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USE OF FLORIDA ROUND-TAILED MUSKRAT HOUSES BY AMPHIBIANS AND REPTILES

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Abstract.—Black swamp snakes (*Seminatrix pygaea*) and two-toed amphiumas (*Amphiuma means*) are reported for the first time as associates of Florida round-tailed muskrat (*Neofiber alleni*) houses at four pond sites near Lake Delancy, Ocala National Forest, Putnam County, Florida. At least 12 other species of amphibians and reptiles have been recorded in the literature as associates of this rodent. These data suggest that the nest of *Neofiber alleni* contribute significantly to the species diversity of wetland habitats in Florida.

The Florida round-tailed muskrat (*Neofiber alleni)* is an aquatic rodent associated with vegetated marshes and ponds in Florida and southeastern Georgia (Birkenholz 1972). This mammal usually constructs houses of tightly-woven grasses and other plant material in shallow, fluctuating pools with abundant vegetation. Active houses are dome-shaped, 17-60 cm in diameter, and generally rest upon a base of decaying vegetation in the pond (Birkenholz 1963). These structures have been shown to be havens for aquatic and semiaquatic amphibians and reptiles (Schwartz and Duellman 1952, Porter 1953, Birkenholz 1963, Lee 1968). This paper notes the occurrence of two additional species of amphibians and reptiles that use these structures.

METHODS

We sampled 13, 2, 3, and 7 *Neofiber alleni* houses at four sites near Lake Delancy in the Ocala National Forest, Putnam County, Florida. The first three ponds were located on the north and northeast sides of Lake Delancy (Site 1— sec.22, t.18S, r.25E;

Sites 2 and 3— sec.23, t.18S, r.25E), and the fourth site was south of the lake (sec.26, t.18S, r.25E). We sampled all available houses at each site.

We considered the 18 houses at Sites 1 to 3 to be abandoned; the seven houses at Site 4 were active and appeared to be freshly constructed. The abandoned houses were completely saturated with water, and only the uppermost layers of plant material floated near or at the water surface. The complete inundation of these structures probably resulted from heavy rains in late fall and winter that dramatically raised water levels in local ponds. Active houses extended 5 to 8 cm above the water surface and the living grasses surrounding the platform were bent inward to form a canopy. The foundations of active and abandoned houses rested on or near the pond bottom.

Sites 1, 2, and 4 were seasonal ponds that formed in shallow sinkhole depressions, whereas Site 3 was on the northern edge of a large wet prairie that probably was connected with Lake Delancy during periods of high water. Sites 1, 2, and 4 also lacked fish populations, but Site 3 supported centrarchids, *Fundulus chrysotus*, and *Gambusia holbrooki*.

Houses at each site were located in water less than 1 m deep. Ponds had extensive growths of emergent vegetation, particularly maidencane (*Panicum hemitomon*), bog button (*Eriocaulon* sp.), yellow-eyed grass (*Xyris* sp.), and dog fennel (*Eupatorium* sp.) and were edged with narrow fringes of saw palmetto (*Serenoa repens*) and slash pine (*Pinus elliottii*). The sand hills that surround these wetlands are modified sand pine (*Pinus clausa*) scrub in the northern part of the Ocala National Forest.

Amphibians and reptiles were obtained by rolling the entire plant mass of each house into large dip nets. We separated the associated snakes and salamanders from the plant matter and placed them in holding containers. We obtained snout-vent length (SVL), total length (TL) (to the nearest mm), and body mass (to the nearest 0.1 g) for each snake. Sex was determined by probing each snake's cloaca. We kept swamp snake data sets separate for four of the houses at Site 1. One swamp snake was retained as a voucher in the collection of the Florida Museum of Natural History (UF 87751). We measured TL for three amphiumas, which represented extremes in body sizes in the salamander sample; these salamanders were preserved as vouchers (UF 87691-3). The rest of the amphiumas were released following the completion of sampling.

RESULTS

Seminatrix pygaea.— We caught 64 black swamp snakes (25 females, 39 males) at 11 of 13 houses at Site 1. The two houses that lacked snakes appeared to be older than the others and floated slightly lower in the water column. No other vertebrates were found in these structures. All captures occurred between 1430-1530 hrs EST on 28 March 1993. The mean number of snakes per nest (excluding the two older nests) was 5.8 (range= 2-12, SD= 3.1).

Most of the black swamp snakes were between 21.0 and 23.0 cm SVL (Table 1). The mean SVL of males was 22.7 cm, compared with a mean of 22.1 cm in females (Table 1). Females are reported to attain sexual maturity at 24.0 cm SVL (Dowling 1950, Gibbons and Semlitsch 1991), whereas the minimum size for males is not known. However, if we assume that 24.0 cm SVL is the minimum size for both sexes, then we estimate that 83% of the captured snakes are immature.

Table 1. Summarized data for *Seminatrix pygaea* at Site 1 in the Ocala National Forest in March 1993.

	Mean	Range	SD
Males (n=39)			
Snout-vent length (cm)	22.7	19.1-25.7	1.51
Total length (cm)	28.4	23.7-31.8	1.87
Weight (g)	9.6	5.9-13.4	1.82
Females (n=25)			
Snout-vent length	22.1	18.0-27.5	2.31
Total length	25.9	21.5-32.6	2.72
Weight	9.4	6.4-16.9	2.49

The overall male/female ratio was 1.5:1 and was not significantly different from 1:1 (χ^2= 1.53, df = 1, P > 0.10). The numbers of males to females in the four houses with separate data sets were 3:1, 4:0, 8:4, and 5:2.

Amphiuma means.— Two amphiumas were recovered in each flooded house at Site 2; one, three, and three were taken from three houses at Site 3. None were found in the active houses at Site 4. Houses were sampled in mid-morning on 6 April 1993. Three voucher specimens (13.5, 15, and 16.9 cm TL) from Site 3 represented the extremes in body sizes for the sample. All of the amphiumas in the *Neofiber* houses were immature based on their small size.

DISCUSSION

The presence of *Seminatrix pygaea* and *Amphiuma means* in *Neofiber* houses is not surprising in light of literature reports of both species commonly burrowing into soft substrates and using aquatic vegetation as shelter (Ashton and Ashton 1988a, 1988b, Goin 1947, Mount 1975). The data for swamp snakes can be compared with information presented by Dodd (1993) from Breezeway Pond, Putnam County, Florida. He found that 89.1% of 123 snakes that were caught in pitfall traps were juveniles and that the sex ratio was not significantly different from 1:1 (45 males/49 females). Breezeway Pond snakes were caught as they moved in and out of this seasonal pond. The presence of large numbers of immature *Seminatrix* in this sample supports Dodd's contention (Dodd 1993) that isolated, ephemeral wetlands may serve as important developmental habitats for certain amphibians and reptiles in Florida.

Hansell (1993) suggested that the presence of nest building and burrowing species can significantly contribute to species diversity in

habitats and become the focus of important dependent relationships. The presence of 16 amphibian andreptile associates indicates that *Neofiber* houses play important roles in maintaining diversity in wetland habitats with variable hydroperiods in Florida and southeast Georgia (Table 2). Five salamanders and one snake gain protection from predators by living within the flooded woven structures of these houses. They also probably extract a portion of their food supply from the amphibian larvae and invertebrates, particularly aquatic annelids and insects, which can be abundant on the sides and in the interior of the submerged houses. At least seven species of frogs and snakes are known to use above-water parts of the houses as calling, basking, or feeding sites, and another 12 species have been found under stranded-houses during periods of low water (Table 2). Species that are sheltered by the stranded houses gain temporary protection from dehydration and from predation as ponds dry and shrink in size.

Table 2. Amphibians and reptiles associated with the houses of the round-tailed muskrat (*Neofiber alleni*).

Habitat structure	Reference
Houses (in the flooded structure)	
Siren lacertina, greater siren	Lee 1968
Pseudobranchus axanthus, dwarf siren	Lee 1968
Eurycea quadridigitata, dwarf salamander	Lee 1968
Notophthalmus viridescens, peninsula newt	Lee 1968
Amphiuma means, two-toed amphiuma	this study
Seminatrix pygaea, black swamp snake	this study
House roof structures (calling, basking, and feeding sites)	
Gastrophryne carolinensis, narrowmouth frog	Lee 1968
Bufo quercicus, oak toad	Lee 1968
Acris gryllus, Florida cricket frog	Lee 1968
Hyla squirella, squirrel treefrog	Lee 1968
Pseudacris nigrita, Florida chorus frog	Lee 1968
Rana utricularia, southern leopard frog	Lee 1968
Various watersnakes	Lee 1968
Under stranded houses	
Notophthalmus viridescens, peninsula newt	Schwartz and Duellman 1952, Lee 1968
Newly transformed frogs (9 species)	Lee 1968
Eumeces inexpectatus, southeastern five-lined skink	Porter 1953
Sistrurus miliarius, dusky pigmy rattlesnake	Lee 1968

Round-tailed muskrat populations have showed declines in Florida, and the species was listed as a Species of Special Concern by the Florida Committee on Rare and Endangered Plants and Animals (Lefebvre and Tilmant 1993) and as a candidate (C2) for federal listing (Wood 1993). Concerns include the vulnerability of wetland habitats to fragmentation and destruction by human activities and to drastic fluctuations in water levels during flood and drought periods (Lefebvre and Tilmant 1993). Loss of *Neofiber* from wetland systems could threaten certain aquatic amphibians and reptiles by increasing their vulnerability to predation and dehydration, particularly during periods of drought.

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