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the hidden passage

Where have all the  
**indigo snakes gone?**

**Photography**  
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**Ridge Rangers**  
to the rescue





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Volume 61

# FLORIDA Wildlife

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**Tony Young**, Contributing Editor  
**Tim Donovan**, Photographer  
**Tim Lewis**, Photographer

#### Editorial Office

2574 Seagate Drive, Suite 101  
Tallahassee, FL 32301-8974  
850-488-8984 or 850-488-8974  
[FloridaWildlifeMagazine@MyFWC.com](mailto:FloridaWildlifeMagazine@MyFWC.com)

#### Contributors

**Doug Alderson**, writer/photographer  
**Patricia Behnke**, FWC  
**Lynn Berrettter**, photographer  
**David Bingham**, photographer  
**Blickwinkel/Alamy**, photographer  
**Rick & Nora Bowers/Visuals Unlimited**, photographers  
**Geoffrey Brown**, FWC  
**John Burton**, FWC  
**Carla Burton**, photographer  
**Henry Cabbage**, FWC  
**John Cimbaro**, FWC  
**John Cornell/Visuals Unlimited**, photographer  
**Rick Dantzler**, writer/photographer  
**Patrick Delaney**, FWC  
**Carolyn Devonshire**, writer  
**Reinhard Dirscherl/Visuals Unlimited**, photographer  
**Tim Donovan**, FWC  
**Thomas J. Dunkerton**, photographer  
**Pat Ford**, photographer  
**Richard Fortune**, photographer  
**Rick Franchi**, photographer  
**Peggy D. Goldberg**, photographer  
**James L. Harrell**, photographer  
**Charlie Heidecker**, photographer  
**Chris Howes/Alamy**, photographer  
**Sheri Judah**, photographer  
**Dr. Dennis Kunkel/Visuals Unlimited**, photographer  
**Robert J. La Follette**, photographer  
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**Zig Leszczynski**, photographer  
**Walter McCown**, FWC  
**Joe McDonald/Visuals Unlimited**, photographer  
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**Dean Morgan**, writer  
**Dr. Steve Mills**, writer  
**Pasquale R. Mingarelli**, photographer  
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**John Papesca**, FWC  
**Matthew K. Paulson**, photographer  
**Gregory J. Plecora**, photographer  
**Robert & Jean Pollock/Visuals Unlimited**, photographers  
**Carol Pratt**, FWC  
**Jack Rogers**, photographer  
**Keith Ryan**, photographer  
**Andy Sabol**, writer  
**Paul Simson**, photographer  
**Chris Schlosser**, photographer  
**Doug Stamm/Stammphoto.com**, photographer  
**Christi Taylor**, photographer  
**Kevin Thomas**, illustrator  
**Michael Taylor**, photographer  
**Johnny Villaronga**, photographer  
**Tom Walker/Visuals Unlimited**, photographer  
**William J. Weber**, photographer  
**Lizabeth West**, FWC  
**Paul Williams**, photographer  
**Robert T. Zappalorti**, writer/photographer



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# Where have all the indigo snakes gone?

*Article and photographs by Robert T. Zappalorti*

In the past, it was common for Florida residents to see blue indigo snakes on farms and in their neighborhoods. Most people tolerated them in their backyards because they are not aggressive to humans and, more importantly, they are known to eat venomous snakes such as rattlesnakes, copperheads and cottonmouths. Today, because of the indigo snake's apparent scarcity, such sightings by the general public are extremely rare. So the question is: Where have all the indigo snakes gone?

## **Reasons for indigo snake population decline**

The eastern indigo snake (*Drymarchon couperi*) population in Florida, and elsewhere in its

natural southern range, has declined drastically during the past 30 years. Florida Fish and Wildlife Conservation Commission (FWC) herpetologists (scientists who study amphibians and reptiles) Paul Moler and Kevin Enge, along with others, have documented several reasons for this gradual decline. The indigo snake's downward population trend has been noted throughout its historic and current ranges. Some of the causes are obvious, while others are poorly understood.

The general consensus among snake ecologists for indigo snake declines include: critical habitat loss, human population growth, new roads and highways, increased traffic

on older country paved roads or sand roads, gassing of gopher tortoise burrows in some states for rattlesnake round-ups (indigo snakes use gopher burrows for shelter), wanton killing by fearful people, and over-collecting by hobbyist and commercial pet dealers.

On March 3, 1978, the indigo snake was federally listed as a threatened species by the U.S. Fish and Wildlife Service (USFWS). Dr. Ken Dodd, a Gainesville herpetologist, was the lead author on the listing petition. Since 1978, many other scientists have noticed the decline of indigo snake populations, especially in the Florida Panhandle.

Dr. Roger Conant and Dr. Joe Collins, in their 1991 field



which means they do not generate their own inner body heat like mammals, but are cold-blooded. They must seek heat and energy from the sun.

In the northern part of their range, indigo snakes shelter in natural openings on the forest floor. Underground retreats provide them with safety from the elements and protection from predators. While they have mostly been documented overwintering in gopher tortoise burrows, they may also use abandoned burrows of pocket gophers, coyotes, foxes, skunks and armadillos, along with rotted-out tree stump holes. Since central and southern Florida have such mild winters, indigo snakes do not hibernate and are active year-round. They have been observed basking and moving around during warm spells. They also seek cover in hollow logs and under human debris dumped in the forest.

In Georgia, they are far less active in the winter because of the cooler climate.

## Reproduction

Indigo snakes typically mate between November and February, but this may vary at extremes of their range. On warm winter days, adult males move about their habitat searching for receptive adult female indigo snakes, which they find by chemical pheromone cues (olfactory scent trails) laid down by the crawling female.

The female scent trails are most prevalent right after they shed. Adult male indigo snakes are attracted by high concentrations of female skin lipids left on the ground. Snakes have the ability to smell odors with the Jacobson's scent organ located on the roof of their mouth. This powerful chemical receptor can distinguish between female indigo snakes, other snake species and other animal scent trails.

Somewhat in the way a male cat grabs a female behind the head, a male indigo snake bites a receptive female on the neck, then crawls over her body and

entwines his tail around her tail. They press their cloacals together as copulation takes place. Fertilization is internal as the male deposits his sperm during mating. Gestation of egg follicles usually takes three to five weeks. The gravid (pregnant) females deposit their eggs in late April, May or June.

The gravid female must select a nesting site that provides some moisture, along with protection from predators. They are thought to use gopher tortoise burrows, pocket gopher tunnels and decaying tree stump holes to deposit their eggs, but the exact details of nest site selection remains poorly understood.

The average number of eggs or clutch size is 11, but zoo records indicate a clutch size range of four to 24 individual eggs. The large, hen-sized eggs have leathery shells, not brittle like bird eggs, that are capable of absorbing moisture from their surroundings, which helps with the normal development of the



*Indigo snake eggs hatch in seven to nine weeks, and the young may be up to 2 feet long.*



guide to reptiles and amphibians, noted the indigo snake's historic range was southern Alabama, Florida, southern Georgia, southern Mississippi and southern South Carolina. Today, it is not clear if indigo snakes even remain in Alabama or South Carolina. The indigo snake is listed as a threatened species in Georgia and a species of special concern in Florida.

During the past 10 years, only a few individual indigo snake sightings have been recorded by reliable observers in the Florida Panhandle. None have been observed in Alabama and only a few were seen in Mississippi. Southern Georgia and Central and southern Florida may be the last strongholds in the nation for the indigo snake.

### **Habitat and natural history**

Indigo snakes typically survive best on large tracts of undeveloped forested areas with intact xeric sandhill habitat communities. This type of upland, dry, long-leaf pine habitat also supports gopher tortoise colonies, which provide long, deep, underground burrows. These burrows are important for indigo snakes, along with several other rare wildlife species such as the Florida pine snake, gopher frog and Florida mouse. Selected indigo snake habitats are usually contiguous with extensive areas of poorly-drained or mesic upland areas (pine flatwoods, mixed pine-oak forests and slope forests) and wetlands (isolated ponds, blackwater creek swamps, seepage-fed bay swamps and Everglade stream flood plains). The indigo snake is considered a generalist in the habitat it selects.

Snakes are often difficult to study because they are secretive, and depending on season, they remain hidden for long periods of time. Radio-tracking has become the ideal technique for unlocking their secretive behavior. Radio-

telemetry has revealed indigo snakes not only use various upland and wetland habitat, they also use farmland, cattle ranch grassland, sugar cane fields, orange groves, canal edges and urban human-occupied areas.

### **Home range**

A snake's activity range (home range) is defined as an integrated expression of an animal's location and movements over a specific time interval. The activity range of a snake includes all of its movements throughout the year. The habitat types used, as well as their specific activity range movement boundaries, provides a diagrammatic expression of the space required to complete all activities (seasonal migration, hibernation, mating, egg laying and foraging).

This visual expression can be useful when the USFWS and the FWC determine the minimum size of critical habitat preserves that should be purchased for permanent protection of indigo snake populations.

Indigo snakes have been monitored using different forest habitat types, as well as peoples' backyards, extensively during the summer months. Why would these large snakes enter human-occupied areas? Because that's where they can find ample food resources such as mice and rats.

They also prey on other small mammals, birds, amphibians and reptiles, including other snakes – even venomous ones.

With the aid of radio-telemetry, several herpetologists have studied the ecology and natural history of the indigo snake in Florida and Georgia. In the early 1980s, Dr. Jim Diemer and Dr. Dan Speake studied the distribution of the eastern indigo snake in Georgia and made recommendations for its conservation to the USFWS. More recently, Natalie Hyslop, Dirk Stevenson and others conducted detailed radio-telemetry studies in southern Georgia. FWC herpetologist, Paul Moler, conducted preliminary radio-telemetry studies in the 1980s. Rebecca Bolt and others from the Dynamac Corporation, radio-tracked individual indigo snakes for eight years at Kennedy Space Center. Combined, these biologists have learned much of what is now known about the indigo snake. However, additional studies are needed in order to develop a long-term conservation and management plan.

### **Wintering**

Indigo snakes are a warm-climate tropical species. Like all reptiles, they are ectotherms,



*Indigo snakes are stocky and a glossy, blue-black color with a reddish chin and throat.*



embryo inside. Indigo snake eggs hatch in seven to nine weeks. The baby indigo snakes have a distinct blueish-white mottled pattern on the dorsal surface, but these light spots are lost within 1½ years after several skin sheddings.

### Summer movements

As revealed by radio-telemetry, most indigo snakes have large seasonal activity ranges. The areas they traveled ranged in size from 50 to 450 acres. Some large adult males are known to travel up to four miles. Herpetologists have observed indigo snakes returning to the same general area year after year to spend the cooler months. A few individuals have been documented using the same gopher tortoise burrow two years in a row.

Stable indigo snake populations require large tracts of protected, undeveloped land to survive. National and state forests and wildlife refuges, 5,000 acres or more, are the best habitats to support indigo snake populations.

### Conservation and management

Roads and highways can cause fragmentation of indigo snake populations, plus road mortality is an increasing problem. Some drivers purposely run over snakes on roads, including the rare indigo snake. Large tracts of protected forest land without major paved roads passing through them are needed to conserve indigo snake populations.

More eco-passages are needed on major and secondary highways that cross through known indigo snake habitat. Properly designed barrier walls, fencing, culverts and tunnels, similar to the ones on U.S. 441 over Payne's Prairie, south of Gainesville, can help decrease snake, and other wildlife, road mortalities.

Existing conservation laws must be enforced, especially criti-

cal habitat protection. Because of the constant loss of important critical habitat, fragmentation and road kills, indigo snake populations are dwindling at a rate that has not been accurately measured.

Intensive indigo snake research is needed to develop a meaningful and successful conservation plan that includes permanent protection of critical indigo snake habitat. A team of scientists and herpetologists has been organized by the Wildlife Conservation Society to develop a plan of action to ensure the long-term survival and recovery of remaining indigo snake populations. The Florida Working Group of scientists includes representatives from the FWC, The Nature Conservancy, Kennedy Space Center, Nokuse Plantation and Herpetological Associates, Inc. All have been asked to help with this major conservation effort in Florida.

A similar group is working in Georgia as part of the overall conservation plan by the Wildlife Conservation Society.

The Indigo Snake Conservation Coalition's goals are to protect critical indigo snake habitat through direct purchase of large tracts of land (2,500 acres or more), to initiate habitat management on both private- and publically-owned sanctuary lands, and to initiate a captive breeding program at selected zoos and universities in order to raise hatchlings for release back into protected areas. Through scientific research and experimental captive breeding programs, the information gained could be incorporated into a long-term conservation and management plan for the indigo snake throughout its current range. The Wildlife Conservation Society, with funding from an anonymous donor, takes the first step towards this goal with the plan of purchasing private unprotected land to create an indigo snake sanctuary in southern Georgia.



*The author holds an indigo snake, the longest nonvenomous snake in the country, reaching up to 8.5 feet.*

Indigo snakes in Florida, and across the Southeast, are on the decline and every effort should be made to conserve the remaining populations. They are protected by state and federal laws. Permits are required by the USFWS and the FWC in order to catch or take specimens from the wild. Only qualified applicants receive permits from the Service's Southeast Regional Office in Atlanta, Ga.

Radio-tracking and long-term monitoring are the only ways to study indigo snakes and find answers to difficult research questions. Beyond that, protection of indigo snakes by the USFWS and the FWC needs no special reason or excuse, because they are part of the natural heritage of Florida. **FW**

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*Robert T. Zappalorti is the founder and executive director of Herpetological Associates, Inc., specializing in conservation biology of endangered and threatened reptiles and amphibians. He is a "qualified bog turtle surveyor and trapper" by the U.S. Fish and Wildlife Service.*