

FOODS OF THE NINE-BANDED ARMADILLO IN FLORIDA*

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Abstract: The foods of 172 armadillos from the recently established Florida population were compared with foods of the native population as reported by various authors. Some differences were observed, but the foods of armadillos in Florida were quite similar to those reported for the species from its native U.S. range. Seasonal variation in the consumption of Coleoptera, Diptera, Lepidoptera, Hymenoptera, Myriapoda, and Annelida were noted.

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Historically an animal of the southcentral United States, Mexico, Central and South America, the nine-banded armadillo (*Dasybus novemcinctus*) was first introduced to Florida about 1920 at Hialeah (Bailey 1924). During a 1924 storm, several additional animals escaped from a private zoo near Cocoa. More armadillos were liberated near Titusville in 1936 when a circus truck overturned (Talmage and Buchanan 1954). The armadillo has since spread over all of peninsular Florida, north from the Everglades to the Aucilla River (Humphrey 1974), and has become one of Florida's most conspicuous mammals.

The native southwestern population is spreading north and east and may soon merge with the westward expanding Florida population (Humphrey 1974). A comparison of the food habits of the native population with those of the burgeoning Florida population would be an important step toward better understanding of the ecology of the introduced Florida population.

Several food studies have been made of the armadillo, most notably: Aldous et al. (undated), Bushnell (1952), Baker (1943), Fitch et al. (1952), and Kalmback (1943). All but Bushnell's study involved the native population and were summarized by Talmage and Buchanan (1954). Bushnell examined 139 Florida armadillo stomachs collected year-round, presumably from the central Florida area.

MATERIALS AND METHODS

For this investigation, armadillos were collected, primarily with a .22 caliber rifle, at several collection sites from Duval County in north Florida to Glades County in south Florida (Fig. 1). Stomach contents were sorted and identified by the second author and L. A. Hetrick. Volume calculations were based on water displacement in a graduated cylinder.

RESULTS

During this investigation, 3.9 liters of foods from 172 stomachs were analyzed (Table 1). Insects accounted for 78.5 percent of the diet by volume. Coleoptera, especially May beetles (Scarabaeidae, *Phyllophaga* sp.), were the single most prominent item. Hymenoptera, Diptera, Orthoptera, and Lepidoptera were also important food items. Florida carpenter ants (*Camponotus abdominalis floridanus*), imported fire ants (*Solenopsis invicta*), as well as *Pheidole divtata*, *Conomyrma pyramicus*, *Nonomiorium minimum*, and *Odontomachus ruginodis* were the main ant species taken. March fly larvae (*Bibionidae*), and fungus gnat larvae (*Mycetophilidae*), horse fly larvae (*Tabanidae*), and crane fly larvae (*Tipulidae*) were the main Diptera taken. Mole crickets (*Gryllotalpidae*) were the main Orthoptera found in the Florida armadillo's diet. Noctuid moth larva were the most heavily used Lepidoptera. Arachnida, predominantly wolf spiders, made up 5.1 percent of the diet by volume. Millipedes (Diplopoda), mainly flat-backed millipedes, and centipedes (Chilopoda) amounted to 8.1 percent, while earthworms (Macrodile) comprised 4.9 percent. Vertebrates, especially amphibians and reptiles, accounted for only 1.5 percent of the diet. Some avian egg shell fragments and the remains of several young cotton rats (*Sigmodon hispidus*) were encountered. A small amount of vegetation, mainly seeds and berries, consistently occurred in the armadillo's diet.

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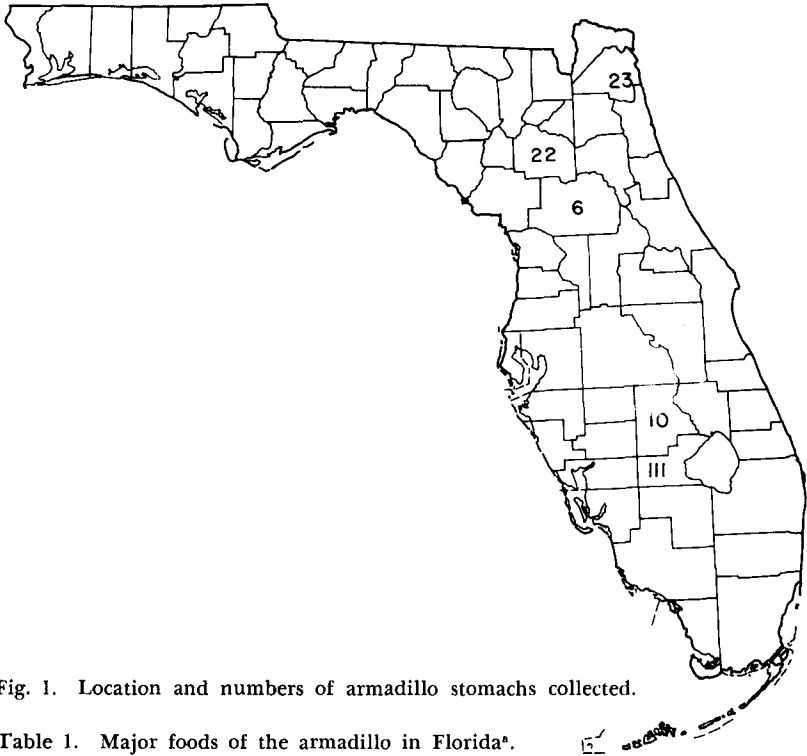


Fig. 1. Location and numbers of armadillo stomachs collected.

Table 1. Major foods of the armadillo in Florida*.

<i>Item</i>	<i>TOTAL (N-172)</i>	
	<i>Volume ml-%</i>	<i>Frequency Total Number of Occurrences-%</i>
Coleoptera	1,162.8 - 29.71	927 - 34.10
Diptera	519.0 - 13.26	299 - 10.49
Orthoptera	412.8 - 10.54	412 - 14.45
Lepidoptera	360.8 - 9.21	245 - 8.59
Hymenoptera	589.9 - 15.07	269 - 9.43
Hemiptera	3.4 - 0.08	26 - 0.91
Homoptera	11.8 - 0.30	17 - 0.59
Neuroptera	1.3 - 0.03	3 - 0.10
Dermoptera	4.4 - 0.11	17 - 0.59
Isoptera	4.4 - 0.11	17 - 0.59
Odonata	0.2 - 0.01	2 - 0.07
Arachnida	199.4 - 5.09	6 - 3.48
Myriapoda	315.5 - 8.06	217 - 7.61
Annelida	190.2 - 4.86	78 - 2.73
Mollusca	6.7 - 0.17	16 - 9.30
Crustacea	38.4 - 0.98	10 - 0.35
Vertebrata	60.0 - 1.53	52 - 1.82
Amphibia	60.0 - 1.53	52 - 1.82
Reptilia	15.1 - 0.38	11 - 0.38
Avis	1.3 - 0.03	2 - 0.07
Mammalia	17.0 - 0.43	3 - 0.10
Vegetation	32.4 - 0.82	56 - 1.95

*More detailed information from author on request.

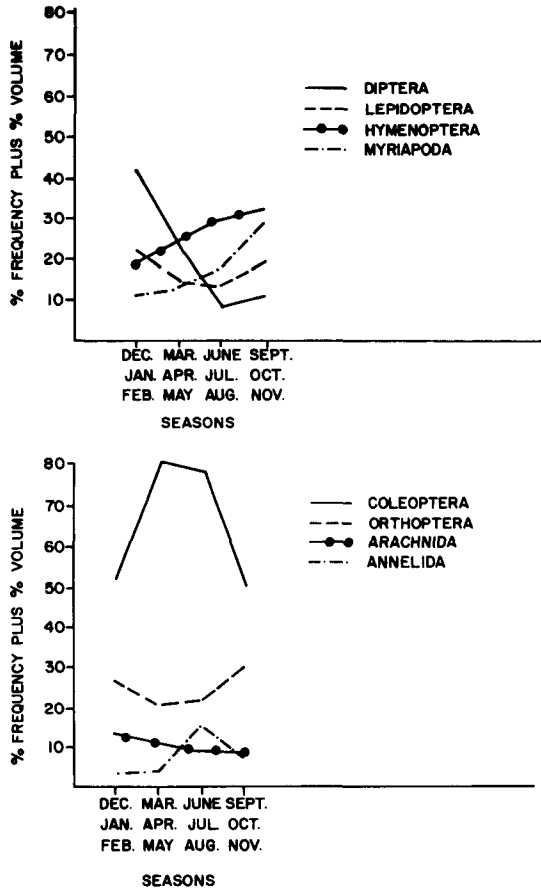


Fig. 2. Seasonal variations in percentage consumption (% volume + % frequency) of major food items in the armadillos diet.

Some seasonal variations in the occurrence of major food items were noticed (Fig. 2). Coleoptera were more prevalent in the spring-summer diet. Ants occurred at a slightly higher rate during the fall season. Lepidoptera larvae appeared to be slightly more important in the fall-winter diet. Centipedes were taken at a consistent rate throughout the year, but millipedes were more common in the fall diet. This accounts for the fall peak (Fig. 2) in the consumption of Myriapoda. Earthworms were most prevalent in the summer diet. Normally, this is a rainy season in Florida which would make distressed earthworms more available to foraging armadillos. Spiders, vertebrates and vegetation occurred in the diet at about the same rate year-round.

DISCUSSION

The diet of the armadillo in Florida compares closely with armadillo diets described for other areas. Table 2 compares the diet as derived from this study with diets reported from five previous investigations. Substantial differences did not occur among these diets. Superficially, differences seemed to occur in the consumption of Diptera larvae. However, further analysis of the results shows Diptera consumption to be highly seasonal. Fitch et al. (1952) found that in armadillo diets in Louisiana, Diptera larvae were most important in the spring. The spring period was poorly represented in Kalmback's report on the diet of Texas armadillos (Kalmback 1943) though Kalmback did find Diptera

most common in the May diet. The spring period in Louisiana and Texas probably corresponds with the winter-spring period in Florida when Diptera larvae were most important in the armadillo diet. Bushnell (1952) unfortunately did not separate Diptera from other "miscellaneous" insects. Similarities between the diets of the native armadillo populations and the recently established Florida population suggest armadillos consistently feed on the same prey types even in quite different habitats.

The armadillo in Florida consumes a number of economically important pests. One individual consumed 245 fall army worms (*Spodoptera frugiperda*). The most common cockroach encountered was the Surinam cockroach (*Pycnocelus surinamensis*) and one of the main Orthopterans occurring in the diet were eggs of the lubber grasshopper

Table 2. Comparison of Armadillo Food Studies by Percent Volume.

Item	Kalm- bach (1943) ^a	Baker (1943) ^a	Aldous et al. ^a (undated)	Bush- nell (1952)	Fitch et al. (1952)	Present Study
Insecta	77.6	77.4	(70.2) ^c	69.9	(66.0) ^d	78.5
Coleoptera	41.6	56 ^b	27.2	34.5	42.6	29.7
Scarabaeidae	27.9	23 ^b	13.5	23.1	—	22.2
Carabidae	9.4	20 ^b	9.2	6.5	—	1.1
Elateridae and other Coleoptera	4.3	13 ^b	4.5	5.2	—	6.4
Hymenoptera	14.0	10 ^b	16.4	12.2	4.2	15.1
Lepidoptera	7.8	13 ^b	7.2	5.1	4.2	9.2
Orthoptera	6.2	13 ^b	8.2	17.8	9.3	10.5
Isoptera	4.5	1 ^b	8.0	17.8	1.1	0.1
Hemiptera	2.0	—	0.5	17.8	0.9	0.1
Diptera	1.5	1 ^b	2.7	17.8	3.7	13.3
Arachnida	1.7	+	4.1	2.2	2.3	5.1
Myriapoda	6.2	1.0	+	2.2	8.6	8.1
(Isopoda, Crustacean Annelida, Mollusca)						
Total	6.2	13.8	4.5	15.6	6.3	6.0
Amphibians & Reptiles (including eggs)	1.2	0.9	2.4	2.4	5.2	1.0
Mammals & Birds (including eggs)	0.4	—	4.5	2.4	—	0.5
Vegetable matter						
Total	6.7	2.6	12.2	9.9	10.3	0.8
Possible food	2.1	2.6	—	—	—	0.5
Debris	4.6	+	12.2	—	—	0.3

^aAfter Talmage and Buchanan 1954.

^bFrequency in 25 stomachs.

^cSummary inferred from original authors.

(*Romalea microptera*).

Armadillos have been suggested as a possible predator of the eggs of ground nesting birds (Fuller 1927, and others). Taber (1945) found captive armadillos showed no interest in unbroken chicken eggs. Kalmbach in 1943 summarized the work of Lehman (1934), Aldous (1936) and his own work with dummy nests, testing the magnitude of armadillo disturbance to the eggs of bokwhite (*Colinus virginianus*) and turkey (*Meleagris gallopavo*). Kalmbach concluded that "While armadillos certainly destroyed some eggs of ground-nesting birds, the extent of this predation is not considered excessive." In a more recent study, Breece and Causey (1973) reported that during 300 dummy nest nights, 25 of 96 destroyed nests were attributed to armadillos. Breece and Causey concluded that "though their data show armadillos will consume quail eggs under certain

conditions, armadillo predation upon natural nests is unknown and possibly insignificant." During our study, bird egg shell remains were encountered in only one stomach. If, as suggested (Taber 1945), armadillos break the eggs before consuming the contents, shell remains would not always be present.

The armadillo apparently consumes food as it is encountered and does not selectively prey on any particular items. Such random feeding methods would obligate the armadillo to consume reptiles, amphibians, nestling cotton rats, or the eggs of ground-nesting birds whenever they were encountered, along with the more orthodox components of their diet. The frequency of such encounters would probably be quite limited and the effects of such predation on a given population of quail or turkeys or other ground-nesting birds would likely be negligible.

SUMMARY

Main foods of the armadillo in Florida were Coleoptera (29.7%), Hymenoptera (15.1%), Diptera (13.3%), Orthoptera (10.5%), and Lepidoptera (9.2%). Some vertebrates, mostly amphibians and reptiles, were also consumed.

Diptera were most important in the winter-spring diet and Lepidoptera in the fall-winter diet. Hymenoptera were prominent in all seasons. Myriapoda were a prominent item in the fall diet and earthworms were most important during the summer season.

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