Prey Records for the Eastern Indigo Snake (*Drymarchon couperi*)

Dirk J. Stevenson[1,*], M. Rebecca Bolt[2], Daniel J. Smith[3], Kevin M. Enge[4], Natalie L. Hyslop[5,6], Terry M. Norton[7,8], and Karen J. Dyer[9]

Abstract - Prey items for the federally protected Eastern Indigo Snake (*Drymarchon couperi*) were compiled from published and gray literature, field observations, necropsies, dissection of museum specimens, and personal communications from reliable sources. One hundred and eighty-six records were obtained for 48 different prey species. Anurans, Gopher Tortoises, snakes, and rodents comprised ca. 85% of the prey items. Most records (n = 143) that mentioned size were from adult indigos; 17 were from juveniles. Prey records were collected from 1940–2008 and were available for all months of the year. These data confirm that Eastern Indigo Snakes eat a wide assortment of prey of varying sizes. This strategy allows *D. couperi* to potentially forage successfully in many different types of habitats and under fluctuating environmental conditions, a valuable trait for a top-level predator that requires a large home range.

Introduction

Drymarchon couperi Holbrook (Eastern Indigo Snake), with a maximum recorded total length of 2629 mm, is one of the largest snakes in North America (Conant and Collins 1991). It has been federally listed as Threatened since 1978 under the Endangered Species Act (US Fish and Wildlife Service 1978). *Drymarchon couperi* is diurnal and mostly terrestrial (Layne and Steiner 1996, US Fish and Wildlife Service 2008). Of the two main hunting strategies employed by snakes (ambush predator vs. active forager; see Mushinsky 1987), *D. couperi* is generally regarded as a wide-ranging, active forager (Hyslop 2007, Landers and Speake 1980, Moler 1992, Smith and Voigt 2005). In portions of its range, *D. couperi* spends the cooler seasons (November–March) in xeric upland habitats such as *Pinus palustris* Miller (Longleaf Pine)-*Aristida stricta* Michaux (Wiregrass) sandhills, where individuals frequently shelter in *Gopherus polyphemus* (Daudin) (Gopher Tortoise) burrows (Hyslop et al. 2009a, Stevenson et al. 2009). During

[1]Project Orianne, Ltd., Indigo Snake Initiative, 414 Club Drive, Hinesville, GA 31313. [2]Dynamac Corporation, Mail Code DYN-5, John F. Kennedy Space Center, FL 32899. [3]Department of Biology, University of Central Florida, 4000 Central Florida Boulevard, Orlando, FL 32816. [4]Florida Fish and Wildlife Conservation Commission, 1105 SW Williston Road, Gainesville, FL 32601. [5]Warnell School of Forestry and Natural Resources, University of Georgia, Athens, GA 30602. [6]Present address - Department of Wildlife Ecology, University of Florida, 324 Newins-Ziegler Hall, Gainesville, FL 32611. [7]St. Catherines Island Foundation, 182 Camelia Road, Midway, GA 31320. [8]Present address - Georgia Sea Turtle Center, 214 Stable Road, Jekyll Island, GA 31527. [9]Audubon's Tavernier Science Center, 115 Indian Mound Trail, Tavernier, FL 33070. [*]Corresponding author - dstevenson@projectorianne.org.

the warmer months (April–October), these snakes may move considerable distances to lower and wetter habitats such as mesic pine flatwoods, hydric hammocks, or hardwood swamps (Breininger et al. 2004, Hyslop 2007, Smith and Voigt 2005, Speake et al. 1978).

Drymarchon couperi forage in a variety of habitats and have been observed sticking their heads into stump holes and burrows, patrolling the margins of wetlands, prowling thickets and brush piles, investigating rodent nests and burrows, and climbing in pursuit of *Pantherophis alleghaniensis* (Say) (Rat Snake) (Hyslop 2007; Layne and Steiner 1996; P. Moler, Gainesville, FL, pers. comm.; A. Nielson, Punta Gorda, FL, pers. comm.; D.J. Smith, 2009 unpubl. data). *Drymarchon couperi* is not a constrictor; prey is approached rapidly and swallowed alive or immobilized/killed by the muscular chewing motions of the predator snake (Keegan 1944, Moulis 1976). We conducted the current study to bring together all available information regarding the diet of *D. couperi* in an attempt to answer the following questions: What types of prey are preferred? During what seasons/months does *D. couperi* forage?

Methods

We compiled *D. couperi* prey records based on 1) a comprehensive review of the published literature and technical reports, including the results of recent *D. couperi* studies we conducted in Georgia (Hyslop 2007; Norton et al. 2004; Stevenson et al. 2003, 2009) and Florida (Breininger et al. 2004, Smith and Voigt 2005) (n = 115 records); 2) our personal observations (n = 27 records); 3) dissection of museum specimens housed at the herpetological collections of Georgia Southern University, Statesboro, GA (formerly the Savannah Science Museum Collection [Williamson and Moulis 1994]) (n = 12 records); the University of Florida Museum of Natural History, Gainesville, FL (n = 2); and the University of Central Florida, Orlando, FL (n = 5 records); and 4) interviews with experienced field biologists, commercial or recreational snake hunters, and local residents who lived on sites inhabited by *D. couperi* (n = 26 records).

We compiled prey records for wild *D. couperi* only, and included prey records of radio-transmittered *D. couperi* released and tracked at their original capture sites following transmitter implantations (Hyslop 2007, Smith and Voigt 2005) and juveniles hatched and raised in captivity before being released (Smith 1987).

When data were available, we listed the date, size (snout–vent length [SVL] or total length [TL] in mm), and sex of the corresponding *D. couperi* for each prey record, and the literature citation or name of the individual from which the record is based. Additionally, we characterized each prey record as follows: examination of feces of captured individuals held briefly in the laboratory (F); dissection from a necropsied specimen or from a museum specimen (N); observation from the field (O); regurgitated by or palpated from a snake (R); or unknown (U). We classified *D. couperi* <1000 mm TL as juveniles, and snakes ≥1000 mm as adults. We treated those records where

multiple eggs (e.g., a clutch of turtle or bird eggs) were recovered from the same *D. couperi* on the same date as a single prey record.

We determined proportions for the four major prey types (Anurans, Gopher Tortoises, snakes, and small mammals), and calculated 95% confidence limits (Beyers et al. 1984). We subdivided the *D. couperi* prey record data into three categories: 1) males and females, 2) juveniles and adults, and 3) Georgia snakes and Florida snakes.

Results

We compiled 185 separate vertebrate prey records for *D. couperi* totaling 47 species: 1 fish, 1 salamander, 3 anuran, 1 crocodilian, 3 turtle, 1 lizard, 24 snake, 4 bird, and 9 mammal species (Appendix 1). Anurans, Gopher Tortoises, snakes, and rodents accounted for 158 (85.4 %) of these records, with snakes accounting for 91 (49.2 %) of the records. Ten of the 41 (24.4 %) specimens we necropsied or dissected contained prey. Table 1 provides the proportions of the four major prey types for *D. couperi* by sex (males and females), size (juveniles and adults), and state (Georgia snakes and Florida snakes).

Invertebrate prey records ($n = 10$), many of which probably represent secondary ingestion, were limited to one slug and insects (beetles, caterpillars, unidentified insects). These prey records include three instances of carrion-feeding by *D. couperi* (shark [Chondrichthyes], *Lithobates sphenocephalus* Cope [Southern Leopard Frog], and *Pantherophis guttatus* (L.) [Red Cornsnake]). A minimum of 16 individual *D. couperi* contained multiple prey items.

Specific size of the predator *D. couperi* was available for 72 individuals (6 juveniles, 66 adults) and an additional 49 snakes were recorded as adults without being measured; 160 prey records were available for these snakes (Fig. 1). Prey documented for juvenile *D. couperi* included a *Anaxyrus terrestris* (Bonnaterre) (Southern Toad), two Glass Lizards (*Ophisaurus* sp.), a *Thamnophis sauritus* (L.) (Eastern Ribbonsnake), a *Cemophora coccinea* (Blumenbach) (Scarletsnake), a *Diadophis punctatus* (L.) (Ring-necked Snake), a Red Cornsnake, seven *Sistrurus miliarius* (L.) (Pigmy Rattlesnake), a juvenile *D. couperi*, and the aforementioned slug and insects. The distribution of prey records per month (Fig. 2) was: 6 (January), 3 (February), 2 (March), 2 (April), 7 (May); 9 (June), 9 (July), 5 (August), 4 (September), 9 (October), 10 (November), and 4 (December).

Discussion

This review reinforces prior conclusions from other researchers that *D. couperi* is a eurytrophic species (Layne and Steiner 1996, Moler 1992). Our study corroborates the findings of Landers and Speake (1980), who reported that *D. couperi* preys primarily on amphibians, small Gopher Tortoises, snakes, and small mammals. The diverse food habits of *D. couperi*, combined with its high vagility (Breininger et al. 2004, Hyslop 2007, Smith and Voigt 2005, Speake et al. 1978), allow individuals to forage successfully in a wide variety of habitats (xeric pinelands, scrub, flatwoods, hydric

hammocks, wetlands, and disturbed landscapes such as ditch banks within sugarcane plantations, agricultural fields, and suburban neighborhoods) and may enable populations to endure the effects of adverse environmental conditions (e.g., droughts, see Stevenson et al. 2003). In addition to frequently moving between habitats, *D. couperi* have among the largest home ranges of any North American snake (ca. 809–1214 ha [2000–3000 ac] for some Georgia males; Hyslop 2007, Layne and Steiner 1996, Speake et al. 1978).

Our only documented fish-predation event by *D. couperi* was one instance of carrion-feeding on a shark. We also located a single instance of

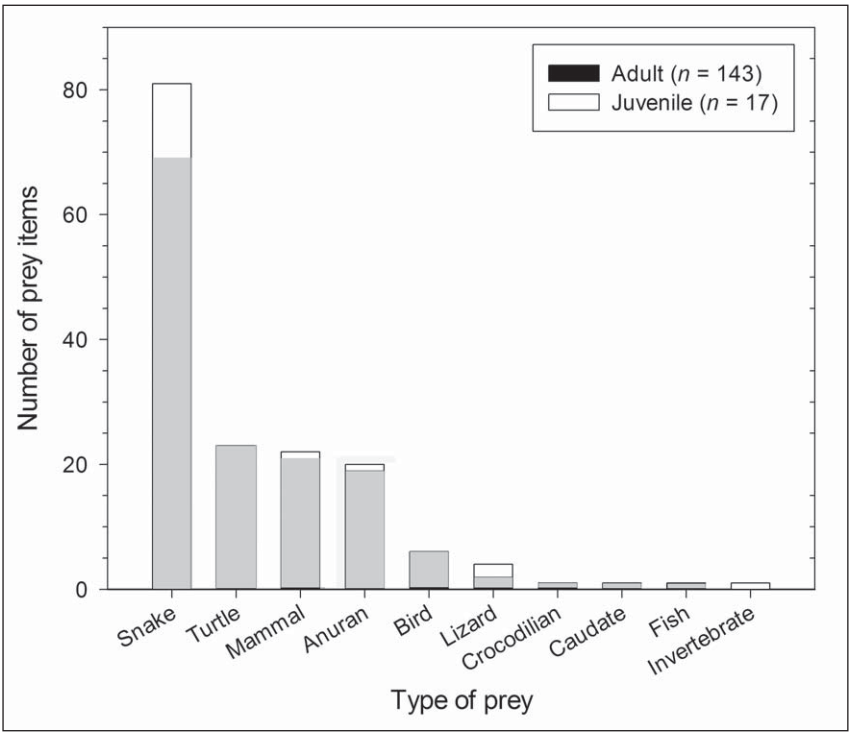

Figure 1. Prey records for juvenile (n = 17 records) and adult (n = 143 records) Eastern Indigo Snakes (*Drymarchon couperi*).

Table 1. Proportions (P) and lower (LCL) and upper (UCL) 95% confidence limits for major prey types for Eastern Indigo Snakes categorized by sex, age, and location.

	Anurans			Gopher tortoises			Snakes			Small mammals		
	P	LCL	UCL	P	LCL	UCL	P	LCL	UCL	P	LCL	UCL
Males	0.17	0.13	0.21	0.20	0.15	0.24	0.54	0.48	0.59	0.10	0.07	0.13
Females	0.13	0.09	0.16	0.06	0.04	0.09	0.69	0.64	0.74	0.13	0.09	0.16
Juveniles	0.07	0.06	0.09	0.00	0.00	0.00	0.86	0.84	0.88	0.07	0.06	0.09
Adults	0.15	0.13	0.17	0.17	0.14	0.19	0.50	0.47	0.53	0.19	0.16	0.21
Georgia	0.16	0.12	0.20	0.24	0.20	0.28	0.52	0.47	0.57	0.08	0.05	0.11
Florida	0.17	0.13	0.21	0.08	0.05	0.10	0.56	0.51	0.60	0.20	0.16	0.24

D. couperi preying on a salamander. However, captive *D. couperi* readily consume live *Carassius auratus* (L.) (Goldfish), minnows (Cyprinidae), and dead mullet (Mugilidae) (D. Alessandrini, Cincinnati, OH, pers. comm.; V. Johnson, Auburn, AL, pers. comm.), and we suspect that wild snakes forage in seasonal "dry-downs" where receding water levels concentrate fishes, amphibians, and other vertebrate prey. Lizards are also poorly represented in our summary data (Appendix 1). This result could be an artifact of the dataset, as several species of lizards including *Anolis carolinensis* Voigt (Green Anole), *Pleistiodon* (= *Eumeces*) *laticeps* (Schneider) (Broadhead Skink), *Pleistiodon* (= *Eumeces*) *inexpectatus* Taylor (Southeastern Five-lined Skink), *Ophisaurus ventralis* (L.) (Eastern Glass Lizard) and *Ophisaurus attenuatus* Cope (Slender Glass Lizard) that commonly occur sympatrically with *D. couperi* are readily consumed by wild-caught captive adults and their hatchlings (Moulis 1976, Williamson and Moulis 1979; V. Johnson, pers. comm.). We believe, however, that *D. couperi* are seldom successful in capturing fast-moving, secretive, and/or arboreal lizards (e.g., *Aspidocelis sexlineata* (L.) [Six-lined Racerunner], *Plestiodon* [= *Eumeces*] spp. [toothy skinks]) under natural conditions, and the small size of many lizards makes it energetically costly to pursue them.

Our review indicates that *D. couperi* is capable of subduing and eating sizeable prey, including *Crotalus* spp. (rattlesnakes) up to ca. 1000 mm TL and adult *Sigmodon hispidus* Say and Ord (Hispid Cotton Rat), and that

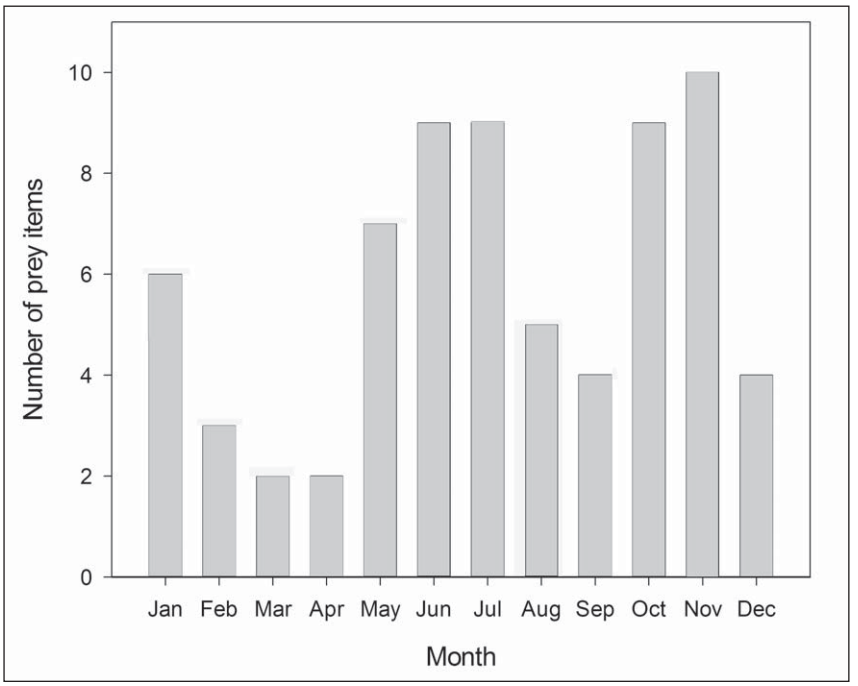

Figure 2. Monthly distribution of prey records (n = 70) for Eastern Indigo Snakes (*Drymarchon couperi*).

multiple food items are often eaten within a short period of time. In Guatemala, a *Drymarchon melanurus* (Boie) (Black-tailed Indigo Snake) that was 2950 mm TL was observed swallowing a 1683-mm TL *Boa constrictor* L. (Boa Constrictor); this same individual also contained a 953-mm TL *Atropoides nummifer* (Rüppell) (Jumping Viper) (Duellman 1963). Conversely, large *D. couperi* may sometimes consume fairly small prey items relative to their size. For example, the stomach of a 1637-mm TL adult male *D. couperi* from Long County, GA, contained a hatchling Red Cornsnake (ca. 250 mm TL). The observation of a large male *D. couperi* that fed repeatedly on *Pipilo erythrophthalmus* (L.) (Eastern Towhee), (R. Ashton, Newberry, FL, pers. comm.; see Appendix 1) is noteworthy. On three occasions, Ashton observed this snake lying motionless on the ground near a small artificial pond, where it successfully ambushed Eastern Towhees when they came to bathe.

The diet of hatchling and juvenile *D. couperi* in the wild remains poorly known. Layne and Steiner (1996) mention that insects were the only food items in stomachs of three juveniles ranging from 493 to 591 mm TL. From the limited number of records that we report herein, it does appear that juvenile *D. couperi*, similar to adults, often feed on snakes. Additional sympatric prey species (i.e., not listed in Appendix 1) that were consumed by young *D. couperi* (captive hatched from wild-caught females) included tadpoles of the Southern Leopard Frog, *Scaphiopus holbrookii* (Harlan) (Eastern Spadefoot), and a number of snakes including the *Regina rigida* (Say) (Glossy Crayfish Snake) and *Lampropeltis triangulum* (Holbrook) (Scarlet Kingsnake) (Moulis 1976; V. Johnson, pers. comm.). Young *D. couperi* grow rapidly, reaching 1250–1450 mm TL by their second winter (Stevenson et al. 2009) and presumably feed often to meet energy requirements.

Clearly, *D. couperi* are strongly ophiophagous, and the frequency of cannibalism in wild populations merits further study. As documented for Georgia and some Florida locations, *D. couperi* of various size classes concentrate seasonally in the same xeric upland habitats, potentially utilizing the same Gopher Tortoise burrows (Hyslop et al. 2009a, Smith and Voigt 2005, Stevenson et al. 2009). In addition to the instance of cannibalism listed in Appendix 1, Smith (1987) documented cannibalism at her northern Florida study site, where a yearling *D. couperi* was consumed by a larger yearling.

Drymarchon couperi were observed feeding, or prey items were documented, during every month of the year. The eleven instances that occurred in January–March were all from Florida. Snakes in the northern part of the range (southern Georgia) restrict their above-ground movements and foraging during January–February when low temperatures (nighttime lows of -4 to +4 ºC, daytime highs of 13 to 18 ºC) are common (Hyslop 2007; D.J. Stevenson, unpubl. data). Adult female *D. couperi* annually lay clutches of 4–14 eggs (Hyslop et al. 2009b; Moulis 1976; V. Johnson, pers. comm.) during the spring. We documented only a single instance of an adult female *D. couperi* feeding during the winter (Appendix 1), suggesting that gravid females may limit food intake prior to oviposition.

Our study indicates that *D. couperi* is a predator of a wide diversity of animals, including invertebrates, fish, anurans, salamanders, small crocodilians,

turtles, lizards, snakes—including venomous species—birds, mammals, and the eggs of vertebrates. Although certainly not dietary specialists per se, small turtles (including young Gopher Tortoises), anurans, rodents, and snakes figure prominently in the diet of wild *D. couperi*.

Where their ranges overlap, burrows of the Gopher Tortoise are likely important to the foraging ecology of *D. couperi*; of the prey species we compiled, the Southern Toad, Gopher Tortoise, *Coluber flagellum* (Shaw) (Eastern Coachwhip), *Heterodon platirhinos* Latreille (Eastern Hog-nosed Snake), and *Crotalus adamanteus* (Palisot de Beauvois) (Eastern Diamond-backed Rattlesnake) are known to frequently shelter in tortoise burrows (Jackson and Milstrey 1989; D.J. Stevenson, unpublished data.). Thus, at sites where *D. couperi* inhabits upland pineland ecosystems (e.g., sandhills, pine flatwoods and scrubs), it is vital to employ the appropriate habitat management or restoration techniques (e.g., prescribed fire, mechanical or herbicide thinning of hardwoods, etc.) that foster the open-canopied, grassy Longleaf Pine environs preferred by Gopher Tortoises and *D. couperi* (Landers and Speake 1980, Hyslop et al. 2009a, Means 2006). Because adult *D. couperi* have large home ranges, often travel between upland and wetland habitats, and commonly prey on upland species (e.g., Eastern Coachwhip, Gopher Tortoise) as well as wetland species (ranid frogs, aquatic snakes), our study underscores the importance of large contiguous tracts that contain both upland and wetland habitats connected by intact habitat corridors to the conservation of *D. couperi*.

Acknowledgments

For contributing their unpublished observations on eastern indigo snake prey items, we thank F. Antonio, R. Ashton, D. Breininger, B. Cope, J. Emanuel, A. Flanagan, S. Godley, H. Kale, K. Krysko, J. Layne, M. Legare, B. McGighan, P. Moody, K. Morin, R. Moulis, A. Nielson, D. Pearson, R. Redmond, C. Schmittler, M. Smith, R. Van Nostrand, J. Watt, and C. Webb. For general support and assistance, we thank D. Alessandrini, M. Barnwell, L. Carlile, J. Jensen, L. McBrayer, P. Moler, K. Ravenscroft, A. Safer, E. Shackleton, F. Snow, M. Wallace, M. Welker, and B. Willis-Stevenson. We thank E. Stolen for his statistical expertise and C. Jenkins for reviewing the manuscript.

Literature Cited

Alvarez, K. 1996. Indigo snake preys on marsh rabbit. Florida Department of Environmental Protection Resource Management Notes 8(2):37.

Babis, W.A. 1949. Notes on the food of the indigo snake. Copeia 1949(2):147.

Becker, C. 1997. Indigo notes. Florida Department of Environmental Protection, Florida Park Service Resource Management Notes 9(2):22–23.

Belson, M.S. 2000. *Drymarchon corais couperi* (Eastern Indigo Snake) and *Micrurus fulvius fulvius* (Eastern Coral Snake): Predator-prey. Herpetological Review 31(2):105.

Beyers, C.R., and R.K. Steinhorst. 1984. Clarification of a technique for analysis of utilization-availability data. Journal of Wildlife Management 48:1050–1054.

Breininger, D.R., M.L. Legare, and R.B. Smith (Bolt). 2004. Eastern Indigo Snakes (*Drymarchon couperi*) in Florida: Influence of edge effects on population viability. Pp. 299–311, *In* H. Akcakaya, M. Burgman, O. Kindvall, C. Wood, P. Sjögren-Gulve, J. Hatfield, and M. McCarthy (Eds.). Species Conservation and Management: Case Studies. Oxford University Press, New York, NY.

Carr, A.E., Jr. 1940. A Contribution to the Herpetology of Florida. University of Florida Publications, Biological Science Series: Volume III, No. 1. Gainesville, FL.

Conant, R., and J.T. Collins 1991. Reptiles and Amphibians of Eastern and Central North America. Houghton Mifflin Company, New York, NY. 450 pp.

Dilley, W.E., 1954. Indigo snakes versus Flat-tailed Water Snake. Everglades Natural History 2:48.

Dodd, C.K., Jr. and W.J. Barichivich. 2007. Movements of large snakes (*Drymarchon*, *Masticophis*) in north-central Florida. Florida Scientist 70:83–94.

Duellman, W.E. 1963. Amphibians and reptiles of the rainforests of southern El Petán, Guatemala. University of Kansas Museum of Natural History Publications 15(5):205–249.

Hopkins, M.N., Jr. 2001. In One Place: The Natural History of a Georgia Farmer. Saltmarsh Press, St. Simon's Island, GA. 265 pp.

Hyslop, N.L. 2007. Movements, habitat use, and survival of the threatened Eastern Indigo Snake (*Drymarchon couperi*) in Georgia. Unpublished PhD Dissertation. University of Georgia, Athens, GA. 132 pp.

Hyslop, N.L., R.J. Cooper, and J.M. Meyers. 2009a. Seasonal shifts in shelter and microhabitat use of the threatened Eastern Indigo Snake (*Drymarchon couperi*) in Georgia. Copeia 2009(3):460–466.

Hyslop, N.L., J.M. Meyers, R.J. Cooper, and T.M. Norton. 2009b. Survival of radio-implanted Eastern Indigo Snakes (*Drymarchon couperi*) in relation to body size and sex. Herpetologica 65(2):199–206.

Jackson, D.R., and E.G. Milstrey. 1989. The fauna of Gopher Tortoise burrows. Pp. 86–98, *In* J.E. Diemer, D.R. Jackson, J.L. Landers, J.N. Layne, and D.A. Wood (Eds.). Gopher Tortoise Relocation Symposium Proceedings. Nongame Wildife Program Technical Report No. 5. Florida Game and Fresh Water Fish Commission, Tallahassee, FL.

Keegan, H.L. 1944. Indigo snake feeding upon poisonous snakes. Copeia 1944(1):59.

Landers, J. L., and D.W. Speake. 1980. Management needs of sandhill reptiles in southern Georgia. Proceedings Annual Conference Southeastern Association of Fish and Wildlife Agencies 34:515–529.

Layne, J.N., and T.M. Steiner. 1996. Eastern Indigo Snake (*Drymarchon corais couperi*): Summary of research conducted on Archbold Biological Station. Report prepared under Order 43910-6-0134 to the US Fish and Wildlife Service; Jackson, MS.

Means, D.B. 2006. Vertebrate faunal diversity in Longleaf Pine savannas. Pp. 155–213, *In* S. Jose, E. Jokela, and D. Miller (Eds.). Longleaf Pine Ecosystems: Ecology, Management, and Restoration. Springer, New York, NY.

Moler, P.E. 1992. Eastern Indigo Snake *Drymarchon corais couperi* (Holbrook). Pp. 181–186, *In* P.E. Moler (Ed.). Rare and Endangered Biota of Florida, Volume 3, Amphibians and Reptiles. University Press of Florida, Gainesville, FL. 291 pp.

Moulis, R. 1976. Autecology of the Eastern Indigo Snake, *Drymarchon corais couperi*. Bulletin of the New York Herpetological Society, Vol.12 No. 3 and 4.

Mount, R.H. 1975. The Reptiles and Amphibians of Alabama. Auburn University Experimental Station, Auburn, AL.

Mumme, R.L. 1987. Eastern Indigo Snake preys on juvenile scrub jay. Florida Field Naturalist 15:53–54.

Mushinsky, H.R. 1987. Foraging ecology. Pp. 302–334, *In* R.A. Seigel, J.T. Collins, and S.S. Novak (Eds.). Snakes: Ecology and Evolutionary Biology. Macmillan Publishing, New York, NY.

Neill, W.T. 1964. Taxonomy, natural history, and zoogeography of the Rainbow Snake. *Farancia erytrogramma* (Palisot de Beauvois). American Midland Naturalist 71(2):257–295.

Norton, T.M., R. Poppenga, N. Stedman, D. Stevenson, T. Chen, M. Oliva, M. Mitchell, E. Jacobson, E. Dierenfeld, C. Cray, T. Gross, M.S. Sepulveda, S. Telford, S. Gibbs, K. Zack, E. Baitchman, L. Durden, and N. Hyslop. 2004. Health assessment in the Eastern Indigo Snake (*Drymarchon corais couperi*) in southeastern Georgia. Unpublished update for US Fish and Wildlife Service (Atlanta, GA) and Georgia Department of Natural Resources (Social Circle, GA) permits, June 2004. 8 pp. + appendices.

Rossi, J.V., and R. Lewis. 1994. *Drymarchon corais couperi* (Eastern Indigo Snake): Prey. Herpetological Review 25:123.

Smith, A., and F. Antonio. 2007. *Drymarchon corais couperi* (Eastern Indigo Snake): feeding behavior. Herpetological Review 38(1):88.

Smith, C.R. 1987. Ecology of juvenile and gravid Eastern Indigo Snakes in north Florida. Unpublished M.Sc. Thesis. Auburn University, Auburn, AL. 116 pp.

Smith, D.J., and M. Voigt. 2005. SR 200 wildlife impact study, final report. Florida Department of Transportation, Contract No. BC354-74, Florida Department of Environmental Protection, Office of Greenways and Trails, Contract No. GM 114, and Southwest Florida Water Management District, Contract No. 03CON000078. GeoPlan Center, Department of Urban and Regional Planning, University of Florida, Gainesville, FL. 219 pp.

Speake, D.W., J.A. McGlincy, and T.R. Colvin. 1978. Ecology and management of the Eastern Indigo Snake in Georgia: A progress report. Pp. 64–73, *In* R.R. Odum and L. Landers (Eds.). Proceedings of Rare and Endangered Wildlife Symposium. Georgia Department of Natural Resources, Game and Fish Division, Atlanta, GA. Technical Bulletin WL 4.

Steiner, T.M., O.L. Bass, Jr., and J.A. Kushlan. 1983. Status of the Eastern Indigo Snake in southern Florida National Parks and vicinity. South Florida Research Center Report SFRC-83/01, Everglades National Park; Homestead, FL.

Stevenson, D.J., K.J. Dyer, and B.A. Willis-Stevenson. 2003. Survey and monitoring of the Eastern Indigo Snake in Georgia. Southeastern Naturalist 2:393–408.

Stevenson, D.J., K.M. Enge, L.D. Carlile, K.J. Dyer, T.M. Norton, N.L. Hyslop, and R.A. Kiltie. 2009.. An Eastern Indigo Snake (*Drymarchon couperi*) mark-recapture study in southeastern Georgia. Herpetological Conservation and Biology:4:30–42.

Timmerman, W.W. 1995. Home range, habitat use, and behavior of the Eastern Diamondback Rattlesnake (*Crotalus adamanteus*) on the Ordway Preserve. Bulleting of the Florida Museum of Natural History 38, Part 1(5):127–158.

US Fish and Wildlife Service. 1978. Endangered and Threatened Wildlife and Plants. Listing of the Eastern Indigo Snake as a threatened species. Federal Register 43:4026–4029.

US Fish and Wildlife Service. 2008. Eastern Indigo Snake (*Drymarchon couperi*): 5-Year Review-Summary and Evaluation. Mississippi Ecological Services Field Office, Jackson, MS. 30 pp.

Williamson, G.K., and R.A. Moulis. 1994. Herpetological Specimens in the Savannah Science Museum Collection: Volume 2—Reptiles. Savannah Science Museum Special Publication No. 2. Savannah, GA. 418 pp.

Appendix 1. Eastern Indigo Snake (*Drymarchon couperi*) prey records with corresponding details for each occurrence. Indigos <1000 were classified as juveniles and ≥1000 were classified as adults. # = number of occurrences, So = source, Size = size of *Drymarchon* (mm), Sex = sex of *Drymarchon*. Source: R = regurgitated or palpated, N = dissected from a necropsied specimen or from a museum specimen, F = feces, and O = field observation. Size: TL = total length, SVL = snout–vent length. DOR = road mortality. Specimens from university herpetology collections: UF = University of Florida, GSU = Georgia Southern University, and UCF = University of Central Florida.

Prey items	#	So	State	Observer/ citation	Size	Sex	Date	Notes on Prey
Invertebrates								
Gastropoda								
Stylommatophora: Philomycidae								
Slug (*Philomycus* sp.); 75 mm TL	1	R	FL	Rossi and Lewis (1994)	610 mm TL		17 May 1993	
Insecta								
Insects	6	N,F	FL	Layne and Steiner (1996)	Adults			Insects present in 6 of 54 adults
Insects	3	N,F	FL	Layne and Steiner (1996)	493 - 591 mm TL			Insects present in of 3 of 4 juveniles
Vertebrates								
Chondrichthyes								
Unidentified shark; head only, dead	1	O	FL	Smith and Antonio (2007)	ca. 2000 mm TL		18 Mar 2001	
Amphibia								
Anura: Bufonidae								
Southern Toad (*Anaxyrus terrestris* (Bonnaterre))	1	O	FL	R. Bolt	1320 mm TL	m	July 1998	
Southern Toad; adult	1	R	GA	D. Stevenson	1305 mm SVL	m	25 Nov 2003	Also contained Eastern Garter Snake
Southern Toad; adult	1	N	FL	Layne and Steiner (1996)				
Southern Toads; adults	3	N	FL	Layne and Steiner (1996)	Adult			All from same indigo
Southern Toad; adult	1	N	GA	D. Stevenson	1426 mm SVL	m	10 Oct 2001	Also contained Southern Copperhead
Southern Toad; adult	1	R	GA	N. Hyslop	Adult	m	23 Jul 2004	Also regurgitated adult Eastern Hog-nosed Snake

Prey items	#	So	State	Observer/ citation	Size	Sex	Date	Notes on Prey
Southern Toad; adult	1	N	GA	D. Stevenson	Adult	f	30 Aug 2003	
Southern Toad	1	N	FL	Steiner et al. (1983)				
Southern Toad	1	N	FL	K. Krysko	465 mm SVL		11 Sep 2008	UF #153675
Southern Toad	4	N	FL	R. Bolt	1550 mm TL; 1275 mm SVL			
Anura: Ranidae								
American Bullfrog (*Lithobates catesbeianus* Shaw); adult	1	O	GA	Stevenson et al. (2003)	Adult		15 Aug 1998	
Southern Leopard Frog (*Lithobates sphenocephalus* Cope)	1	R	FL	R. Bolt	1520 mm TL	f	May 2002	
Southern Leopard Frog	1	N	FL	K. Krysko	1010 mm SVL		19 Nov 2007	UF #152681
Southern Leopard Frog	1	O	GA	Hyslop (2007)	2180 mm TL; 1825 mm SVL	m	10 Aug 2004	
Southern Leopard Frog	1	O	FL	Layne and Steiner (1996)				
Southern Leopard Frog; dead	1	O	FL	Layne and Steiner (1996)				
Ranid frog (*Lithobates* sp.)	1	O	GA	Hyslop (2007)	2180 mm TL; 1825 mm SVL	m	20 Apr 2004	
Anura: Unidentified								
Unidentified anuran	3	N	FL	Layne and Steiner (1996)				
Unidentified anuran; large	1	O	FL	Dodd and Barichivich (2007)	1105 mm SVL	m	22 Sep 1986	
Unidentified "toad"	1	R	GA	Mount (1975)	2130 mm TL			Also contained hatchling Gopher Tortoise, Southern Hog-nosed, and Pigmy Rattlesnake
Caudata: Sirenidae								
Unidentified sirenid, ca. 140 mm TL	1	O	FL	J. Emanuel	1067-1219 mmTL		2004	
Reptilia								
Crocodilia: Alligatoridae								
American Alligator (*Alligator mississippiensis* (Daudin)); juvenile	1	O	FL	R. Van Nostrand	Adult			
Testudines: Emydidae								
Peninsula Cooter (*Pseudemys peninsularis* (Carr)) eggs	6	R	FL	Layne and Steiner (1996)	Adult			

Prey items	#	So	State	Observer/ citation	Size	Sex	Date	Notes on Prey
Florida Red-bellied Cooter (*Pseudemys nelsoni* (Carr)); hatchlings	U	O	FL	J. Watt	1829 mm TL			Eating hatchlings emerging from a nest on a turtle farm
Testudines: Testudinidae								
Gopher Tortoise (*Gopherus polyphemus* (Daudin)); hatchling	1	R	GA	Mount (1975)	2130 mm TL			Also contained toad, Southern Hog-nosed, and Pigmy Rattlesnake
Gopher Tortoise; hatchlings	4	R	GA	Landers and Speake (1980)	Adult			
Gopher Tortoise; all hatchlings or small juveniles , egg remains	6	N	FL	Layne and Steiner (1996)	Adults			Two tortoises from same indigo
Gopher Tortoise; hatchling	1	N	GA	Stevenson et al. (2003)	1514 mm SVL	f	17 Oct 1997	DOR; also contained Eastern Diamondback; GSU # 97.0494
Gopher Tortoise; juvenile	1	O	GA	Stevenson et al. (2003)	Adult		27 Sep 2000	
Gopher Tortoise; hatchling	1	R	GA	R. Redmond	1778 mm TL; 1486 mm SVL	m	16 Dec 2006	
Gopher Tortoise; juvenile	1	R	GA	Hyslop (2007)	Adult	m	Oct 2003	
Gopher Tortoise; hatchlings	3	N	GA	Hyslop (2007)	2095 mm TL; 1780 mm SVL	m	20 Nov 2003	All from same indigo
Gopher Tortoise; juvenile	1	R	FL	R. Bolt	Adult	m	Nov	
Gopher Tortoise; juvenile (yearling)	1	O	FL	S. Godley	Adult	m	Jul 1985	
Gopher Tortoise;, juvenile	1	R	FL	Smith and Voigt (2005)	1680 mm SVL	m	7 Dec 2004	Regurgitated following capture for transmitter removal
Testudines: Undentified								
Unidentified turtle eggs	4	N	FL	Babis (1949)	1828 mm SVL		7 Nov 1948	Eggs averaged 3.0 x 1.3 cm; also contained 2 Pigmy Rattlesnakes
Unidentified turtle	1	O	FL	R. Van Nostrand	Adult			
Squamata: Sauria								
Sauria: Anguidae								
Glass Lizard (*Ophisaurus* sp.)	1	O	FL	R. Bolt	1350 mm TL	f	May	
Glass Lizard	1	R	FL	Layne and Steiner (1996)				

Prey items	#	So	State	Observer/ citation	Size	Sex	Date	Notes on Prey
Glass Lizard	2	F	FL	Smith (1987)	Juveniles		1986	
Squamata: Serpentes								
Serpentes: Colubridae								
Watersnake (*Nerodia* sp.)	1	O	GA	Hyslop (2007)	1765 mm TL; 1490 mm SVL	f	10 Jun 2004	
Brown Watersnake (*Nerodia taxispilota* (Holbrook))	1	O	FL	Steiner et al. (1983)	1500 - 1800 mm TL		5 Jan 1982	
Mangrove Saltmarsh Watersnake (*Nerodia clarkii* Kennicott)	1	O	FL	Dilley (1954)	Adult			
Southern Watersnake (*Nerodia fasciata* (L.))	1	O	FL	Smith and Voigt (2005)	1650 mm SVL	m	24 Jun 2004	
Eastern Ribbonsnake (*Thamnophis sauritus* (L.)), 890 mm TL	1	R	FL	K. Dyer	898 mm TL	f	19 May 2003	
Eastern Gartersnake (*Thamnophis sirtalis* (L.)); adult	1	R	GA	D. Stevenson	1305 mm SVL	m	25 Nov 2003	Also contained Southern Toad
Eastern Gartersnake; adult	1	O	FL	R. Van Nostrand				
Scarletsnake (*Cemophora coccinea*) (Blumenbach))	1	O	FL	Smith (1987)	Juvenile		1986	
Ring-necked Snake (*Diadophis punctatus* (L.))	1	O	FL	Smith and Voigt (2005)	1470 mm SVL	f	6 Nov 2004	
Ring-necked Snake	1	O	FL	Layne and Steiner (1996)				
Ring-necked Snake; front half only	1	N	FL	R. Bolt	545 mm TL; 445 mm SVL		18 Aug 1994	UCF #0145
Eastern Hog-nosed Snake (*Heterodon platirhinos* Latreille); adult	1	R	GA	N. Hyslop	Adult	m	23 Jul 2004	Also contained adult Southern Toad
Eastern Hog-nosed Snake; adult	1	O	GA	Hyslop (2007)	1675 mm TL; 1450 mm SVL	f	28 Oct 2004	
Eastern Hog-nosed Snake	1	N	FL	Layne and Steiner (1996)				
Southern Hog-nosed Snake (*Heterodon simus* (L.))	1	R	GA	Mount (1975)	2130 mm TL			
Red-bellied Mudsnake (*Farancia abacura* (Holbrook))	1	O	FL	R. Bolt	1630 mm TL	m	Jan	

Prey items	#	So	State	Observer/ citation	Size	Sex	Date	Notes on Prey
Rainbow Snake (*Farancia erytrogramma* (Palisot de Beauvois)); adult	1	R	FL	Neill (1964)	2235 mm TL			
Common Kingsnake (*Lampropeltis getula* (L.)); ca.1219 mm TL	1	O	FL	P. Moody	1524–1829 mm TL		1996	
Eastern Coachwhip (*Coluber flagellum* (Shaw)); adult, 1500 mm TL	1	R	FL	Carr (1940)	Adult			
Eastern Coachwhip; adult, 1783 mm TL	1	R	FL	Layne and Steiner (1996)	2056 mm TL			
Eastern Coachwhip; adult, 1000 mm TL	1	R	FL	Layne and Steiner (1996)	1918 mm TL			
Eastern Coachwhip	1	N	FL	Layne and Steiner (1996)				
Eastern Coachwhip; adult	1	O	FL	Smith and Voigt (2005)	1630 mm SVL	m	13 Jun 2004	
Eastern Coachwhip; adults, each ca. 914 mm TL	2	R	GA	Hopkins (2001)	1829 mm TL			both from same indigo
Eastern Indigo Snake (*Drymarchon couperi* (Holbrook)); male, ca. 1219 mm TL	1	O	FL	F. Antonio	1829 mm TL	m		
Eastern Indigo Snake); yearling	1	O	FL	Smith (1987)	juvenile		1986	
North American Racer (*Coluber constrictor* L.)	1	O	FL	Dodd and Barichivich (2007)	1105 mm SVL	m	10 Dec 1986	
North American Racer; adult	1	O	FL	R. Bolt	Adult	m		
North American Racer	1	O	FL	R. Ashton				
North American Racer	3	N, F2	FL	Layne and Steiner (1996)	3 different indigos			
North American Racer	1	O	FL	Smith and Voigt (2005)	Adult		Sep 2004	Observed in residential setting, Zellwood, FL
North American Racer; adult, ca. 967 mm TL	1	O	GA	Hyslop (2007)	1860 mm TL; 1555 mm SVL	f	18 Jun 2004	
North American Racer	1	O	GA	Hyslop (2007)	1950 mm TL; 1575 mm SVL	f	23 Jul 2004	
North American Racer; 1168 mm TL	1	O	FL	K. Morin	1524+ mm TL		2001	
North American Racer	1	O	FL	Smith (1987)	Adult		1986	
Eastern Ratsnake (*Pantherophis alleghaniensis* (Say))	1	O	FL	R. Bolt	1880 mm TL	f	Jan	
Eastern Ratsnake	1	R	FL	R. Bolt	1960 mm TL	m	Feb	
Eastern Ratsnake	1	O	FL	Smith and Voigt (2005)	Adult	m	22 May 2004	
Eastern Ratsnake; adult	1	O	FL	R. Ashton	Adult			

Prey items	#	So	State	Observer/ citation	Size	Sex	Date	Notes on Prey
Eastern Ratsnake; adult, ca. 1500 mm TL	1	O	FL	R. Bolt (pers. comm.)	1680 mm TL	m	Oct	
Eastern Ratsnake	1	O	FL	Becker (1997)	1524–1829 mm TL		8 May 1997	
Eastern Ratsnake	1	O	GA	Hyslop (2007)	1555 mm SVL	f	14 May 2004	
Eastern Ratsnake; adult, ca. 970 mm TL	1	O	GA	Hyslop (2007)	1575 mm SVL	m	11 Jun 2004	
Eastern Ratsnake	1	N	FL	Layne and Steiner (1996)				
Eastern Ratsnake; 1000 mm TL	1	O	FL	S. Godley	1400 mm TL	m	6 Jun 1976	Swallowed prey head-first; hydric hammock habitat
Red Cornsnake (*Pantherophis guttatus* (L.))	1	O	FL	R. Bolt	1630 mm TL	m	Jul	
Red Cornsnake	1	R	FL	R. Bolt	2010 mm TL	m	Jun	
Red Cornsnake	1	O	FL	Steiner et al. (1983)	ca. 1840 mm TL		11 Mar 1954	
Red Cornsnake; adult	1	O	GA	Stevenson et al. (2003)	Adult		12 Nov 1989	
Red Cornsnake; adult, 914 mm TL	1	R	GA	D. Stevenson	2229 mm TL; 1880 mm SVL	m	26 Apr 2005	
Red Cornsnake; hatchling, 255 mm TL	1	N	GA	D. Stevenson	1637 mm TL	m	10 Oct 1993	Also contained mammal hair; GSU #93.12646
Red Cornsnake; dead (DOR)	1	O	FL	Steiner et al. (1983)				
Red Cornsnake; 1220 mm TL	1	O	FL	J. Watt	1524–1829 mm TL		Feb 2009	
Red Cornsnake; 1067 mm TL	1	O	FL	J. Watt	Adult		ca. 1990	
Red Cornsnake; ca. 508 mm TL	1	O	FL	B. McGighan	610 mm TL		autumn	Young-of-the-year indigo
Rough Green-snake (*Opheodrys aestivus* (L.))	1	N	FL	Steiner et al. (1983)				
Serpentes: Viperidae								
Southern Copperhead (*Agkistrodon contortrix* (L.)), 610 mm TL	1	N	GA	Stevenson et al. (2003)	1426 mm SVL	m	10 Oct 2001	Also contained Southern Toad
Cottonmouth (*Agkistrodon piscivorus* (Lacepede))	1	O	FL	Smith and Voigt (2005)	Adult		1 Nov 2005	
Cottonmouth	1	R	GA	Landers and Speake (1980)	Adult			
Pygmy Rattlesnake (*Sistrurus miliarius* (L.)); 305 mm TL, 356 mm TL	2	N	FL	Babis (1949)	1828 mm SVL		7 Nov 1948	Also contained 4 turtle eggs
Pygmy Rattlesnake	1	R	GA	Mount (1975)	2130 mm TL			Also toad, hatchling Gopher Tortoise, and Southern Hog-nosed

Prey items	#	So	State	Observer/ citation	Size	Sex	Date	Notes on Prey
Pygmy Rattlesnake	4	O	FL	Smith (1987)	2 juveniles		Aug/Sept 1985 and 1986	
Pygmy Rattlesnake	3	F	FL	Smith (1987)	Juveniles		1986	
Pygmy Rattlesnake	1	O	FL	C. Webb	ca. 1372 mm TL			
Eastern Diamond-backed Rattlesnake (*Crotalus adamanteus* (Palisot de Beauvois))	1	O	GA	M. Smith	Adult			
Eastern Diamond-backed Rattlesnake	1	O	FL	H. Kale	Adult			
Eastern Diamond-backed Rattlesnake	3	R	GA	Landers and Speake (1980)	Adults			
Eastern Diamond-backed Rattlesnake	1	N	GA	Stevenson et al. (2003)	1514 mm SVL	f	17 Oct 1997	Also contained hatchling Gopher Tortoise; GSU #97.0494
Eastern Diamond-backed Rattlesnake	1	O	GA	Stevenson et al. (2003)	Adult			
Eastern Diamond-backed Rattlesnake; ca. 914 mm TL	1	O	FL	Layne and Steiner (1996)	Adult			
Eastern Diamond-backed Rattlesnake	1	O	FL	K. Dyer	Adult			
Eastern Diamond-backed Rattlesnake; 600-700 mm TL	1	O	FL	Dodd and Barichivich (2007)	1105 mm SVL	m	17 July 1986	Also mentioned in Timmerman (1995)
Eastern Diamond-backed Rattlesnake; ca. 610 mm TL	1	O	FL	C. Schmittler	1372 mm TL			
Timber Rattlesnake (*Crotalus horridus* (L.))	1	O	GA	Hyslop (2007)	1575 mm SVL	m	13 Jun 2003	
Timber Rattlesnake	1	O	GA	Hyslop (2007)	1780 mm SVL	m	17 Jul 2003	
Timber Rattlesnake	1	O	GA	Hyslop (2007)	2030 mm TL; 1690 mm SVL	m	12 Jul 2004	
Serpentes: Elapidae								
Harlequin Coral Snake (*Micrurus fulvius* (L.))	1	O	FL	Layne and Steiner (1996)				
Harlequin Coral Snake; ca. 750 mm TL	1	O	FL	Belson (2000)	ca. 1250 mm TL		7 Oct 1998	
Serpentes: Unidentified								
"Ringed" snake (cf. *Micrurus fulvius*)	1	O	FL	Steiner et al. (1983)				
Snake scales	1	F	FL	R. Bolt	1880 mm TL	f	Jan	

Prey items	#	So	State	Observer/ citation	Size	Sex	Date	Notes on Prey
Aves								
Galliformes: Phasianidae								
Domestic Chicken (*Gallus domesticus*); eggs	8	R	FL	A. Flanagan	Adult			
Domestic Chicken; chick	1	O	FL	Layne and Steiner (1996)	Adult			
Passeriformes: Corvidae								
Florida Scrub-jay (*Aphelocoma coerulescens* (Bosc)); juvenile	1	O	FL	Mumme (1987)	1427 mm TL	f	30 Aug 1986	ca. 4-month-old bird being swallowed on the ground
Passeriformes: Icteridae								
Eastern Meadowlark (*Sturnella magna* (L.))	1	N	FL	Layne and Steiner (1996)	Adult			
Passeriformes: Emberizidae								
Eastern Towhee (*Pipilo erythrophthalmus* (L.)); adults	3	O	FL	R. Ashton	Adult	m		Ambushed 1 Eastern Towhee on 3 separate occasions as they bathed in artificial tortoise pond
Unidentified bird	1	N	FL	Layne and Steiner (1996)	Adult			
Mammalia								
Didelphimorphia: Didelphidae								
Virginia Opossum (*Didelphis virginiana* (Kerr)); juvenile	1	O	FL	Smith and Voigt (2005)	1630 mm SVL, 1589 grams	m	29 May 2004	
Lagamorpha: Leporidae								
Marsh Rabbit (*Sylvilagus palustris* (Bachman)); nestling	1	O	FL	Alvarez (1996)	2130 mm TL		29 Feb 1996	"very young marsh rabbit"
Eastern Cottontail (*Sylvilagus floridanus* (J.A. Allen))	3	F1, O2	FL	Layne and Steiner (1996)	3 different adults			Two observed were recent nestlings
Rodentia: Cricetidae								
Cotton Mouse (*Peromyscus gossypinus* (LeConte))	1	F	FL	Smith (1987)	Juvenile		1986	

Prey items	#	So	State	Observer/ citation	Size	Sex	Date	Notes on Prey
Eastern Harvest Mouse (*Reithrodontomys humulis* (Audubon and Bachman))	1	R	GA	Landers and Speake (1980)	Adult			
Hispid Cotton Rat (*Sigmodon hispidus* Say and Ord)	1	N	FL	Steiner et al. (1983)	Adult			
Hispid Cotton Rat	7	N2, F5	FL	Layne and Steiner (1996)	Several different adults			Prey items included 1 recently born young, 3 small juveniles, 1 sub-adult, 1 adult
Hispid Cotton Rat; subadult	1	N	GA	Stevenson et al. (2003)	1156 mm SVL	f	14 Dec 2001	
Hispid Cotton Rat; adult	1	O	FL	A. Nielson	Adult		April/ May 1991	
Hispid Cotton Rat	1	R	FL	S. Godley	Adult	f	30 June 1974	Old field habitat
Rodentia: Muridae								
House Mouse (*Mus musculus* (L.))	1	R	GA	Landers and Speake (1980)	Adult			
Black Rat (*Rattus rattus* (L.))	2	N, F	FL	Layne and Steiner (1996)	2 different adults			
Rodentia: Sciuridae								
Southern Flying Squirrel (*Glaucomys volans* (L.))	2	R, F	FL	Layne and Steiner (1996)	2 different adults			
Rodentia: Unidentified								
Unidentified small rodent	1	N	FL	Layne and Steiner (1996)				
Mammals: Unidentified								
Mammal hair	1	N	GA	D. Stevenson	1637 mm TL	m	10 Oct 1993	Also contained hatchling corn snake; GSU #93.12646
Mammal hair in feces	1	F	FL	R. Bolt	1690 mm TL	m	Jan	
Mammal hair in feces	1	F	FL	R. Bolt	1980 mm TL	m	Jan	