and penalties and fines were given for starting a “forest fire.”

The Longleaf Pine (*Pinus palustris*) ecosystem once covered approximately 90 million acres ranging from Virginia to Texas within the Coastal Plain. Longleaf Pine could be found from ultra-xeric sandhills to wet savannahs. But today, only about 2.5 percent of its original range remains, and only 0.2 percent of this area is being maintained by prescribed fire. The turpentine industry, logging, open-range grazing, agriculture, short-rotational forestry and urban development can all be attributed to the significant reproduction of the species, but the overall perpetuation of Longleaf Pine is mainly due to fire suppression.

Longleaf Pine requires bare mineral soil for its seeds to germinate. When fire is removed from the landscape, litter accumulates and seeds are not able to properly germinate. The removal of fire also allows less fire-adapted woody species, such as hardwoods and other woody vegetation, to compete with Longleaf seedlings which can hinder their growth and regeneration.



Longleaf Pine is undoubtedly an iconic and ecologically-significant species, but this alone does not make up the entire story. The highly-rich and diverse fire-adapted plant communities within this pyrophytic ecosystem are what really make it special. Approximately 6,000 different plant taxa can be found within the ecoregion, and 1,630 species are endemic. It is not uncommon in stands that have been fire-maintained to contain more than 40 species of plants in just one square meter. And it is said that almost a quarter of all plant species in North America can be found within the Longleaf Pine ecosystem alone!

The diverse groundcover dominated by grasses, forbs and composites enhance habitat for fauna and provide fuel to carry fire across the landscape. Some studies have suggested that there is a positive correlation in Gopher Tortoise burrow location to native bunch grass clumps. Many species that are characteristic, such as Wiregrass, require frequent fire during the natural fire season (or growing season) to stimulate flowering and to produce viable seed.

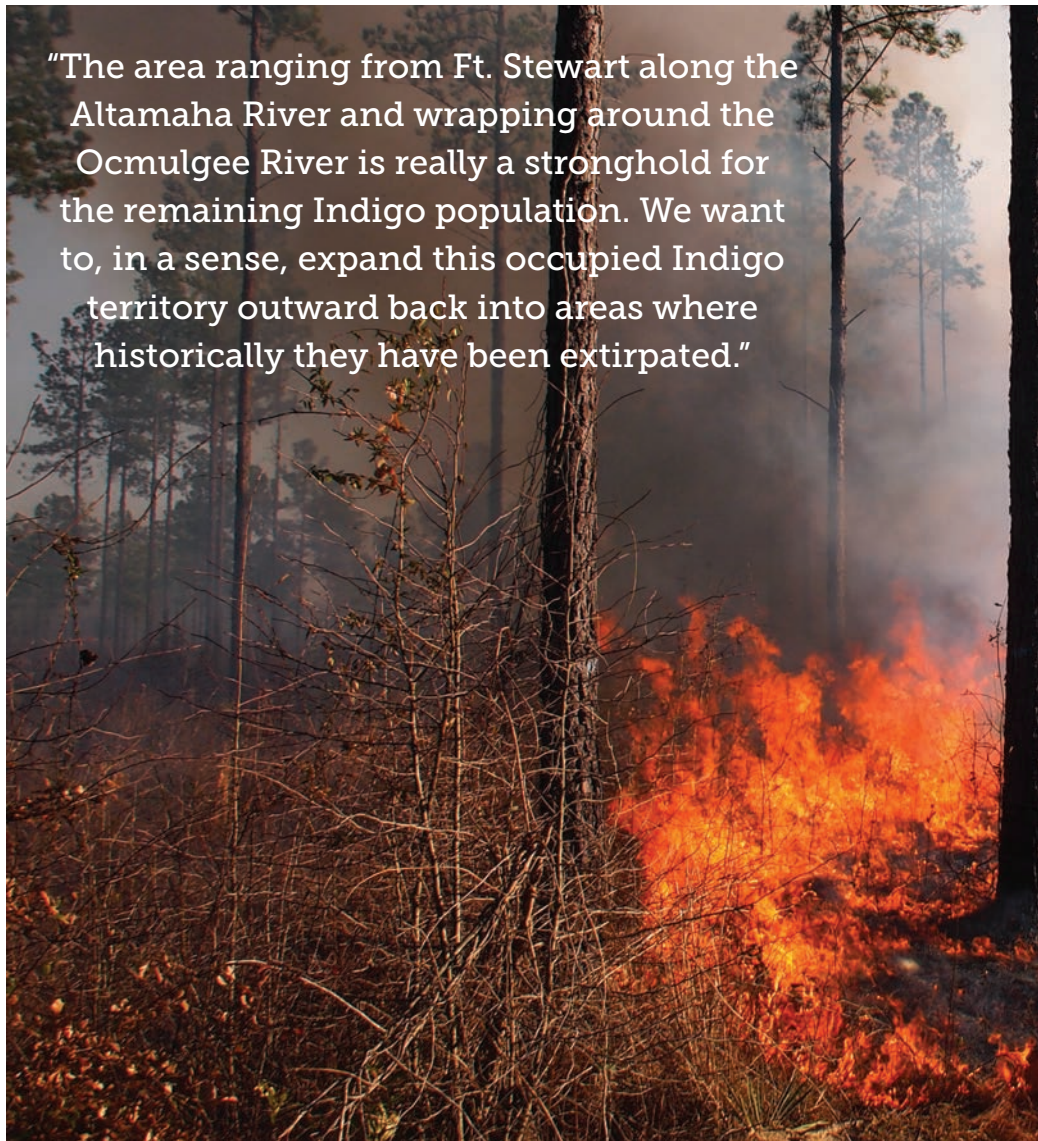
Dendrochronology studies have shown that lightning fires historically occurred every two to three years, mainly during the growing season, which contributed to maintaining the diverse open-canopied forest structure.

So why is this biodiversity in the understory so important?

Most of the productivity within the Longleaf Pine ecosystem occurs at ground level within the groundcover. It supports diverse herbivorous fauna that feed on an abundance of arthropod within the groundcover. The majority of this productivity is driven within native warm season grasses—the bulk of these species are Bluestem Grasses, Three Awn Grasses, Toothache Grass, Indian Grass, and Dropseeds. A bi-layered stratum

consisting of small tree species and shallow-rooted shrubs would all comprise the dynamic structure of the understory but would be very inconspicuous. Some common diverse species include Oaks, Blueberries, Wax Myrtle, Gallberries

in today's forest management when developing strategies to recover iconic or focal species such as Gopher Tortoises and Eastern Indigo Snakes without such a huge component that is symbiotic to overall ecological forest health. The



"The area ranging from Ft. Stewart along the Altamaha River and wrapping around the Ocmulgee River is really a stronghold for the remaining Indigo population. We want to, in a sense, expand this occupied Indigo territory outward back into areas where historically they have been extirpated."

and Palmetto. Longleaf Pine was the dominant over-story species within the presettlement natural communities, consisting of about 60 percent of the total vegetation categories. This does not include communities where Longleaf would have been mixed in with other pine species such as Slash Pine.

I feel that the true value of the native groundcover is easily overlooked

initiation of a basic food web restricts the true potential for the overall sustenance of a plethora of wildlife species. It is important for us to spread this message and provide a boots-on-the-ground effort to make a difference within The Orianne Society's footprint.

Orianne Indigo Snake Preserve

The Orianne Society came to Telfair

County, Georgia, to spread this message and to build a land management program to restore Longleaf habitat on what is now the Orianne Indigo Snake Preserve. We ultimately decided to purchase property within the Altamaha River Corridor (ARC)

simultaneously help us with our mission. The only string attached is that, in return for our help, they allow our scientists to conduct research on their property.

The area ranging from Ft. Stewart along the Altamaha River and wrapping

other means, as well.

Indigo populations are abundant throughout the ARC due to the amount of available overwintering sites. Indigo Snakes typically use Gopher Tortoise burrows on wind-deposited sandy ridges located on the northeastern banks of major rivers and streams.

These plant community associations were developed from a westerly-wind event approximately 15,000 to 30,000 years ago. The course-textured sands can range from 10 to 20 feet deep and easily allow tortoises to dig burrows, which provide winter hibernacula, refugia from summer heat and nesting sites. Gopher Tortoises are considered to be a keystone species because more than 250 species of vertebrates and invertebrates have been documented utilizing their burrows, including endangered Eastern Indigo Snakes. Their burrows are especially important for Indigos in this part of their range where the higher latitudes make the area more susceptible to harsh winters.

Partnering for Greater Effect

Historical fire suppression within these habitats has altered the successional dynamic on these sites, especially on sites that are not as course-texted allowing hardwoods to encroach and shade out groundcover. Tortoises browse on the grasses and forbs in these communities—an important component to their diet that also provides the fuel continuity to carry fire, resetting successional development.

We work with various partners throughout the ARC such as the Georgia Department of Natural Resources (GADNR), The Nature Conservancy, The Longleaf Alliance and private partners to restore these highly-valuable sites. We are a part of an interagency burn team which is essentially a strike team that works throughout the state to burn both public land and private land. This MOU allows us to share resources such as personnel and



Photo: Randy Tate

for a multitude of reasons. First, it would serve as a base of operations for our land program to reach private landowners who had conservation-minded interest to enhance or create Gopher Tortoise and Indigo habitat on their property and to restore the Longleaf ecosystem as a whole. We realized there was a need to provide this service to help them fulfill their management objectives, which would

around the Ocmulgee River is really a stronghold for the remaining Indigo population. We want to, in a sense, expand this occupied Indigo territory outward back into areas where historically they have been extirpated. To do this we would deliver a message to landowners in the area explaining the importance of burning during the natural fire season to restore native plant communities and

equipment to effectively achieve our fire management objectives as well as those of our various partner agencies.

We are also part of the Ft. Stewart/Altamaha Longleaf Restoration Project that focuses on restoring Longleaf on the landscape within the ARC. Under this MOU we work on federal, state and private lands to burn, plant and expand an extensive land base of Longleaf Pine around the Ft. Stewart area. It is important to note that planting Longleaf is very important, but in order to manage and perpetuate the species and the plant communities within, fire is the best and most practical way to achieve such goals as it did naturally millions of years ago.

Accomplishments and Goals

Since 2008 when the first tract of the preserve was purchased, our land management staff have been very busy. It took us little over a year to become operational. Once we became operational, we made contact with 30 different landowners representing over 35,000 acres throughout the Altamaha River Corridor. Over the past five years we have planted or assisted with the planting operations of restoring approximately 1,000 acres

back into Longleaf Pine, of which 750 acres were on the preserve. We have lead or assisted with burning 12,000 acres throughout the Significant Geographic Area (SGA), of which about 6,500 acres were on private lands. We have prepared over 200 miles of firebreak by mulching or raking firelines. We have also logged approximately 450 acres of offsite pine species to convert back into a Longleaf Pine forest.

In the future we plan to continue growing our fire program and to expand it by recruiting additional private landowners who have similar conservation interests. Our goal is to operate at a capacity to be able to burn 10,000 acres annually, with 75 percent of this acreage being private lands.

We are ramping up our groundcover restoration efforts, as well. We are currently working on a 46-acre donor site on our preserve that will be used solely for native groundcover production and that will be used as a source to restore degraded habitat on lands within the SGA. We are also currently working with GADNR and the Longleaf Alliance on a 165-acre groundcover project. 🌲



Photo: Brannon Knight





Photo: Brannon Knight



Photo: Randy Tate



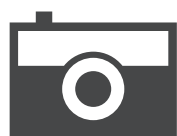
Photo: Randy Tate



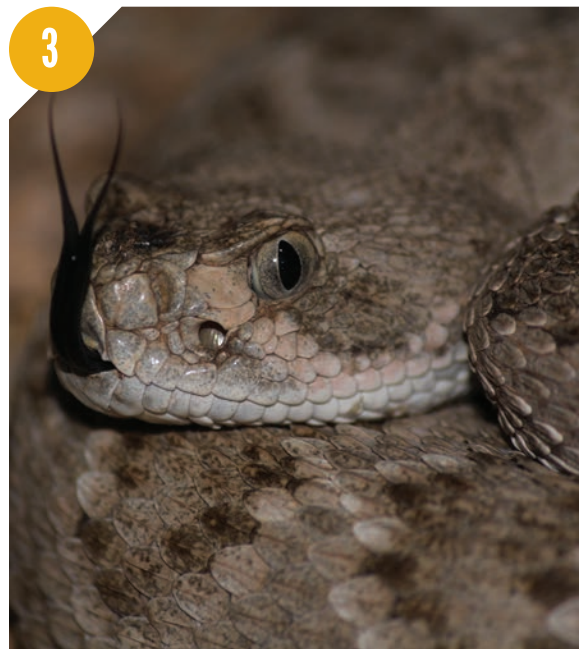
Photo: Randy Tate



Photo: Randy Tate



FIELD



PHOTOS



4



5



7



6



10



11



9



8

1. **ERIC NORDBERG**
Black Headed Monitor
2. **CASSANDRA MAY**
E. Fence Lizard
3. **MATT TIETGEN**
W. Diamondback Rattlesnake
4. **ZHIYUAN GE**
Three Lined Salamander
5. **JENNA CROVO**
American Alligator
6. **JEREMY COHEN**
Black Racer
7. **LISA POWERS**
E. Newt
8. **CHRISTOPHER PELLECCIA**
Green Iguana
9. **MICHAEL DYE**
Pine Woods Treefrog
10. **STEVE BARTEN**
Galapagos Tortoise
11. **SCOTT BOLICK**
Marbled Salamander
12. **RICK DOWLING**
E. Box Turtle
13. **NICK LAUTEN**
Coral Snake
14. **MARISA ISHIMATSU**
Baja California Ratsnake
15. **CHRIS GODFREY**
Green Treefrog

UPCOMING events

MARCH

ASSOCIATION OF ZOOS AND AQUARIUMS MID-YEAR MEETING

March 21-27
Charleston, SC
www.aza.org/midyearmeeting

NORTH AMERICAN BOX TURTLE CONSERVATION WORKSHOP

March 26-28
Urbana, IL
www.boxturtleconservation.org

APRIL

OXBOW MEADOWS' 13TH ANNUAL REPTILE FEST

April 25
Columbus, GA
oxbow.columbusstate.edu/ReptileFest.php

MAY

NORTH CAROLINA CONGRESS OF HERPETOLOGY

May 1-3
Asheboro, NC

ATLANTA BOTANICAL GARDEN'S ENDANGERED SPECIES DAY

May 30
Atlanta, GA
www.atlantabotanicalgarden.org

JUNE

SANDY CREEK NATURE CENTER'S SNAKE DAY

June 6
Athens, GA
www.athensclarkecounty.com/Facilities/Facility/Details/16

PLACES YOU'VE NEVER HERPED 6

June 6-7
Murrells Inlet, SC
www.OrianneSociety.org

JULY

JOINT MEETING OF ICHTHYOLOGISTS AND HERPETOLOGISTS

July 15-19
Reno, NV
www.asih.org/meetings

JOINT MEETING OF SOCIETY FOR THE STUDY OF AMPHIBIANS AND REPTILES/PARCS

July 30-August 3
Lawrence, KS
<http://ssaherps.org/meetings/2015-university-of-kansas-meeting/>



= The Orianne Society
will be participating

2015

Want to announce an upcoming herpetology or land management event in the fall issue of *Indigo Magazine*?
E-mail the event information to info@oriantesociety.org by August 1, 2015 to be included.

TAKE action



BECOME A SUSTAINING DONOR

Members can continue to support our conservation efforts throughout the year by scheduling a recurring donation of your choice on a monthly, quarterly, bi-yearly or yearly basis through our secure website or by contacting us directly.



SPREAD THE WORD

We don't underestimate the power of word of mouth when it comes to letting people know about our work and the ways they can contribute! Please consider sharing this magazine with others who have an interest in conservation, and follow us on Facebook, Twitter and Instagram.



PLAN YOUR GIVING

Don't just plan for your future—plan for the future of reptiles, amphibians and the great places they inhabit. Whether you prefer to set up an annual donation or a deferred gift, we can work with you to determine what you want your gift to support and how it will benefit these amazing animals and landscapes. Please contact us at info@oriannesociety.org or 706-353-7800 for more information about our planned giving opportunities.



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Southern
HOGNOSE
SNAKE

Heterodon simus

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