TABLE 2—Malaria prevalence seen in 398 *Sceloporus jarrovi* from eight localities in southeastern Arizona, 1979 to 1986.

Year	Sites	*n*	Prevalence
1979	2	38	42
1980	1	47	32
1981	1	12	58
1983	2	36	47
1984	5	111	34
1985	4	98	45
1986	4	56	54

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SEASONAL FOOD HABITS OF *CRYPTOBRANCHUS ALLEGANIENSIS* (CAUDATA: CRYPTOBRANCHIDAE)

The hellbender, *Cryptobranchus alleganiensis*, is a large aquatic salamander with two subspecies, *Cryptobranchus a. alleganiensis* inhabits streams in the eastern United States west to north-flowing rivers in the Ozark Plateaus of Missouri and possibly southeastern Kansas. *Cryptobranchus a. bishopi* occurs in four south-flowing streams in the Ozarks. Food contents of stomachs of hellbenders have been surveyed by many investigators for spring and summer, and Nickerson and Mays (1973) reported that food was present in the digestive tracts of *C. a. bishopi* all year. However, no year-round quantitative

TABLE 1—Percent by mass and mean mass per stomach (g) of food items of *Cryptobranchus alleganiensis*.

	C. a. alleganiensis						*C. a. bishopi*					
		Crayfish		Fish		Other		Crayfish		Fish		Other
Month	*n*	%	$\bar{X} \pm SE$	%	$\bar{X} \pm SE$	%	*n*	%	$\bar{X} \pm SE$	%	$\bar{X} \pm SE$	%
January	12	70.4	11.4 ± 4.3	28.4	4.6 ± 2.7	1.2	7	100.0	11.2 ± 7.7	0.0		0.0
February	12	80.0	8.1 ± 3.5	16.1	1.6 ± 1.3	3.9	4	89.4	27.9 ± 5.7	9.1	2.8 ± 2.8	1.5
March							7	85.0	40.1 ± 8.8	14.4	6.8 ± 6.8	0.6
April	12	72.6	14.8 ± 2.4	26.8	5.6 ± 3.9	0.6	5	72.5	36.5 ± 3.5	27.5	13.8 ± 13.8	0.0
May	2	79.7	19.0 ± 4.7	20.3	4.8 ± 3.4	0.0	5	99.4	28.6 ± 8.5	0.0		0.6
June	12	83.5	6.1 ± 1.8	16.0	1.2 ± 1.1	0.5	4	98.9	17.7 ± 7.2	1.1	0.2 ± 0.2	0.0
July	12	93.1	7.6 ± 1.5	4.6	0.4 ± 0.2	2.3	5	99.0	17.9 ± 7.3	0.0		1.0
August	10	82.9	1.2 ± 1.2	17.0	0.2 ± 0.2	0.1	4	100.0	27.8 ± 10.7	0.0		0.0
September	12	96.1	17.9 ± 4.3	3.8	0.7 ± 0.7	0.1	6	71.7	24.1 ± 10.1	28.1	9.4 ± 9.4	0.2
October	12	100.0	29.2 ± 4.1	0.0		0.0	6	100.0	39.8 ± 10.1	0.0		0.0
November							3	100.0	4.5 ± 4.5	0.0		0.0
December	12	98.0	14.0 ± 3.6	1.8	0.3 ± 0.2	0.2	6	80.4	5.9 ± 5.7	2.2	0.2 ± 0.2	17.4

analysis of the diet of hellbenders has been made. The objective of this study was to determine the seasonal food habits of a single population of each subspecies of the hellbender.

We collected *C. a. alleganiensis* monthly during 1974 in Niangua River, Laclede Co., Missouri, 4 km downstream from Bennett Spring. Flooding prevented sampling in March and November. We collected *C. a. bishopi* monthly from October 1985 to September 1986 in Spring River, Fulton Co., Arkansas, 7 km downstream from Mammoth Spring. All collections were made by hand during daylight by overturning rocks and logs. Hellbenders were transported from the rivers on ice to prevent regurgitation and were killed within 24 h with a tricaine solution. We measured total length (TL) of hellbenders to the nearest millimeter and body mass to the nearest gram before stomach contents were removed and weighed to the nearest 0.1 g. Lengths of intact cephalothoraxes of crayfish found in stomachs were determined to the nearest millimeter. Plant fragments were not considered in the dietary analysis because we believed they were ingested accidentally.

Stomachs of 54 male and 54 female *C. a. alleganiensis* from Niangua River were examined (Table 1). Hellbenders ranged from 302 to 545 mm TL and from 180 to 1,547 g. Crayfish (*Orconectes* sp.) remains were present in 81% of the stomachs. Totals of 109 cephalothoraxes and 589 chelae were found. The remains of 26 fishes (14 *Cottus* sp., 1 *Salmo gairdneri,* 1 *Campostoma anomalum,* and 10 unidentified) were present in 20% of the stomachs. Other food items included freshwater snails (Mesogastropoda), a horsehair worm (Gordioidea), a stonefly (Pteronarcidae) nymph, a damselfly (Calopterygidae) nymph, a larval alderfly (Sialidae), fish eggs, and an epidermal slough of a hellbender. Nonfood items included fishing line, hooks, plastic bait, and rocks. Fourteen stomachs were empty: one each in June, July, and December; two in January and August; three in September; four in February.

Stomachs of 31 male and 31 female *C. a. bishopi* from Spring River were examined. Hellbenders ranged from 421 to 611 mm TL and from 445 to 1,956 g. Crayfish (*Orconectes* sp.) remains were present in 82% of the stomachs, and 10% of the stomachs contained fish remains (one *Cottus* sp., two *Catostomus commersoni,* and the remainder unidentified). Other food items were nine freshwater snails and two larval lampreys. Nonfood items included rocks, a fish hook, and a piece of glass. Nine stomachs were empty: one each in July, August, and December; two in November; four in January.

In both sexes and both populations, crayfish was the predominant food item all year. Fishes were secondary items. Crayfish and fishes constituted over 90% of the mass of food items every month except the December sample from Spring River. This exception was due to a larval lamprey (170 mm TL) in one stomach. No significant correlation between total length of hellbenders and cephalothorax length of crayfish from stomachs was found in samples from Niangua River ($r = 0.08$, $0.5 > P > 0.4$, $n = 86$) or those from Spring River ($r = -0.12$, $0.4 > P > 0.2$, $n = 63$). Wiggs (1976) suggested that crayfish exoskeletal elements, particularly chelae, remain in the digestive tract longer than do fish remains based on feedings of captive hellbenders. Thus, fish are likely a more important component of the diet than indicated by dietary analysis, even though only stomach contents were examined.

In most other studies of the diet of hellbenders, crayfish was also the most abundant item in stomachs (e.g., Smith, 1907; Netting, 1929; Swanson, 1948; Nickerson and Mays, 1973). However, Nickerson et al. (1983) collected several *C. a. alleganiensis* in April in Big Piney River, Missouri, which had ingested numerous lampreys, and Peterson (1985) collected 10 female *C. a. alleganiensis* in September in Gasconade River, Missouri, which had eaten large numbers of hellbender eggs.

We do not know how many food items were dead or moribund when eaten. Nickerson and Mays (1973) suggested that the ingestion of fish bait indicated that hellbenders may occasionally scavenge. They also believed that some incidental ingestion of snails may occur where snails are abundant. Snails are abundant in both rivers we sampled.

Hellbenders can withstand starvation in captivity for several months (at about 24°C) and recover after considerable loss of body mass when released in the stream of capture (Nickerson and Mays, 1973; Nickerson, 1980). We found no evidence of seasonal fasting or a lack of available prey at our collection sites. However, Niangua River and particularly Spring River exhibit more seasonally uniform water temperatures than do streams not heavily influenced by springs (Dundee and Dundee, 1965). Bennett Spring on Niangua River has an average discharge of 15 million l/h, and Mammoth Spring on Spring River has an average discharge of 29 million l/h. Thus, hellbenders may be more active during winter in the populations we studied than in streams in other parts of their range.

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EXPANSION OF THE KNOWN DISTRIBUTION OF THE RARE ZION TANSY, *SPHAEROMERIA RUTHIAE* (ASTERACEAE)

Sphaeromeria is a genus endemic to western North America consisting of nine species, eight of which are rare. Several authors have commented that to understand their relationships to one another and to the closely related genera *Artemisia* and *Tanacetum* would be helpful in putting the Anthemideae in biogeographical and phylogenetical perspective (Hall and Clements, 1923; Holmgren et al., 1976; McArthur, 1979). One of the species, *Sphaeromeria ruthiae* Holmgren, Shultz et Lowrey (Zion tansy), had been known only from the type location in Zion National Park's Refrigerator Canyon where the species' authors (Holmgren et al., 1976) stated "We could readily count the number of individuals." It was also known from two other locations in or near Zion National Park (Welsh and Chatterley, 1985; L. M. Shultz, pers. comm.).

During a vegetation survey of Zion National Park (ZNP), which so far (1987 and 1988 field seasons) has covered all but the northwestern quarter of the park, we have observed *S. ruthiae* growing in >15 locations. After our initial discovery of the plant from a previously unknown location (collection *1772*), we made a survey in mid-September 1987 in likely habitats to determine more fully the species' distribution, habitat, density, and plant community associates (collections *1769* through *1778a*). Mid-September is the peak of the flowering season for Zion tansy. We used 7 × 35 binoculars to confirm identification and to count plants no farther than 30 m above or below our vantage points. We extended the survey during the 1988 field season (collections *1810, 1835* through *1837*). Voucher specimens were prepared from portions of mature (woody) plants for 10 of the collection sites (United States Geological Survey, 1980). Vouchers are deposited in the herbaria of Brigham Young University (BRY), Intermountain Research Station Shrub Sciences Laboratory (SSLP), and Zion National Park.

The collections are all from Utah and are presented in order of collection number (abbreviations for locations are EFVR = East Fork of Virgin River; NFVR = North Fork of Virgin River; ZNP = Zion National Park): Kane Co., EFVR, The Barracks, T42S, R9W, NW ¼ Sec.10, 1,440 m, 146