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Gene R. Wilde
University of Nevada, Las Vegas

FOODS AND FEEDING PERIODICITY OF THE WHITE RIVER SPRINGFISH, *CRENICHTHYS BAILEYI*

Gene R. Wilde[1]

ABSTRACT.—White River springfish collected in August and December 1966 from Hot Creek Spring, Nevada, fed primarily on amphipods, ostracods, plant fragments, and detritus. Composition of the diet was similar in both months. However, amphipods were the most important food in August, while in December amphipods, ostracods, plant fragments, and detritus were of approximately equal importance. Comparison of diel feeding periodicity and activity patterns suggests that most of the daily activity of White River springfish is related to feeding.

The White River springfish, *Crenichthys baileyi*, is endemic to several warm springs located along the course of the pluvial White River in southeastern Nevada. Abundance of White River springfish in several springs has declined in recent years as a result of habitat modifications (Courtney et al. 1985), introductions of nonnative fishes (Deacon et al. 1964, Hubbs and Deacon 1964, Courtney et al. 1985), and spread of diseases associated with introduced fishes (Wilson et al. 1966, Deacon 1979); one population became extinct because of predation by introduced largemouth bass, *Micropterus salmoides* (Deacon 1979, Williams and Wilde 1981). In general, mechanisms by which habitat modifications and introduced fishes contribute to declines in springfish abundance are not well understood. This is at least partially due to the paucity of life history information on the White River springfish; Williams and Williams (1982) provide the only description of its foods.

This paper describes the summer (August) and winter (December) diets and diel feeding periodicity of White River springfish from Hot Creek Spring, Nye County, Nevada.

METHODS

Fish were collected from the springpool of Hot Creek Spring with minnow traps on 24–26 August and 29 December 1966. Contents of the stomachs of 45 fish collected in August and 21 collected in December were examined. Foods were identified and enumerated; the percentage each food contributed to the volume of the stomach contents and the percent fullness of each stomach were visually estimated. Percent frequency of occurrence and indices of absolute (AI) and relative (RI) importance were calculated following Williams and Williams (1982).

Diel feeding periodicity was determined by averaging percent fullness of the stomachs of fish collected at 2-hr intervals during 24–26 August 1966. Stomachs of five fish were examined at each 2-hr interval; empty stomachs (percent fullness = 0) were included in the analysis.

RESULTS AND DISCUSSION

The White River springfish is an opportunistic omnivore. In Hot Creek Spring, the diet was composed of benthic invertebrates (mainly ostracods, amphipods, and gastropods), plant fragments, and detritus (Table 1), indicating that springfish foraged along the substrate and in plant cover. A similar mode of foraging is indicated in Preston Big Springs where diatoms, filamentous algae, and vascular plant fragments dominated the diet (Williams and Williams 1982).

The invertebrate fauna of Hot Creek Spring is depauperate (Brues 1932), and the diet of White River springfish showed a corresponding lack of diversity. Only five invertebrate groups were observed in stomachs of White River springfish. Intestinal tracts of fish collected in December also contained (dytiscid) coleopteran and dipteran larvae; no additional taxa were observed in intestinal tracts of fish collected in August.

[1]Department of Biological Sciences, University of Nevada, Las Vegas, Nevada 89154

TABLE 1. Percent of stomach contents, frequency of occurrence, mean number per occurrence, and relative importance (RI) of food items in stomachs of White River springfish from Hot Creek Spring, Nevada. Sample size was 45 in August 1966 and 21 in December 1966.

	Percent of stomach contents		Frequency of occurrence		Mean number per occurrence		RI	
	August	December	August	December	August	December	August	December
Algae	4.0		18		—		6.8	
Plant fragments	10.0	39.3	35	44	—	—	10.8	24.0
Detritus	9.3	18.3	38	56	—	—	14.5	21.3
Animal remains	6.6	4.9	10	25	—	—	4.9	8.6
Gastropoda	4.9	5.3	8	6	4.0	4.0	4.0	3.2
Ostracoda	8.1	16.1	40	63	5.8	3.1	14.8	22.7
Amphipoda	50.6	15.0	73	56	3.9	2.2	38.0	20.3
Odonata	3.3		8		1.3		3.5	
Ephemeroptera	3.3		5		1.0		2.6	

There was no significant difference ($p > .10$; Mann-Whitney U-test) between August and December in fullness of the stomach; however, there were qualitative differences in the diet. Amphipods and ostracods were the most frequently consumed invertebrates and contributed 59% of the stomach contents in August, but only 31% in December. Vascular plant fragments and detritus were the most common nonanimal foods and comprised 19% of the stomach contents in August and 58% in December. The difference in diet between August and December is probably the result of decreased abundance of invertebrates in December, rather than increased availability of plant fragments and detritus, and suggests a preference for invertebrate foods.

Diel feeding periodicity and activity patterns were bimodal, with peaks in morning (0600–1000 hrs) and afternoon (1400–1600 hrs; Fig. 1). Because White River springfish are inactive at night (Deacon and Wilson 1967, Hubbs et al. 1967), feeding was at a minimum from 0200 hrs to 0400 hrs. Similarities in diel feeding periodicity and general activity suggest that most activity is related to foraging (Deacon and Minckley 1974).

The summer diet of White River springfish from Hot Creek Spring was similar in composition to that described by Williams and Williams (1982) at Preston Big Springs; however, relative importance of animal and plant foods was reversed in the two springs. Invertebrates, especially amphipods, were the most important items in the diet of springfish at Hot Creek Spring (pooled RI = 67.9); pooled RI for algae, plant fragments, and detritus was 32.1. At Preston Big Springs, pooled RIs for invertebrates and algae plus vascular plants were 32.1 and 67.9, respectively (Williams and Williams 1982).

Differences in diet between Hot Creek Spring and Preston Big Springs may result from differences in the abundance of diatoms and filamentous green algae, which Williams and Williams (1982) suggested were the preferred foods of White River springfish. The elongate digestive tract of White River springfish suggests an herbivorous nature, but does not necessarily indicate obligate or preferential herbivory. The Amargosa pupfish, *Cyprinodon nevadensis*, also has an elongate intestine (Naiman 1975). Its diet is largely composed of algae and detritus, but invertebrates are readily eaten when present (Leser and Deacon 1968, Naiman 1975).

Differences in diet are more likely related to differences in the fish communities of Hot Creek Spring and Preston Big Springs. White River springfish is the only fish present in the springpool of Hot Creek Spring; however, it is a member of a more diverse fauna at Preston Big Springs (Williams and Williams 1982). Absence of other fishes from Hot Creek Spring may allow White River springfish to assume a more carnivorous diet.

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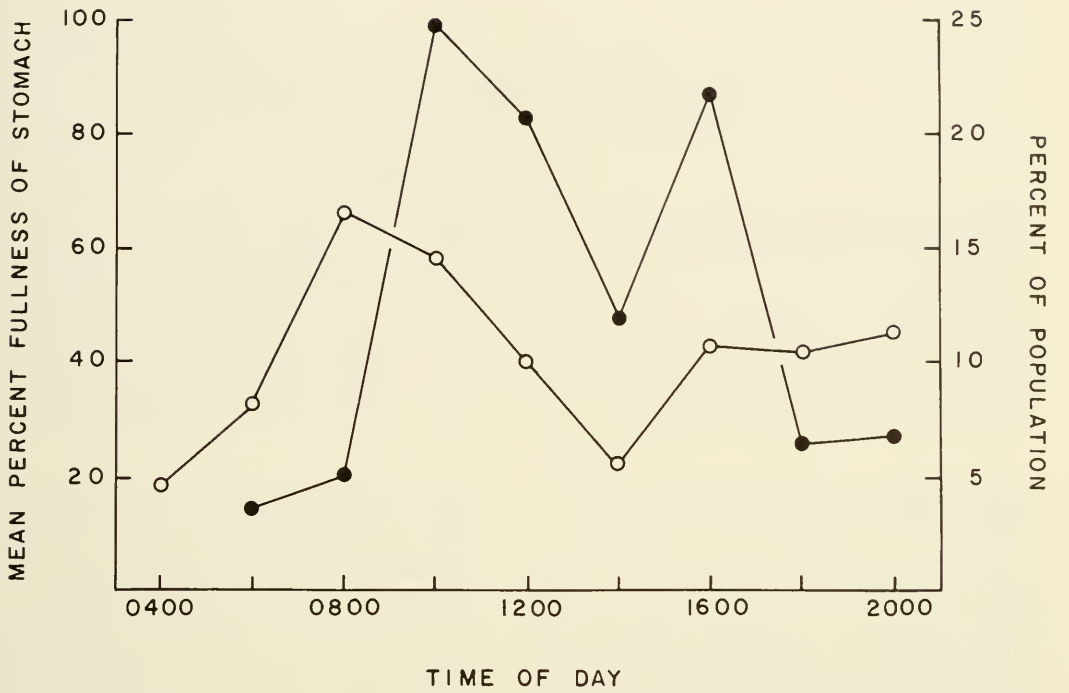

Fig. 1. Diel feeding periodicity measured as mean percent fullness of stomachs of fish captured at 2-hr intervals (open circles) and activity patterns (solid circles) of White River springfish at Hot Creek Spring, Nevada, on 24–26 August 1966. Diel activity pattern is a weighted average of patterns for 24–25 and 25–26 August 1966 and is expressed as the percent of the captured population that was taken during each interval (Deacon and Wilson 1967).

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