Trophic Niche Breadth in a Widely-Foraging Snake (Colubridae : *Coluber*)

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Abstract

The trophic niche width of a species varies depending on the foraging strategy employed by the individuals within a population. Among reptiles, the niche breadth of many species of snakes is relatively understudied. Within this clade, the genus *Coluber* includes wide-ranging, actively foraging snakes that have been historically labeled as dietary generalists. We report on the diet composition of *Coluber constrictor foxii*, the Blue Racer. The dietary information available for this subspecies is mostly anecdotal and little is known about ontogenetic or gender differences in the prey species consumed. In addition to obtaining gut contents by palpation, we employed stable isotope analyses using $\delta^{13}C$ and $\delta^{15}N$ to quantitatively describe the dietary preferences of *C. constrictor foxii*. We collected blood and tissue samples of *C. constrictor foxii*, along with whole specimens representing a range of potential prey taxa. We freeze-dried all samples, homogenized them using an amalgamator, and analyzed the samples using mass spectroscopy. We compared the isotope signatures of potential prey taxa to those from *C. constrictor foxii* tissues to determine the prey items that the snakes are including in their diet. We used a Bayesian mixing model to determine the source of $\delta^{13}C$ and $\delta^{15}N$ in the snake tissues, and assessed differences in diet between individuals representing different genders and ontogenetic stages. At the population level, *C. constrictor foxii* appears to support the pattern typical of a dietary generalist; differences exist, however, when comparing prey taxa consumed by different life-history stages and sexes.

Fig. 1. Three ontogenetic stages of Blue racer: (a) yearling; (b) subadult; and, (c) adult.

Introduction

- Intra- and inter-individual shifts in diet should be included when defining the niche of an organism within an ecosystem.
- The biogeography of Racers (*Coluber*; 2) contributes to variation in life-history traits of species within this genus, including prey preferences and foraging behaviors.
- Historically, racers are described as generalist feeders known to depredate a variety of vertebrates and invertebrates (7, 8). Current understanding of racer diet is mostly anecdotal &/or limited to recent meals (4), providing limited understanding of where the species is positioned in a trophic web.
- Stable isotope analyses provide detailed dietary information because of the retention of isotopic nitrogen in the proteins of consumers from their prey items (9,10).

Purpose

Our objective is to use stable isotope analysis of tissue types from both predator and prey species (1, 5) to provide temporal and spatial information about the diet and trophic position of Blue Racers (*Coluber constrictor foxii*).

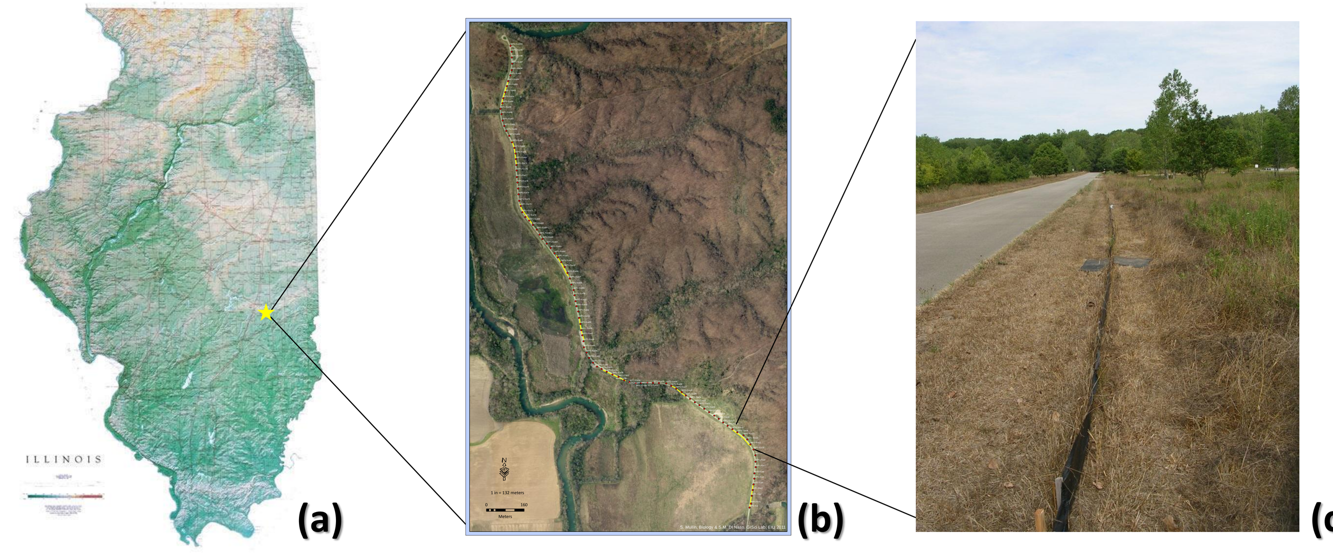


Fig. 2. Fox Ridge State Park study site:(a) locality within Illinois state; (b) placement of arrays on road; and, (c) array with coverboards and funnel trap.

Methods

Study Site & Specimen Surveys

- Fox Ridge State Park (FRSP; Fig. 2b) in Coles Co., Illinois (39°24'9"N, 88°8'14"W).
- 9 drift fences along ecotone habitat, each 100 m long, with 4 large and 3 small pitfall traps, 3 pairs of coverboards, and 2 funnel traps.
- Study site checked daily from March to November for any racers. Prey items collected from fence or scheduled trapping effort.
- Specimens returned to the lab and standard morphometrics for snakes (3) are recorded. We obtained blood and scale samples, and marked each individual (11) for future captures.

Stable Isotope Analyses

- We prepared snake tissue and whole prey samples by cryogrinding and weighing subsample allotments of 0.6-1.2mg.
- We will analyze samples using an Elemental Analyzer- Isotope Ratio Mass Spectrometer where samples are combusted with oxygen to become gaseous
- We will use Bayesian mixing models (MixSIR; 5) to depict isotopic ratios of both carbon and nitrogen in graphical space.

Results

- During Summer2011 to Spring 2012 we encountered 23 live and 4 dead-on-road (DOR) *C. c. foxii.*
- We collected prey items from classes Insecta, Amphibia, Reptilia, and Mammalia which included over 20 different genera with replicates.

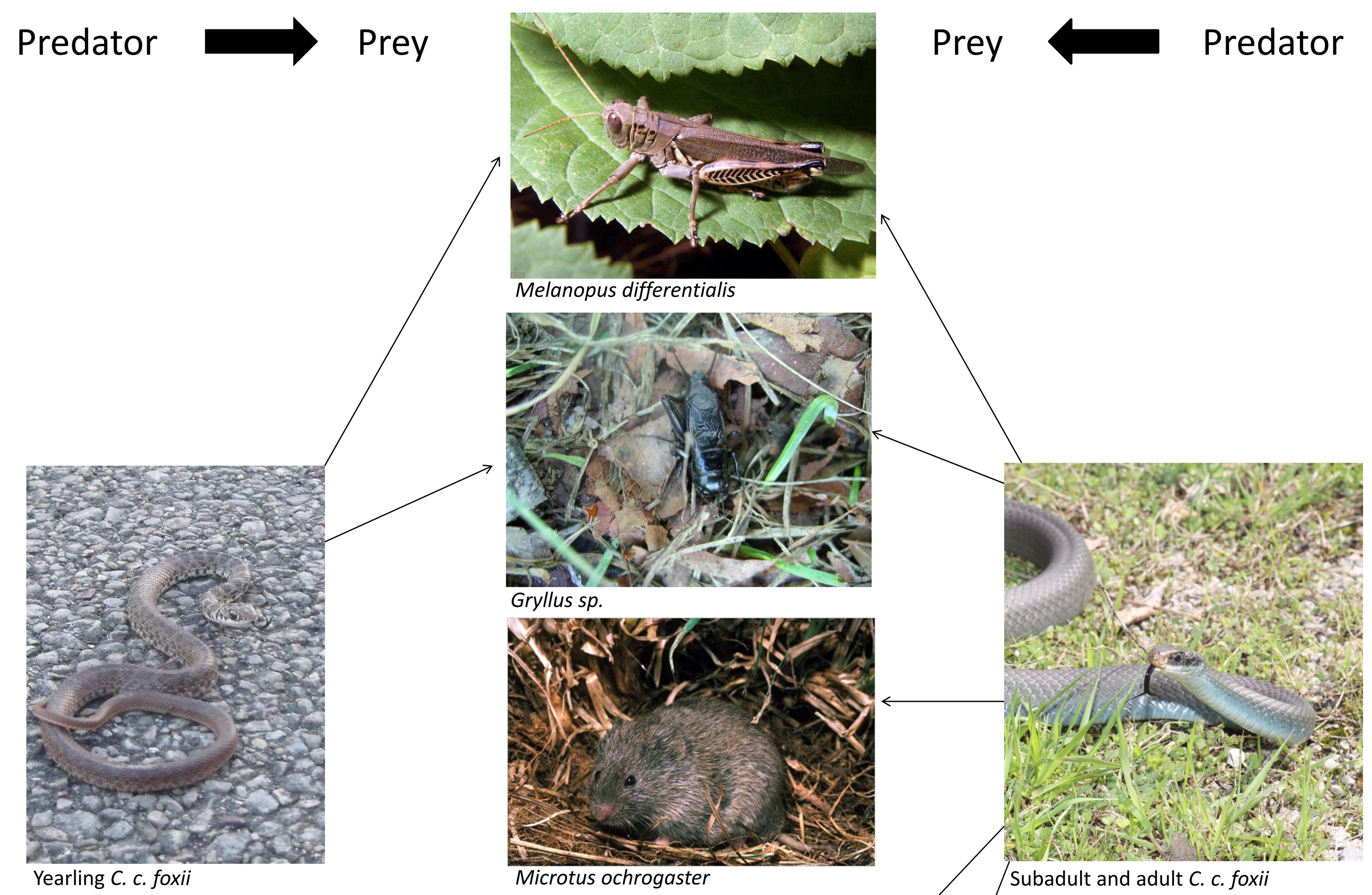
Table 1. Summary of Blue racers encountered during the first three seasons of this project

ID #	Season Encountered	Age Class	Sex
9	Summer	Subadult	M
10	Summer	Adult	F
11	Summer	Subadult	F
12	Summer	Subadult	M
13	Summer	Subadult	F
14	Summer	Subadult	F
15	Summer	Yearling	M
16	Fall	Yearling	M
17	Fall	Yearling	M
18	Fall	Yearling	M
19	Fall	Yearling	M
20	Fall	Yearling	F
21	Fall	Yearling	F
22	Fall	Yearling	M
23	Spring	Subadult	M
24	Spring	Subadult	M
25	Spring	Yearling	F
26	Spring	Yearling	F
27	Spring	Adult	M
28	Spring	Yearling	M
29	Spring	Adult	M
30	Spring	Yearling	M
31	Spring	Yearling	M

Notes: Summer: May-August, Fall: September-October, Spring: March-April; This table does not include any recaptures or individuals encountered DOR

Discussion

- Based on previous anecdotal research (Fig. 3; 8) we expect there to be differences in dietary preference of the three ontogenetic stages of Blue racer.
- We expect that differences in dietary preference will lead to different stable isotope ratios of carbon and nitrogen in the Blue racer (Fig. 4; 6). These differences are also expected to be represented for each individual through blood, plasma, and tissue samples.
- We expect there to be seasonal variation in stable isotope ratios according to prey abundance.



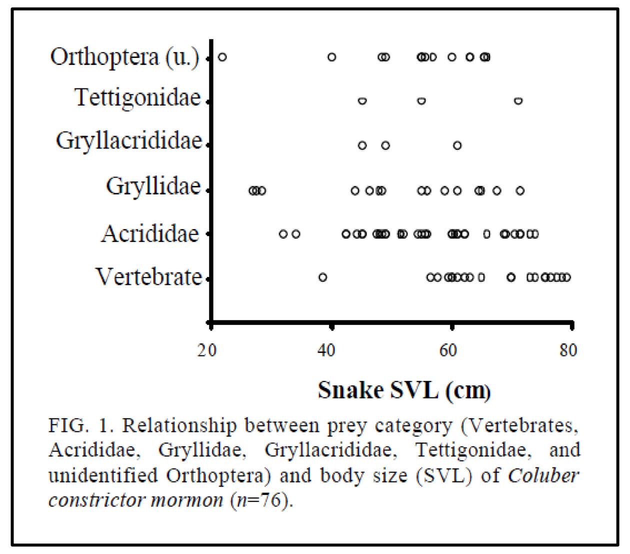


Fig. 3. Shewchuck and Austin 2001 (8)

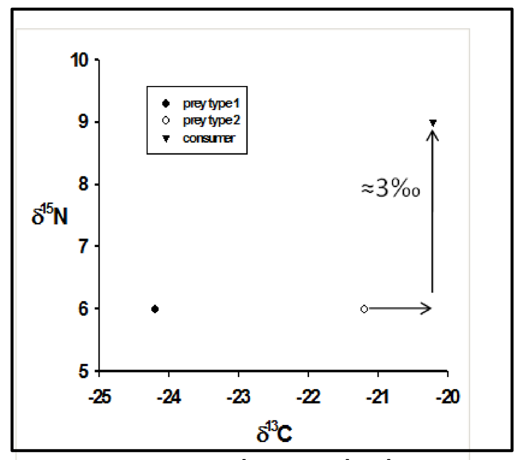


Fig. 4. Hypothetical plot showing stable isotope relationship. Pilgrim 2005 (6)

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