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## Observations on the Diets of *Rana pretiosa*, *Rana pipiens*, and *Bufo boreas* from Western Montana

### Abstract

Observations were made on the activities of feeding and habitat utilization of *Rana pretiosa* and *Rana pipiens* in Western Montana. Stomach samples from 50 *R. pretiosa* and 52 *R. pipiens* were analyzed. The diets were similar in taxonomic composition but varied in the dependence upon the taxa. The 40 families of insects and a variety of other organisms in the diets included ground-dwelling, foliage-feeding, and flying forms. Stomach samples from seven *B. boreas* contained primarily ground-dwelling forms.

### Introduction

The diets of *Rana pretiosa* (Spotted frog), *Rana pipiens* (Leopard frog), and *Bufo boreas* (Boreal toad) have been studied in other parts of their respective ranges (Kelby, 1945; Linzey, 1967; Moore and Strickland, 1954, 1956; Turner, 1960; Whitaker, 1961; and Campbell, 1970), but have received little attention in the mountainous sections of western Montana.

Black discussed the distributional patterns of the genus *Rana* (Black, 1969) and the genus *Bufo* (Black, 1971) in Montana. The physiography of western Montana was also discussed by Black (1969).

The purpose of the present study was to examine the diets of *Rana pretiosa* and *Rana pipiens* from the Northern Flathead Valley, Montana. Lesser emphasis was placed on the diet of *Bufo boreas*.

### Methods

Specimens were observed and collected at 14 riparian localities (Table 1) in the Flathead Valley during June, July, and the first week of August, 1974.

General activities of feeding and habitat selection were noted for each species. The habitats which were frequented by the ranids as well as those which were avoided were measured for height and density of the vegetation.

Only those specimens which contained food material were sacrificed. The number of members of each taxon of food items was recorded.

### Results

Observations of the feeding behavior of the anurans indicated that they selected food items which were moving. Unsuccessful attempts to feed on an insect resulted in the ingestion of plant material or debris.

The habitats which were utilized by the ranids were similar in height and density of vegetation (Fig. 1). The available habitat varied from no vegetation to over 3000

stalks per square meter. The height of the grasses ranged to more than 2 m. Both frogs avoided sections of vegetation which contained more than 2000 stalks per square meter and which were more than 1 m in height. The excluding effect of density was reduced in grasses less than 15 cm in height. The excluding effect of height was reduced when the density was below 700 stalks per square meter. The diameter of the grasses ranged from 0.1 cm to 1.0 cm; mean approached 0.4 cm.

TABLE 1. List of sites, loci,<sup>1</sup> and resident species utilized in the study.

Location	Loci	Resident Species
Jette Pond	T23N, R21W, S2	1, -, 3
Jette Lake	T23N, R21W, S14	-, 2, 3
Roger's Lake	T27N, R27W, S30	1, 2, 3
Mud Lake	T31N, R19W, S9	1, 2, 3
Smith Lake	T27N, R22W, S7 & 9	-, 2, 3
Lion Lake	T30N, R19W, S9 & 16	1, -, 3
Ranch Slough	T31N, R19W, S21	-, 2, -
Morning Slough	T29N, R20W, S3	-, 2, -
Spoon Lake	T31N, R20W, S3	1, -, 3
Telephone Bog	T31N, R20W, S2	1, -, -
MacWeneger Slough	T29N, R20W, S31	-, 2, -
Skaggs Lake	T31N, R25W, S22 & 27	1, -, -
Doris Creek	T29N, R19W, S1	-, 2, -
Halfmoon Creek	T30N, R21W, S2	1, -, -
1 <i>Rana pretiosa</i>		
2 <i>Rana pipiens</i>		
3 <i>Bufo boreas</i>		

<sup>1</sup>from U.S. Department of Agriculture, Forest Service, Map: Flathead National Forest (north half).

*Rana pretiosa* was not found more than 10 m from the edge of water (Fig. 2). Adults sat in shallow water or near the margin of the water. Juveniles were noted foraging further away from water than the adults.

*Rana pipiens* was not found more than 20 m from the edge of water (Fig. 2): both adults and juveniles were observed at various distances from the water.

Only two sites were found to be coinhabited by the ranids. Temporal separation occurred between the ranids at Mud Lake and, to a lesser extent, at Roger's Lake. Analysis of samples from the stomachs of 50 *Rana pretiosa* and 52 *Rana pipiens* illustrated that the frogs fed primarily upon the same food items (Table 2).

The presence of 40 families of insects and a variety of other organisms in the diet demonstrated the versatility of the feeding behavior of the frogs. Ground-dwelling insects, foliage-dwelling insects, and flying insects in the samples indicated that the frogs fed opportunistically.

The composition of the samples confirmed that the frogs fed primarily in the riparian habitat but occasionally fed in bordering meadows and woodlands. This behavior was supported by repeated observations.

Samples from the stomachs of seven *Bufo boreas* illustrated that the toads fed upon ground-dwelling insects (Formicidae and Carabidae) (Table 2). All samples contained Formicidae and pine needles plus other ground debris. Two samples contained only Formicidae and debris.

#### Discussion

The variety of dietary items which were represented by only one or two specimens from a family resulted from variations in the habitats which surrounded the 14 collection

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Resident Species

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- 1, 2, 3
- 1, 2, 3
- , 2, 3
- 1, -, 3
- , 2, -
- , 2, -
- 1, -, 3
- 1, -, -
- , 2, -
- 1, -, -
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- 1, -, -

Forest (north half).

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sites and the associated insect fauna. Oliver (1955) placed emphasis upon the individual situation to account for variation in the composition of samples.

Repeated observations of the frogs confirmed that both fed upon any item which was of appropriate movement. The size of the item executed limited effect upon selection but did limit ingestion. Turner (1960) found that among *Rana pretiosa* juvenile frogs fed upon small prey but that adults ingested large and small prey. An analogous situation existed for *Rana pipiens*. Adult leopard frogs consumed Aeschnidae, Libellulidae, and newly metamorphosed toadlets, whereas juveniles did not. Juveniles were observed to attempt to consume the odonates, but all attempts failed before ingestion.

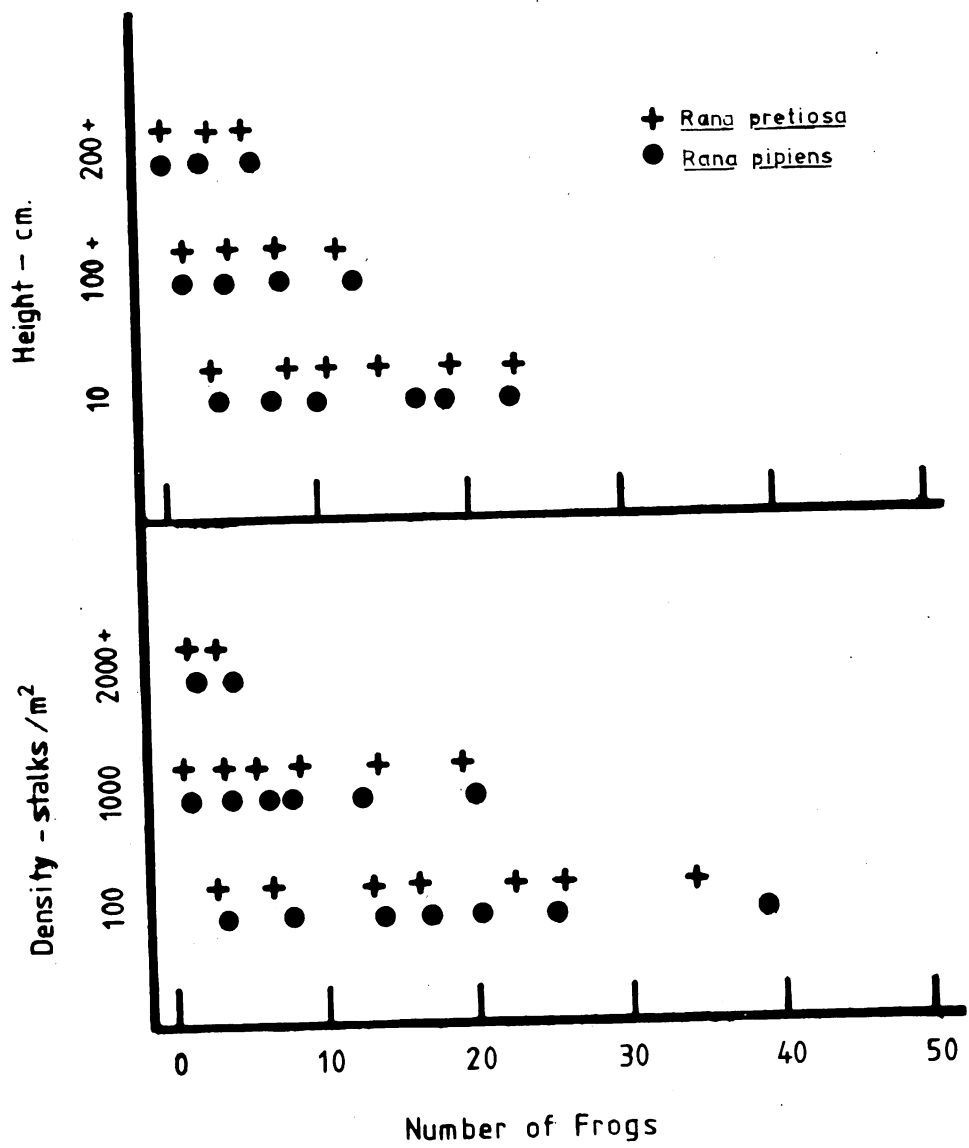


Figure 1. The relationship of the number of frogs to the height and to the density of the vegetation.

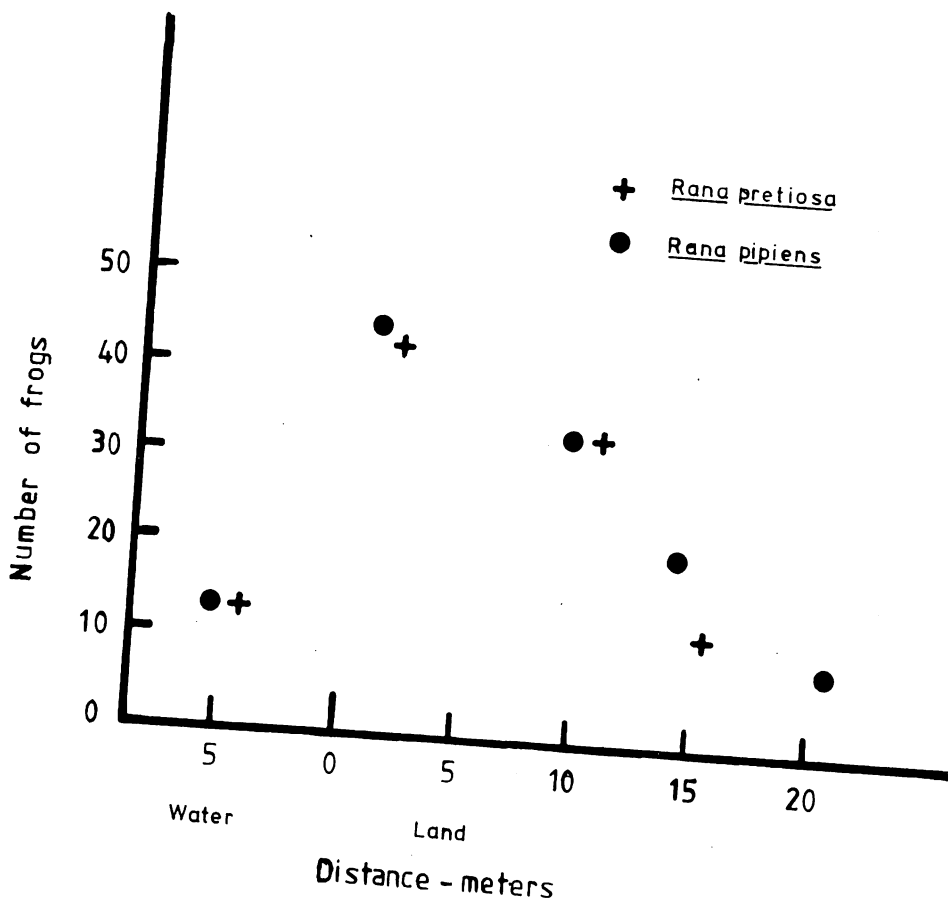


Figure 2. Location of frogs in relation to distance from water.

Whitaker (1961) and Turner (1960) demonstrated that abundance and availability of prey affects the diet. Abundance was dependent upon the life cycle of the prey (Linzey, 1967; Whitaker, 1961); availability was determined by the co-utilization of a habitat by prey and predator.

The consumption of 40 Coenagrionidae by *Rana pipiens* resulted from the abundance and availability of the dragonflies. The odonates were abundant along the margin of Smith Lake in mid-July which is the time of emergence. The odonates were available to the frogs because the vegetation in the area frequented by the frogs and dragonflies was short and thus brought the two physically close. Individual frogs were found to contain one, two, or three dragonflies along with other food items. No frog contained odonates exclusively.

Linzey (1967) reported that one or more families of insects form a stable portion of the diet. Carabidae, Chrysomelidae, and Tenebrionidae formed the major portion (~35 percent) of the diet of each ranid throughout the period of collection.

The diet of *Bufo boreas* as illustrated by this study did not differ in principle from the diet reported from other parts of the range (Campbell, 1970; Moore and Strickland,

TABLE 2. Comparison of ingested matter excluding inorganic and vegetable matter in selected specimens of *Anura* from northwestern Montana.

Food Item	R. pretiosa N = 50		R. pipiens N = 52		B. boreas N = 7	
	No.	%	No.	%	No.	%
<b>INSECTA</b>						
Coleoptera		34.8		35.3		23.3
Cantharidae	7		3		-	
Carabidae	76		39		66	
Chrysomelidae	14		31		2	
Cicindelidae	10		1		1	
Coccinellidae	3		2		-	
Curculionidae	18		6		18	
Dytiscidae	3		1		1	
Elateridae	4		2		4	
Halplidae	1		-		-	
Histeridae	1		-		-	
Meloidae	1		-		-	
Scarabaeidae	2		7		-	
Silphidae	-		7		1	
Staphylinidae	4		11		1	
Tenebrionidae	20		16		21	
Unidentified	13		5		-	
Diptera		9.2		11.3		0.4
Anthomyiidae	-		2		-	
Calliphoridae	11		-		-	
Chironomidae	5		18		-	
Dolichopodidae	-		6		-	
Muscidae	4		3		1	
Simuliidae	5		2		-	
Syrphidae	2		1		-	
Tipulidae	15		8		1	
Unidentified	4		2		-	
Hemiptera		5.0		4.5		-
Gerridae	18		7		-	
Miridae	3		2		-	
Nepidae	1		-		-	
Pentatomidae	1		1		-	
Reduviidae	2		-		-	
Saldidae	1		5		-	
Homoptera		0.4		0.5		-
Cercopidae	1		1		-	
Cicadellidae	1		-		-	
Membracidae	-		1		-	
Hymenoptera		22.4		9.7		75.3
Apidae	4		3		-	
Bombidae	1		-		-	
Formicidae	100		23		372	
Ichneumonidae	-		1		-	
Megachilidae	1		1		-	
Sphecidae	2		5		1	
Vespidae	7		3		-	
Lepidoptera		4.6		1.9		0.6
Adult	2		-		-	
Larvae	22		7		3	
Odonata		1.7		13.8		-
Aeschnidae	-		4		-	
Coenagrionidae	9		40		-	
Libellulidae	-		7		-	
Orthoptera		1.7		4.3		0.4
Acrididae	1		11		2	
Gryllacrididae	1		-		-	
Tetrigidae	7		5		-	
Plecoptera	2	0.4	2	0.5	-	-
Trichoptera	4	0.7	3	0.8	-	-

TABLE 2—Continued

Gastropoda	22	4.2	16	4.3	-	-
Arthropoda						
Arachnoida		14.5		11.6		3.0
Acarina	2		1			
Araneida	68		42		13	
Opiliones	4		2		2	
Chilopoda	-	-	1	0.2	-	-
Diplopoda	-	-	-	-	-	-
Julida	-	-	2	0.5	3	0.6
Amphibia						
Salientia						
Bufonidae	-	-	4	1.1	-	-
Total	517	100	373	100	513	100

1954). *Bufo boreas* fed upon such ground-dwelling forms as Formicidae, Carabidae, and Araneida. However, dependence upon specific taxa did vary. The apparent dependence upon Formicidae resulted from the small number of toads in the sample. Campbell (1970) defined the utilization of Formicidae by toads within the perspective of a larger sample. Formicidae formed a stable portion of the diet.

The similarity of the diets of the frogs indicated that competition for food items may at times be acute as a result of a reduced abundance and availability of prey. However, the temporal separation between the ranids noted by Black (1969) and Dumas (1964) restricted the areas of competition. *Rana pretiosa* populated the mountain lakes, ponds, and streams; *Rana pipiens* inhabited the slough, ponds, and lake margins of the valleys. Both species coinhabited several locations in the foothill regions of the Flathead Valley.

The observed abundance of food items served to reduce potential competition between the ranids at coinhabited sites. The frogs were observed to remain segregated at coinhabited sites. At Mud Lake *Rana pretiosa* inhabited a relatively cold spring-fed stream while *Rana pipiens* inhabited the margin of the lake. At Roger's Lake, *Rana pretiosa* was seldom observed in the same locations as *Rana pipiens*. *Rana pretiosa* was common along the beach areas of the northern shore, and *Rana pipiens* was common along the vegetated margin of the southern shore of the lake.

Temporal separation also restricted potential competition between the ranids and the bufonid. The frogs were active diurnally and the toad was active nocturnally.

#### Conclusion

*Rana pretiosa* and *Rana pipiens* inhabited a variety of vegetated areas but avoided areas of extreme density and height. Both frogs remained close to the water.

The diets of the ranids exhibited similar taxonomic composition. However, dependence upon specific families of insects varied. The variations were attributed to differences in abundance and availability of item at the various sites. Ground-dwelling forms were predominant in the diets. As a result of the abundance of food items and temporal separation, competition between the ranids was reduced.

The diet of *Bufo boreas* consisted almost exclusively of ground-dwelling forms. Potential competition for food between the toad and the frogs was reduced by dietary and temporal separation.

### Acknowledgments

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