Copeia, 1999(2), pp. 523–525

Diet of the Red Hills Salamander *Phaeognathus hubrichti*

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I examined the diet of *Phaeognathus hubrichti* using stomach contents of preserved specimens and fecal samples from live salamanders. Land snails (20%) and arthropods (68%), including ants, beetles, and spiders, were the most numerous prey items found. Diet composition may indicate how habitat quality affects foraging behavior of Red Hills salamanders.

THE Red Hills salamander (*Phaeognathus hubrichti*) is a unique species found only in the Red Hills physiographic region of southern Alabama (Schwaner and Mount, 1970). Red Hills salamanders inhabit burrow systems on steep, moist, hardwood-dominated slopes shaded by a full canopy (Dodd, 1991). Information on life-history characteristics, including foraging behavior, of *P. hubrichti* is limited due to their fossorial habits. Red Hills salamanders may feed on prey items found within their burrows and on prey captured on the surface. During burrow excavations, Jordan (1975) found numerous invertebrates that could serve as prey for the Red Hills salamander, including camel crickets, millipedes, spiders, and snails. Red Hills salamanders often sit at the entrance to their burrows at night, and sometimes during the day, and may feed opportunistically on any prey item that passes by on the surface of the ground. Brandon (1965) found that the diets of *P. hubrichti* and *Plethodon glutinosis* captured from the same site were similar, suggesting that these salamanders have similar foraging strategies and may feed mainly at or above the surface. Jordan (1975) rarely observed Red Hills salamanders capturing prey while sitting at the entrance of their burrows, but in captivity Brandon (1965) reported several instances in which a salamander crawled halfway out of its burrow to capture a mealworm. Here I present additional information on the diet of the Red Hills salamander.

MATERIALS AND METHODS

I examined stomach contents of preserved salamanders and fecal samples from live salamanders. Stomach contents of 33 *P. hubrichti* specimens from the Auburn University Museum were obtained by dissection. Salamanders were collected from 1964 to 1976 from various localities in Butler, Covington, Crenshaw, and Monroe Counties, Alabama. Fecal samples were obtained from 22 *P. hubrichti* while they were maintained in captivity. These salamanders were collected using small hooks baited with crickets (*Achaeta domesticus*; after Mount and Schwaner, 1970) from one site (see Gunzburger and Guyer, 1998, for description) in Monroe County, Alabama, during 1995 and 1997. Fecal samples were collected before the salamanders were fed (usually within the first 2–3 days in captivity) to ensure that samples accurately represented prey of the salamander in the wild. If a fecal sample contained any cricket parts (resulting from the capturing method), it was excluded from the study. Stomach and fecal samples were examined with a stereomicroscope, and prey items were identified to the lowest possible taxon.

RESULTS AND DISCUSSION

The diet of *P. hubrichti* from both stomach and fecal contents combined consisted of a variety of invertebrate prey including mostly arthropods (68%) and gastropods (20%; Fig. 1). Several new diet records for *P. hubrichti* were found in this study, including spiders, hemipterans, earthworms, and a shed skin. The function of dermatophagy (shed skin-eating) is unknown but has been reported from other plethodontid salamanders and may serve to reclaim epidermal protein (Weldon et al., 1993). Plant material found in the stomach and fecal contents included moss and small leaves and was most likely ingested accidentally during foraging. Unidentified arthropods in this study usually consisted of a wing, leg, or body segment, which may indicate either the salamander was unable to capture the entire prey item or the remaining portion of the prey item was not detected because it had passed through the digestive system at a different rate.

Densities of prey items from stomach contents and fecal contents were sometimes different (Table 1). Soft-bodied prey such as earthworms were not detected in fecal samples but were present in a minor part of the stomach samples. Hard-bodied prey (arthropods) were common in both stomach and fecal samples. This is probably because of differential digest-

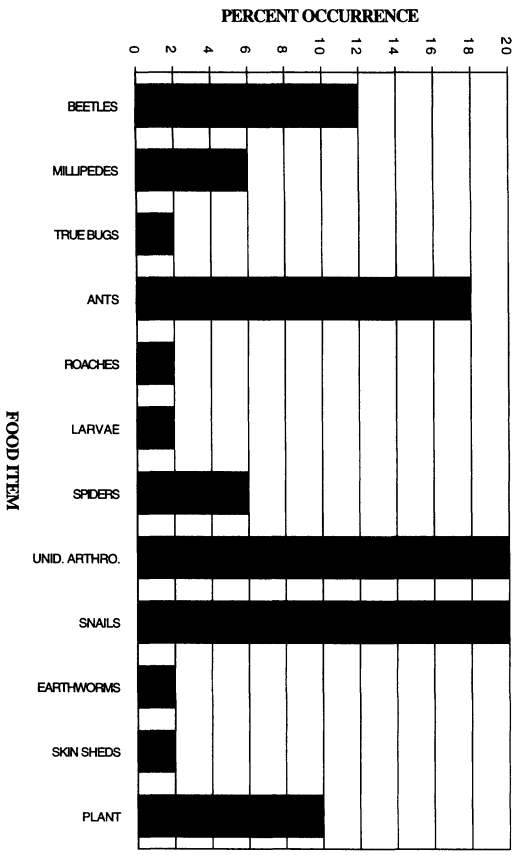

Fig. 1. Percent occurrence of food items in the diet of *Phaeognathus hubrichti*. Data from stomach (n = 33) and fecal (n = 22) samples are combined (n = 55) in this figure.

TABLE 1. NUMBER OF *Phaeognathus hubrichti* STOMACH AND FECAL SAMPLES CONTAINING EACH FOOD ITEM. *indicates a previously unreported food item for *P. hubrichti*.

Food Item	Stomachs (n = 33)	Fecals (n = 22)	Total (n = 55)
Arthropoda			
Coleoptera (beetles)	1	5	6
Hymenoptera (ants)	1	8	9
Orthoptera (cockroaches)	0	1	1
Hemiptera (true bugs)*	0	1	1
Insect Larvae	1	0	1
Arachnida (spiders*/mites)	3	0	3
Diplopoda (millipedes)	0	3	3
Unidentified Arthropods	6	4	10
Mollusca			
Gastropoda (land snails)	0	10	10
Annelida			
Oligochaeta (earthworms)*	1	0	1
Skin Shed*	0	1	1
Plant material	1	4	5
Empty/Unidentifiable	19	0	19

ibility of hard versus soft prey and not an indication of differential foraging (Demuth and Buhlmann, 1997).

Diet composition of Red Hills salamanders may be an indicator of the quality of the habitat from which they were collected. Almost half of the fecal samples from salamanders collected from one site in Monroe County contained land snails, but snails were not found in the diet of salamanders from any other site. Land snails may be a more attractive prey source for salamanders because they are relatively larger, slower, and easier to catch than arthropods. Snail remains in fecal samples consisted of crushed shells with no soft tissue remaining, indicating that salamanders are able to obtain nutrients from snails that are captured. Terrestrial gastropods are highly prone to desiccation (Ruppert and Barnes, 1994), and their occurrence may be dependent on high moisture in leaf litter. A high level of moisture in the leaf litter has also been shown to be an important factor in the maintenance of Red Hills salamander populations (Dodd, 1991). The absence of snails from the diet of *P. hubrichti* from certain sites may be an indicator of marginal habitat quality. Areas with moist leaf litter may be more conducive to aboveground foraging, allowing salamanders to selectively forage on choice prey items. In areas with dry leaf litter, salamanders may remain within their burrow to retain moisture and therefore may have no choice but to forage on any prey that enters the burrow or passes close to the entrance.

MATERIAL EXAMINED

Specimens of *P. hubrichti* dissected for stomach contents from the Auburn University Museum (AUM) listed by county in Alabama: Butler County—2244, 2245, 2246, 2755, 2756, 2757, 2760, 4514, 4515, 4516, 25077; Covington County—9000, 9001, 9002, 9003, 11091, 11224, 11225, 11226; Crenshaw County—2700, 9004, 9005, 11490, 11491, 11493, 11494; and Monroe County:—11092, 11114, 11115, 11381, 11428, 11429, 11430.

ACKNOWLEDGMENTS

I thank C. Guyer for help with the museum specimens as well as providing lab space during this study. C. Guyer, M. Bailey, E. Blankenship, K. Bailey, A. Carroll, and M. Aresco assisted with

collection of salamanders in 1995 and 1997. G. Folkerts provided helpful suggestions and assistance with invertebrate identifications. K. Dodd and an anonymous reviewer provided constructive criticism for an earlier draft of this manuscript. This project was approved by IACUC PRN 9812-R-0844 and conducted under State of Alabama Department of Conservation Permit 9784.

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