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APPENDIX I

Specimens Examined

Aspidoscelis neotesselata: Pueblo Chemical Depot, Pueblo County, Colorado, USA. Along south boundary fence, east of Chico Creek, HLT 2 (UTM 13S 555537, 4236036); west side Chico Creek (1): HLT 4–6, 11–13, 22, 107, 136 (UTM 13S 554843, 4236110); (2) HLT 1, 3, 14, 21 (UTM 13S 554856, 4236332); (3) HLT 18–20, 33–38, 133–135 (UTM 13S 554734, 4237814).

APPENDIX II

Meristic Characters

GAB = number of granular dorsal scales in a single row around midbody (the 15th ventral scale posterior to the axilla established the point for beginning this count); COS = bilateral total of circumorbital scales; LSG = sum of lateral supraocular granules on both sides of the head (the count includes all scales between the supraoculars and superciliary scales, anterior to the suture line between the third and fourth supraoculars); FP = sum of femoral pores on both thighs; L-breaks = total number of interruptions by black pigment of the lateral stripes; DL-breaks = total number of interruptions by black pigment of the dorsolateral stripes; PV-breaks = the total number of interruptions by black pigment of the paravertebral stripes; PV = number of scales between paravertebral stripes at midbody; SDL-T4 = number of subdigital lamellae on the fourth toe of one foot (right was chosen unless damaged); ILS = all interlabial scales between the lower labials and sublabials counted anterior to the suture line between 5th and 6th lower labials; SVL = length of body from tip of snout to posterior edge of preanal scales (in mm).

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Diet of *Pipa carvalhoi* (Amphibia, Pipidae) is Not Influenced by Female Parental Care

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Costs of parental care may include increased risk of predation, reduced mating opportunities, and reduced food intake (Crump 1995). The latter cost is particularly important to females as they have a large gametal investment compared to males. Consequently, reduced food intake may limit future clutches, reduce the number of eggs per clutch, and retard growth rate which, indirectly, also may decrease fecundity as it is correlated with female size (Salthe and Duellman 1973).

The benefits of parental care to reproductive success have been documented for certain species, but the costs have been rarely quantified (Crump 1995). Simon (1983) reported reduced feeding in *Cophixalus parkeri* (Microhylidae) and Townsend (1986) found similar results for *Eleutherodactylus coqui* (Leptodactylidae). Parental care in these species requires that the parent remain near the clutch; this behavior may negatively affect foraging activity (Crump 1995).

Crump (1995) suggested that the cost of parental care is reduced in species that transport eggs because carrying eggs adhered to the body does not preclude foraging activity and causes no reduction in the feeding efficiency. Transport of eggs is known in four anuran families: Discoglossidae, Hylidae, Pipidae, and Myobatrachidae (Duellman and Trueb 1986). Female *Pipa* carry eggs in the dorsal skin, where either tadpoles or juveniles emerge, according to the species (Trueb and Cannatella 1986).

Data concerning the diet of *Pipa carvalhoi* (Miranda Ribeiro, 1937) are scarce and anecdotal. The species is aquatic but Myers and Carvalho (1945) observed some individuals leaving a lake during and after a rain, apparently foraging for insects. Weygoldt (1976) described the feeding behavior of *Pipa carvalhoi*, and also reported some types of prey. Nevertheless, his study was performed in the laboratory and, therefore, the number of available kinds of prey was limited. There are no studies analyzing food items in the diet of this species under natural conditions.

We studied the diet of *Pipa carvalhoi* in seminatural conditions and compared the diet of females carrying developing eggs on their backs to the diet of males and females without eggs, in order to analyze the influence of this kind of parental care on feeding.

Material and Methods.—Specimens were collected by U. Caramaschi on 11 March 1986 at the campus of Comissão Executiva do Plano da Lavoura Cacaueira -CEPLAC, Municipality of Ilhéus, State of Bahia, Northeastern Brazil. Specimens were collected in a fishfarm pool with no fish at the time of collecting (U. Caramaschi, pers. comm.). All specimens are deposited in the herpetological collection of Museu Nacional, Rio de Janeiro, Brazil (MNRJ 19527, 19529–30, 19533, 19535–36, 19538, 19540–19550, 19554–19559, 19566, 19573, 19589–90, 19596–97, 19605, 19608, 19610, 19612, 19620, 19633, 19645, 19676, 19685, 19698, 19701, 19704, 19707–19709, 19711, 19714, 19717, 19719, 19728, 19741, 19749, 19760, and 19766). In 2003, 54 specimens were analyzed and grouped into three classes: six females transporting eggs, 20 females without eggs, and 28 males. The snout–vent length (SVL) and the mouth width (MW) of each specimen were measured with calipers (nearest 0.05 mm). The stomachs were removed and food items were identified and counted under a stereomicroscope. Stomach contents were dried in an oven and weighed on an electronic balance (nearest 0.001 g).

Numeric frequency ($\%n_i = n_i / \sum n_{1-n}$ where n_i is the number of prey of category *i*) and occurrence frequency ($\%oc_i = oc_i / N$, where oc_i is the number of stomachs with category *i* and N is the total number of analyzed stomachs) were calculated based on the prey categories found in the stomach contents of each class. Statistical analyses were performed after testing for assumptions (homocedasticity, normality, and parallelism); when appropriate, non-parametric techniques were employed. Analyses of covariance (ANCOVA) were conducted to compare the mass of stomach contents among classes, using SVL as the covariant variable to remove the effect of size difference among classes. The non-parametric Kruskall-Wallis test was performed to compare the

TABLE 1. Total number of prey (N), numeric frequency (%n), and occurrence frequency (%oc) of prey categories in the diet of each class of *Pipa carvalhoi*. NI indicates unidentified items. M (Q_1;Q_3) show the median, first and third quartiles in the distribution of the number of prey per specimen.

	Females carrying eggs			Females without eggs			Males		
Category	N	%n	%oc	N	%n	%oc	N	%n	%oc
Chironomid larvae	288	98.3	100	816	98.1	70.0	1103	99.2	82.1
Diptera – adult	1	0.3	16.7				1	0.1	3.6
Other Diptera Larvae				1	0.1	5.0	2	0.2	3.6
Formicidae	1	0.3	16.7						
Amphipoda				11	1.3	15.0	3	0.3	14.3
Arachnids	2	0.7	33.3						
Pipa tadpole				1	0.1	5.0			
Odonata Larvae				1	0.1	5.0	2	0.2	7.1
NI Arthropoda				2	0.2	10.0			
NI Larvae	1	0.3	16.7				1	0.1	3.6
Fragmented material and grains of sand			66.7			50.0			53.6
M (Q_1;Q_3)	41.5 (16.0;78.0)			17.0 (1.0;45.0)			22.5 (2.0;62.0)		

number of prey in the stomach contents and the number of categories ingested by different classes. Similarity among diets of the different classes was calculated by Pianka's Overlap Index (Krebs 1989).

Results.—Aquatic arthropods were the most frequent prey items we found in *Pipa carvalhoi* stomachs (Table 1). Chironomid larvae represented most of the prey (> 98%) and were found in nearly all specimens of the three classes (%oc varied from 70 to 100%). Fragmented material and grains of sand were also a dominant component of the stomach contents (%oc 50% or higher).

There was no difference in mass of stomach contents among the three classes ($F_{2,44}$ = 0.94; p = 0.40). There were also no differences among classes in number of prey per stomach (H [2, N = 44] = 0.68, p = 0.71) or the number of prey categories per stomach (H [2, N = 54] = 5.23, p = 0.07). The diet of the three classes was qualitatively similar (Overlap Index approximately 0.9999 considering all possible combinations), probably due to the high numeric frequencies of chironomid larvae in all classes.

Discussion.—Our results show that female *Pipa carvalhoi* carrying eggs at this site had no difference in food ingestion compared to males or females without eggs. It suggests that carrying eggs in *Pipa carvalhoi* is a kind of parental care that does not affect diet, at least in the studied population, probably because it does not interfere with the mobility of parents, supporting the hypothesis suggested by Crump (1995).

All three classes appeared to feed mainly in water. If these frogs leave the water to forage, as suggested by Myers and Carvalho (1945), this habit was not frequent in the studied population.

According to Weygoldt (1976), *Pipa carvalhoi* captures chironomid larvae together with sediment and sand, sucking the larvae into the mouth. This author observed that although the frog discards some of the sand before ingesting the larvae, much of the sand and sediment is ingested with the prey. This behavior might explain the high frequency of fragmented material and grains of sand found in the stomach contents of the three analyzed classes.

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