

RESULTS OF THE ARCHBOLD  
EXPEDITIONS. No. 45

MAMMAL NOTES FROM HIGHLAND COUNTY, FLORIDA

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BY A. L. RAND AND PER HOST

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BULLETIN  
OF  
THE AMERICAN MUSEUM OF NATURAL HISTORY

VOL. LXXX, ART. I, pp. 1-21

*New York*

*Issued August 12, 1942*

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Article I.—RESULTS OF THE ARCHBOLD EXPEDITIONS. NO. 45

MAMMAL NOTES FROM HIGHLAND COUNTY, FLORIDA

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TABLES I TO V AND TEXT FIGURE 1

Sherman (1936, A List of the Recent Land Mammals of Florida, Proc. Fla. Acad. Sci., I, pp. 102-128) has given a distributional summary of Florida mammals. This and several subsequent regional papers have indicated the need for additional data on Florida mammals.

The present list is not complete but is the result of observation and trapping carried on while establishing the Archbold Biological Station in Hicoria, near Lake Placid, February, 1941, to January, 1942. Most of it was incidental to other work in which we were engaged, but part of the time we had Mr. Garvin Shackelford of Hicoria carry on trapping for small mammals. Host is responsible for the notes on parasites and most of the stomach contents, and all the write-up of *Peromyscus polionotus*; Shackelford made most of the measurements and took the weights. The rest is a combining of our notes. Samples were kept of most parasites, and the specimens collected will be deposited in The American Museum of Natural History. The mammals have been identified to species only, so we have not added subspecific designations. Sometimes the English book name is followed by its "right name," that is, what it is locally called.

The area covered most intensively is the area from the town of Lake Placid to that of Venus, about twenty miles north and south, and a few miles east and west of this line. This includes the southern end of the sand scrub hill country of the lake region characterized by oaks and spruce pine (*Pinus clausa*) and some *P. caribaea*; the pine (*P. caribaea*) flatwoods to the west and south; the line of wooded swamp, locally called the "baygall" to the east, and scattered areas elsewhere; and the edge of the marsh and grand prairie that stretches eastward to the Kissimee River and Lake Okeechobee.

Perhaps the most striking thing about the mammal life here is the relative paucity of small mammals and the comparative abundance of such medium sized animals as opossum, raccoon and fox. The following data give some idea of relative abundance.

In the 1,080 acres of sand scrub that comprise the property of Archbold Biological Station, a certain amount of "vermin control" had been practiced before we acquired it. Mr. J. W. Kelsey, in charge of maintenance, supplied us with the records kept of the animals trapped from January, 1932, to July, 1941. They are:

TABLE I

	9½ years	Average per year
Opossum	106	11.2
Skunk	53	5.6
Fox	52	5.6
House cat	42	4.4
Wild cat	3	0.3
Weasel	2	—

No raccoons were recorded, trapped animals being released.

The animals were trapped throughout the year. No effort was made to take as many as possible, but a line of about seven traps was set occasionally to keep down their numbers.

These animals seem as common on the property now as on contiguous areas where there was no trapping. The chief interest in these figures is that they give a clue to the relative abundance of the various animals. Raccoons on the property are about as common as opossums, though elsewhere raccoons are perhaps somewhat less common than opossums. Both striped and spotted skunks are included under skunks, but Mr. Kelsey told us most of those caught were striped skunks.

The following data are from Shackelford's notes on trap yields, to give an indication of the relative abundance of small mammals:

Sept. 6. 54 traps in sand scrub of property yielded *Oryzomys*, 1; *Peromyscus gossypinus*, 2.

Sept. 9-12. 216 trap nights in palmettos and oak scrub with a little grass yielded *P. gossypinus*, 12; *Oryzomys*, 5.

Oct. 7-9. 150 trap nights in sand scrub on property yielded nothing.

Oct. 15-17. 150 trap nights in the grass and palmetto of the flatwoods yielded *P. gossypinus*, 6; *Sigmodon*, 7; *Oryzomys*, 2.

Oct. 21-25. 300 trap nights in open, low sand scrub yielded *Peromyscus floridanus*, 6; *P. polionotus*, 5.

Nov. 4-6. 180 trap nights in the palmetto and grass of the flatwoods yielded *Peromyscus gossypinus*, 1; *Sigmodon*, 2.

Nov. 19-21. 400 trap nights in scantily grassed and weed-grown abandoned clearing and its palmetto edges on the hill country yielded *P. polionotus*, 7; *P. floridanus*, 2; *Reithrodontomys*, 1.

Dec. 10-18. 900 trap nights in an old, densely grassed field and in the adjacent edge of the cabbage palmetto and wooded swamp yielded *P. gossypinus*, 4; *Oryzomys*, 4; *Blarina*, 6; *Reithrodontomys*, 2.

### *Didelphus virginianus* Kerr

#### Opossum, Possum

Common and generally distributed. As elsewhere it is commonly killed on the highways by cars. The number of fatalities in this species is exceeded only by those of cottontails. Two opossums were found in the daytime with the aid of a terrier. One was about a yard down an abandoned gopher turtle burrow; the other was in a nest of dead palmetto leaves under the roots of a small tree on the edge of a swamp forest. Here the opossum is the worst marauder about chicken yards, but its raids are few compared with the numbers of opossums present. They are occasionally used for food. The price paid for their skins is low, but the number of skins taken makes them competitors of skunks for the third most important position as fur bearers; when prices were good, they brought as much as forty to fifty cents commonly, and even as high as eighty cents per skin. However, now the animals are sometimes thrown away instead of being skinned when caught. One hundred and six animals have been taken in desultory trapping on the thousand-acre Station grounds in the last nine and one-half years without appreciably affecting their numbers.

We assembled a series of seventeen skins, to show the variation in the forty or so individuals caught in the wild that we have handled. The outstanding characteristic of this series is its variability. Ten of the specimens require no comment. They have grayish-black or blackish-brown tipped underfur with the white base more or less showing through, and the guard hairs are white. Two more specimens are similar, but the underfur is more blackish. These represent the "normal," probably ninety per cent of the population.

One specimen, a male, taken September 7, appears partly albinistic. Superficially there are few guard hairs; most of the underfur present is dirty white, with a brownish tinge due to some brownish tips. All four legs are normal color, but over the back and thighs are obscure irregular black areas. Examination shows that the animal was in heavy molt, and over much of

the body black fur, mostly hidden by the full-grown underfur, was growing in. It looked as though, if the animal had completed its molt, it might have become a dark gray, or even darker. The ears and tail are normal in color.

One specimen, a female taken November 22, is much blacker than any of the grays mentioned above. The underfur is tipped with black, and little of its white bases shows through. White guard hairs are plentiful, but there are also many black guard hairs. The concealed bases of these latter are white. This skin is more glossy in appearance and has a softer, smoother feel than the gray-pelaged skins. The tail is lightly pigmented with black throughout its length.

There remain three specimens in which few white guard hairs are present. The color of the guard hairs and underfur varies from brownish black to black with the individual, both underfur and most of the guard hairs having white bases. These specimens also have a glossier, softer fur than normal grays, due to shorter, softer, guard hairs, less sharply differentiated from the underfur. This is not caused by simply losing the white guard hairs, as we demonstrated by plucking the white guard hairs from a normal gray.

This represents a considerably more complicated picture than that discussed by Hartman (1922, Jour. Mammalogy, III, pp. 146-149), who mentions grays, dark grays, blacks and brown mutants. We found variation in the extent and depth of pigment on the tips of the underfur, variation in the color of the guard hairs, not always conforming with the color of the underfur; we found black, and white guard hairs on the same animal; and most of the black guard hairs have white bases. (Hartman found black guard hairs not to have white bases.) The black guard hairs also are shorter than white ones, and black furs are glossier to the eye and softer to the touch than normal grays.

From Hartman's description his brown mutant might fit into our series as a further variation from the norm than our brownest specimen.

An adult opossum taken April 19 weighed

2,960 grams. A female and young were caged in July. On January 8, the young, about eight months old, were as large as the parent, and their weights were as follows: mother (thin) 1,848 grams; young females (fat) 1,648, 1,723, 1,758; young males (fat) 2,478, 2,558, 2,628, 3,131. A male of this litter that had been castrated was also fat but weighed only 1,848 grams, about that of females.

A captive female had nine young on September 18, a few weeks after capture. The female had thirteen large young in the pouch in July.

Caged specimens quickly became heavily infested with fleas.

On May 12 an opossum skull was found in an eagle's nest near Lake Placid.

### **Scalopus aquaticus** (Linnaeus)

Mole, Ground Mole

Fairly common and generally distributed except in the wetter areas. The raised ridges marking their burrows are commonly seen in the sand areas and cause some annoyance about the flower beds of the Station, but we saw no mounds made by them.

One specimen weighed 35 grams.

### **Blarina brevicauda** (Say)

Short-tailed Shrew

Six specimens were taken in 900 trap nights in a field of dense grass and in the adjacent swamp forest on the edge of the prairie. Those from the swamp forest were taken in their characteristic burrows under the leaf litter. Three were taken under dense grass tussocks about myrtle thickets on the edge of sand scrub country.

Three stomachs contained insect matter including remains of a caterpillar. One specimen had a few small cestodes in the intestine; another, a nematode in the stomach and more than 100 cestodes in the intestine; another had a few large cestodes, several hundred small cestodes (another species) and a trematode in its intestine, and had a cyst occupying a whole lobe of the lung and containing several filaria 5 to 10 mm. long and thousands of eggs and microfilaria. This last specimen also had a few microfilaria in a blood smear.

One specimen brought in had been run over by an automobile.

The weights of specimens were: male 8.5, 10, 10.3, 11, 11, 11 grams; female 9, 9, 10 grams.

***Eptesicus fuscus* (Beauvois)**

Big Brown Bat

When felling a seventy-foot pine stub in the sand scrub country on August 25 several of these bats flew from a cavity about forty feet up, and four came to the ground in a cavity of the stub. There were at least six bats in all. Host kept one alive, and it did well on a diet of about twelve meal worms a day, but after the onset of cool weather in November the bat, while not completely torpid, almost ceased to feed.

***Lasiurus borealis* (Muller)**

Red Bat

Previous to August bats were seen occasionally. About the first of August red bats became common and continued common until the first part of October, the last one being recorded October 8. From twenty to thirty were usually seen in an evening, flying about over Lake Stearns. They appeared fifteen or twenty minutes after sunset, while it was still light enough to catch a glimpse of their color. Over Lake Stearns they seemed to be feeding, but on August 25, while watching at dusk on a road through a wooded swamp, we saw fifteen to twenty red bats, solitary or in couples, moving in a generally southerly direction.

***Nycticeius humeralis* (Rafinesque)**

Rafinesque Bat

On August 25, six or eight bats, presumably this species, were seen about a group of buildings near Lake Placid, and one was taken. Their flight was much slower and more fluttering, they flew lower, sometimes within a few yards of the ground, and appeared about ten minutes later than red bats which were also feeding in the area. Another solitary individual was taken while flying low about a building, and two others were brought in.

Occasionally bats that could not be

identified were seen flying over the sand hill or flatwoods areas, but they were nowhere common.

***Ursus (Euarctus) floridanus* (Merriam)**  
Bear

There are perhaps twelve bears in Highland County, according to the estimates of several residents of long experience. They are confined almost entirely to the forested swamps, are rarely seen and are occasionally hunted with dogs.

Mr. Frank Tauchen, who has kept and hunted with bear dogs since 1935, told us that he and his parties killed five bears in 1935, thirteen in 1936, five in 1937 and seven in the period 1938-1941. Those were all taken in the "baygall," the forested swamp area between Hickory Branch and Lake Istokpoga, an area about fifteen by two miles in extent. Tauchen estimates there are probably three or four bears in this area now. They are hunted with dogs and shot ahead of them by men stationed at strategic points. Male bears never tree, females do occasionally. They do not hibernate. The largest bear Tauchen had taken weighed 338 pounds; he said males run about 300 pounds, females 200 pounds in weight.

Cooper, the local game warden, said there are perhaps fifteen bears in the county. All of these are in the southeast part, about four or five in the "baygall" between Hickory Branch and Lake Istokpoga, and the rest in the big Horse Shoe Bend country east of Venus. Part of the former (south of Route 8) and all of the latter are in the game refuge established two years ago, where bears as well as other animals are protected. He said that the bears are less active in winter, but occasionally come out to kill hogs.

***Procyon lotor* (Linnaeus)**

Raccoon, Coon

Common and generally distributed. Individuals are frequently seen moving about during the day. They are occasionally found on the roads, killed by cars. In August Rand found one asleep in a hawk's old nest thirty feet up in a solitary tree on

the prairie. The local people say the coon from the prairie is paler and yellower than that from the sand hills.

This is the most important fur bearer of this region. Prices fluctuate, but top prices of which we heard were \$11.00 apiece for two skins about 1927, received by Mr. J. W. Kelsey, and \$7.25 for a skin about 1929, received by Mr. Richard Tuck.

In May Host was shown the sites of two nests from which the young had been removed a short time before; the parent had presumably removed one litter of two; a local resident had removed the other litter of two. Both nests were in the same cabbage palmetto and oak hammock areas of about four acres in extent, in the prairie. Both nests were in broken-off, upright, hollow palmetto stems.

Two November specimens had been feeding on palmetto berries. The stomach of a January specimen contained a frog, insect remains, and what looked like well chewed acorn remains. They are said to visit the groves to eat oranges. The weights of four average sized males in good condition were 10.5, 10.5, 11 and 11 pounds. A young female about eight months old, that had been raised in captivity and was very fat, weighed 7.5 pounds in January. Two specimens had a few ticks on them.

### ***Mustela frenata* Lichtenstein**

Weasel

Apparently rare. Two were taken in the nine and a half years of "vermin control" here. Trappers told us that they have occasionally taken them. Mrs. Rand saw one in sand scrub country January 14, 1942.

### ***Lutra canadensis* Schreber**

Otter

Uncommon and rarely seen, even by people who spend much time about the marshes and waterways. The last of August we saw three on a log across a canal in the nearby prairie. They were quite tame, and after disappearing in the flooded saw-grass country one animal kept continually swimming out, looking at us, at twenty yards distance, diving and swimming back underwater into the saw-grass and repeat-

ing its approach. A blowing or snorting noise it made repeatedly was conspicuous.

On October 31, east of Okeechobee City, in grass country with canals each side of the road, we picked up an otter that had been killed by a car. It had been seen dead there about four hours earlier, and though buzzards were sitting about it and had tried to feed on it, they had been unable to do more than scar the skin. This animal, a female with slightly worn teeth, weighed eight pounds.

### ***Spilogale ambarvalis* Bangs**

Spotted Skunk, Civet Cat

This animal appears to be fairly common, even locally abundant, but somewhat sporadic in occurrence. They are found in both the flatwoods and the sand scrub. These skunks are said to kill chickens and take eggs occasionally. In January one entered a chicken house in Lake Placid and killed nine little chicks in one night. The pungent odor pervading the chicken house left no doubt as to the marauder, and the skunk was taken the next night. Shackelford said that his father, a few years ago, took eleven civet cats in two weeks in traps set at the mouth of one gopher turtle burrow near his home. Crews said that a few years ago they were very common about his place at Venus and took many hens' eggs, but since then he had seen few. Some individuals had the white of the fur strongly tinged rusty yellowish. January specimens weighed as follows: male 350, 355, 390, 464, 527 grams; female 252 grams. The heavier animals were very fat. Three stomachs contained insects only; one, insects and two lizards. The parasites recorded included fleas, ticks and, in the intestines, nematodes.

A few notes made on animals kept in captivity are of interest. These animals when annoyed by the close approach of humans tapped loudly with their front paws or did the vertical "handstand." When just put into cages together, two individuals frequently attempted to occupy the same box and fought furiously, biting each other about the head and body, rolling over and apparently trying to scratch each other with their hind claws, continually

giving little grunting calls and squeals. They never used the handstand display or threw scent in such encounters. Apparently no blood was drawn, and they usually came to tolerate each other after some minutes. The only digging seen was to get under an object and make a shallow hollow directly under it for a nesting place. Probably this is all the digging that is done here. The two seen digging acted much the same. They went up close to the edge of the box, lifted their heads out of the way, and scratched the dirt back between their widely spread hind legs, with their front paws. After going nearly out of sight the animals backed out and threw back the accumulated dirt between their back legs. There was no forcing their way into the loose soil, nor pushing back the soil with the hind feet. While quarreling one skunk fell into a pool of water and swam about bewildered for a few moments before climbing out. Though very fat it swam low in the water, with only the nose and top of the head out.

### ***Mephitis mephitis* (Schreber)**

Striped Skunk, Pole Cat

Fairly common. We saw occasional animals moving about in the daytime, and their tracks were quite often seen in the sand. They are fairly common in both the sand scrub and the flatwoods. In the nine and a half years of trapping records of the property both striped and spotted species were included in the fifty-three skunks recorded, but Mr. Kelsey said most of them were striped skunks. On September 16 Mr. T. Browning of Venus showed us a hollow log in the flatwood where there was heavy palmetto undergrowth and in which he had seen a skunk with young that morning. We found the female with four small young nearby in a palmetto thicket. Three of them weighed 219, 312 and 312 grams, respectively. Four months later two of these that had been kept in captivity weighed: male 2,522 grams, and female 2,070 grams, and appeared as large as the parent. A lone young skunk was caught alive by Richard Tuck January 3, 1942, that was the same size as the young of September 16, indicating litters at different

times during the year. A male taken January 8, 1942, weighed 1,350 grams. Its stomach contained palmetto berries and some nematodes.

Of the fifteen or so skunks seen, most had broad white stripes the length of the back and tail, but one specimen had only narrow stripes extending a few inches from the white nape, and a white tip to the tail.

### ***Urocyon cinereo-argenteus* (Schreber)**

Gray Fox

Common. Its tracks were often seen in the sand and the hill country, and individuals were occasionally seen in the daytime. It was also common in the flatwoods. Two were found that had been killed by cars on the highway. Less valuable and less common than the coon, this is perhaps the second most important fur bearer in this area. The highest price paid for skins from this section was \$2.50 about twelve years ago. Fifty-two foxes were trapped on the Station property in the nine and a half years of trapping, and they still are common there. The weights of four males were 7.5, 8.75, 9 and 10.25 pounds; of two females, 7.5 and 8 pounds. Two stomachs examined (November and December) contained palmetto berries, and one a lizard. Parasites found in specimens were: (1) nematodes in intestine; (2) tape worms in intestine; (3) two tapeworms, nematodes in intestine, and fleas.

### ***Felis concolor* Linnaeus**

Panther

Occasionally pass through this area, and individuals were seen near Sebring and Lake Placid in 1941. In the past ten years panther tracks have been seen on three different occasions on the Station property. Mr. Frank Tauchen said that a panther shot north of Lake Placid after feeding on a hog it had killed weighed 150 pounds. Cooper said none lives in the county, but some occasionally visit it. One was killed this year between Sebring and the Hardee County line.

### ***Lynx rufus* (Schreber)**

Bobcat, Wildcat

Fairly common. Its tracks are often seen in the sand country and perhaps two

or three regularly live on or visit the property. Three were taken in the nine and a half years of trapping there. The fur is of little value and, even when prices were high, forty cents was a good price for a skin. Along a canal bank through the wet prairie Host found many cat tracks in the dense dog fennel and the remains of several marsh rabbits apparently left by cats on November 27. One taken January 11, 1942, a male, weighed 22 pounds. It was shot by Mr. A. Austin of Lake Placid, and the story he told of its capture is interesting. In mid-afternoon Mr. Austin's twelve year old son was walking along a road through the sand scrub near their house and saw the cat. It frequently gave a short, harsh "roar," and, "sniffing and roaring," came within a few yards of the boy. When the animal moved off the boy ran home and got his father. Together they spent about an hour hunting it before they were able to shoot it. During this time the cat stayed within a quarter of a mile of the place where it was first seen. Its location could be told from the sound of its occasional "roars."

These animals are sometimes seen along the roads during the daytime. Two other specimens weighed: male 25 pounds, female 18 pounds. One had its stomach filled with the flesh, fur and feet of a marsh rabbit. One had a few ticks on it.

### **Sciurus carolinensis** Gmelin

Gray Squirrel, Cat Squirrel

Common in the sand hill scrubs and in the swamp forests. They become familiar about dwellings where they are protected. Their food includes the cypress "balls" in November, and the seeds from spruce pine cones in December.

One adult male taken December 2 weighed 353 grams. It had some small nematodes in the intestine.

### **Sciurus niger** (Linnaeus)

Fox Squirrel

Scarce in this area. We saw only four or five during our ten months at the Station, all on the sand scrub country. They are also said to frequent the swamp forests. Mr. Richard Tuck of Hicoria said

that of the sixty or so squirrels he killed in November and December only one was a fox squirrel. They are said to have become scarce in recent years, and this is believed to be correlated with the extensive lumbering operations carried on during this time.

### **Glaucomys volans** (Linnaeus)

Flying Squirrel

Fairly common and generally distributed in the wooded sand areas and the pine flatwoods. The locations of sleeping places found were: two full grown females were taken in a cavity ten feet up in a tall live pine in the flatwoods, June 11; when we felled a seventy-foot dead pine stub in sand scrub country at least four squirrels glided from a cavity about forty feet up; also in other cavities in the same stub were at least six big brown bats and a nest full of young red-headed woodpeckers, July 25; two squirrels were found in a mass of trash, perhaps deposited by gray squirrels, under the platform of a hundred-foot water tower on the property, May 31; two males were taken in a small hollow oak in sand scrub in August; and two squirrels were started from a gray squirrel's old nest twenty feet up in a spruce pine thicket in sand scrub country, August 28.

In an oak grove about Shackelford's residence in Lake Placid where these squirrels are very common their fine chattering or chipping notes are often heard. The flying squirrels become active shortly after the sun goes below the horizon, and they can be seen plainly. The longest glide seen was from the top of a thirty-foot clump of bamboo to five feet up on a pine thirty-five yards distant.

In literature it is sometimes said these are gentle animals, reluctant to bite, but those we handled struggled and bit savagely.

One stomach examined contained the remains of acorns. Three adults, two males and a female, confined in a large cage, slept in the same nest box. In this nest box, still containing all three adults, two young were found on September 7. These young opened their eyes on September 19, and, assuming they open their eyes at thirty



days of age, as Svihla (1930, Jour. Mammalogy, XI, pp. 211-213) found in this species, they had been born about August 20, being about nineteen days old when found. The female vigorously defended her young, while the males simply ran to distant parts of the cage, when the nest box was opened.

The following data on the development of the young supplement those given by Hatt (1931, Jour. Mammalogy, XII, pp. 233-238) and Svihla (*loc. cit.*) and are correlated with their data.

SIZE.—Svihla's data are as follows: weight, first day 3.4; eighth day 6.5; fifteenth day 7.8; twenty-first day 9.5; thirty-first day 12.5 grams.

Our data are found in Table II.

TABLE II

Age	Weight		Total length		Tail		Hind foot		Ear	
	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
19 days	10.8 gm.	10.4	—	—	—	—	—	—	—	—
20 "	11.5	11.5	105 mm.	103	39	38	15	16	7	7
22 "	12.9	12.9	110	111	45	43	17	16	—	—
23 "	13.7	13.7	113	114	45	45	17	—	—	—
25 "	15.3	15.1	123	119	50	47	18	—	—	—
27 "	16.3	15.7	123	122	54	51	20	20	—	—
30 "	20.1	20.2	132	130	59	58	23	21	—	—
33 "	22.4	22.5	141	137	64	61	25	23	—	—
42 "	25.4	24.0	152	148	72	69	30	30	—	—
47 "	28.8	23.2	171	166	81	82	—	—	—	—
55 "	32.0	29.0	—	—	—	—	—	—	—	—
140 "	53.2	49.1	214	215	109	110	29	24	18	18
Adults										
caught	60.3	54.9	232	227	105	95	34	28	18	17
in the wild	67.0	—	228	225	95	95	28	29	19	18

Hatt gives the measurements of a forty-day young as: total length 164, tail 75, hind foot 29 mm.; and traces the weight from 26 grams at forty days to 57 grams at 147 days.

PELAGE.—The molt into the adult coat was about three-quarters complete by the 140th day; Hatt's specimen was about half molted by the 125th day.

OTHER STRUCTURES.—Svihla was unable to sex her young squirrels until the forty-second day and mentions only the mammae of the female. In our young the penis of the male was plainly evident when first examined, at nineteen days of age. The lower incisors appeared at twenty-two days,

the upper at thirty-three days. Small mammae became visible in both sexes by the thirty-third day.

FEEDING.—When suckling, the young were not firmly attached to the nipples of the parent, as with some rodents, but could be easily detached. On the thirty-seventh day the young were first seen to chew on a part of a pecan nut. (Svihla records first chewing on a twig at fifty-three days.) By the forty-second day they quite frequently nibbled nut meats.

VOICE.—At twenty days the young made a continual, high-pitched chirping sound when removed and kept from the female. (Svihla mentions first voice at seven weeks.) This ceased at about forty days. At eighty-three days sharp squeals were

uttered for the first time when trying to escape from the hand.

GENERAL BEHAVIOR.—About the thirty-third day, just after the opening of the eyes and the appearance of the upper incisors, a marked change in posture and activities occurred. They began to stand on their feet and arch their backs and crouch when resting, instead of simply sprawling; they moved about effectively and climbed a little, for the first time. By the eighty-third day they behaved about as adults.

In a wild male taken the end of September the testes were large, measuring about 13 by 12 mm. A captive male showed the same enlargement. By January the same

captive male's testes were in a state of regression. Upon dissection these were found to be 13 by 4 mm. in size.

### ***Geomys floridanus***

(Audubon and Bachman)

Pocket Gopher, Salamander

The mounds of this species are commonly seen in the sand hill country along the road coming south from Sebring as far as Josephine Creek, about five miles north of Lake Placid. Just south of Josephine Creek the last of them disappear and none is found in the similar sand hills to the south.

### ***Reithrodontomys humulis***

(Audubon and Bachman)

Harvest Mouse

Evidently a rare species, as Shackelford made a special effort to find it. One was taken in two weeks trapping with 100 traps in a scantily weed-grown and grassed, large abandoned clearing in the sand area, and two were taken in about eight days trapping with about fifty traps in a densely grassy field that had been cleared in the damp gum and cabbage swamp land on the edge of the prairie.

A male and a female each weighed 9 grams.

### ***Peromyscus polionotus* (Wagner)**

Beach Mouse

This species is common on the sand hill ridges around the Station, and the burrows are easily found, especially in areas with scanty vegetation and big patches of open sand. From the beginning of July to the middle of January observations on the life and habits of these mice were recorded regularly, both in the field and on captive specimens. A number of adult couples and whole families were captured at different times and transferred to laboratory cages where the growth and development of the young could be studied. We found them easy to handle, and most of the young born in captivity were successfully raised. Very useful in the study of some of their activities was a terrarium, five feet long, two feet wide and three feet high, with sand at

the bottom ten inches deep, and with glass walls on two sides.

**BURROWS AND NESTS.**—The interesting burrows of this species have been described by Hayne (1936, Jour. Mammalogy, XVII, pp. 420-421). In the six months during which our observations were made we excavated more than 400 burrows of this species. They are easily found, as the mounds of sand in front of the entrances make them conspicuous. The form of the majority of them is stereotyped and as described by Hayne. The distance from the entrance to the nesting chamber is in most cases between two and three feet. In burrows that were inhabited there was always an "escape tunnel," rising from the nest chamber almost to the surface. The length of the escape tunnel varied from one to four feet, the normal length being between two and three feet. If the escape tunnel was open to the surface before we started digging, it was usually found that the burrow had already been abandoned, although there were a few exceptions to this rule.

Usually the adult inhabitants of the burrows broke through to the surface and tried to escape while we were digging. By covering the ground with cheese cloth, where the escape tunnel was expected to open, all the inhabitants of the burrow could easily be captured. In the majority of cases the escape was not attempted until we had reached the nest chamber or had continued our excavating beyond this point. The nest chamber was usually at the lowest point of the burrow. The depth of the burrows varied greatly. In single instances they were more than three feet deep, measured in vertical distance from the surface to the bottom of the nest chamber; in the majority of cases the nest was found between one and two feet below the surface; and in a few cases the chamber was less than a foot below the surface of the sand.

With a few exceptions all complete burrows had a nest in the nest chamber. The most common material used for the nest was grass, but a number of nests were also made of palmetto fibers and other materials. Nests were found in burrows occupied by single individuals as well as by families. In a few instances single indi-

viduals or couples without young were found in nesting chambers without any trace of a nest. These were always fresh burrows, and the explanation might be that their construction had started so late at night that nest material could not be collected before daylight forced the mice to retire.

Many of our observations show that these mice move from one burrow to another very frequently. Even in the middle of the nursing periods such changes of burrows occur. In several cases when I have excavated new burrows that had appeared overnight in areas that were under close observation, I have found them occupied by families with young that must have been born from one day to a couple of weeks before these burrows were constructed and thus must have been transported from another burrow. In some cases I have also found families with young in burrows with very scanty nests, giving the impression that the nest was unfinished, thus indicating that the young had been moved to this burrow before construction and nest-building were completed.

In the neighborhood of an occupied burrow there are always one or more complete but empty ones. Some of these burrows are old, and their whole appearance, as well as that of the nests, indicates that they have been abandoned for good, while others may be freshly dug and have new nests in them. There are usually also several incomplete burrows in the vicinity of an occupied one, some of them ending abruptly only a foot or so from the entrance. These structures may sometimes serve the purpose of a refuge in an emergency. Often when I excavated occupied burrows the mice coming out through the escape tunnel headed straight for one of the reserve burrows in the neighborhood and disappeared there.

The burrow usually follows a straight line from the entrance to the end of the escape tunnel. A number of burrows were, however, more irregular. Sometimes the tunnel made a sudden turn or curved out more slowly at an angle to the main course of the rest of the burrow. Such turns could sometimes be explained by roots or other

obstacles that had interfered with the normal construction. This was not always the case, however, and some atypical burrows could be explained only as results of peculiarities in the burrowing habits in certain individuals. In several cases where atypical burrows were excavated, perfectly identical ones were found in the vicinity, suggesting that they had been constructed by the same individual. In one instance a couple with young were dug out from a burrow that had another tunnel beside the escape tunnel, leading out horizontally from the nesting chamber at a right angle to the main course of the burrow and about twenty inches long. About thirty feet away we excavated an abandoned burrow with exactly the same peculiarity in the construction. On another occasion a single male was found in a nest in an unusually short and shallow burrow with the nest only about a foot from the entrance, and the exit tunnel going from the nest chamber to the surface at a steeper angle than I had found in any other burrow. At distances of about fifteen and 100 feet, respectively, from this burrow were found two empty burrows of a construction that was identical with the first one.

Many of the occupied burrows were found solidly plugged at the entrance. This was often the case—but not always—when the burrow was occupied by a family with nursing young.

Several other animals use *polionotus* burrows for shelter. Of these the Gopher Frog (*Rana capito* Le Conte) was commonly found in abandoned burrows, and often also in occupied burrows, where it was usually sitting near the entrance. This was of particularly frequent occurrence in July and August, when this frog was found in more than ten per cent of all excavated burrows, mostly singly; but in one instance there were three together. Commonly found in the burrows were also oak toads (*Bufo quercicus* Holbrook) and lizards, most often the Six-lined Race-Runner (*Cnemidophorus sexlineatus*). Twice scorpions (unidentified) were found in *polionotus* burrows, and very commonly the "mole cricket" (*Canthophilus* sp.). Snakes seem to invade the burrows frequently, as could

be seen by their tracks leading in and out of burrows, and they might be the most important of the enemies of *polionotus*. Only once was a snake actually excavated from a burrow. It was about two feet long and spotted in a bright pattern. It escaped and was not identified. Twice I have found burrows partly excavated by skunks (*Mephitis mephitis*) but in neither case was the digging deep enough to have reached the nest chamber.

In the terrarium the digging methods could be observed in detail, especially when the mice made their burrows alongside the glass wall, as sometimes happened. Their capacity for rapid digging was amazing. Less than a minute from the start of digging an individual might have totally disappeared in the new tunnel, and I have seen a *polionotus* dig a burrow more than two feet long in less than ten minutes. They dig by scratching the sand under them with rapid movements of the front paws and then throwing the accumulated sand backward with a few violent jerks of the hind legs. Sometimes they will turn over on the side while digging or even on the back. At short intervals a digging *polionotus* will come out again to the entrance, look around for a moment or perhaps run about for a few seconds on the surface of the sand and sit on its hind legs "washing its face" with nervous movements of the front paws. Always when entering again they make some digging movements at the entrance and throw out sand that has accumulated there, and they stop and repeat this several times when proceeding along the tunnel, until they reach the end of it, where they start on the really heavy digging again. If a couple were together in the terrarium, they would usually cooperate in digging a new burrow, part of the time by alternating in digging, part of the time by digging simultaneously one just behind the other.

They constructed nests in the burrows in the terrarium of the same type as those found in the field. The nests were always made at night, and if ample material was available they were completed in a few hours. Observations on the methods of nest-building were not obtained, as the animals worked on them only in the dark

and stopped whenever artificial light was turned on.

As a whole these mice are strictly nocturnal in their habits. We studied tracks around the burrows at different times of the day but never found any made in the daytime, indicating that they practically never leave the burrow voluntarily during the day. We made several attempts to study their activities at night by means of a flashlight but with little success, as they were shy and avoided the light. Observations on activities in the terrarium showed the same nocturnal habits. Except when we forced them out by destroying their burrows, we never observed any on the surface of the sand in the daytime during the several months we kept *polionotus*, nor did tracks on the surface show that they ever came out voluntarily except at night. They usually did not come out until two hours after dark and retired again before daylight in the morning. If artificial light was put on in the room at night, they would continue their activities for two or three minutes, then retire to the burrow or sit inactive in a corner. If very strong light was projected on the terrarium, they became extremely busy burying themselves in the sand. We kept the terrarium covered with dark cloth for four days in an attempt to change their daily rhythm, but even then they never came out on the surface in the daytime. During this time they seemed to be asleep in the burrow. Sometimes the burrow was constructed so that we could look into the chamber. They could be seen lying there quietly all day, practically without changing their positions. There were no indications of any activity inside the burrow in the daytime.

POPULATION DENSITY.—*P. polionotus* is not gregarious and is not found in colonies.

The species offers an opportunity for population studies that is rather unusual in mammals, as it is possible to determine the population density by getting the actual number of individuals in a given area. Because of the exclusively nocturnal habits of these animals, one can be reasonably sure of finding them all underground in the daytime. Their burrows, both the more permanent ones and those used just over-

night in an emergency, can easily be found. By excavating the burrows, all individuals can be captured and counted.

Four different localities were used for determining the population density in different types of habitat and at different times of the year. In each locality every single burrow on an area of several acres was excavated, and the inhabitants captured. The method used was as follows: a rectangular area measuring half an acre was picked out at random and the sides marked. This area was then examined foot by foot, and all burrows found were excavated, examined and the inhabitants captured and killed, or brought alive to the laboratory for other types of study. Then a new area of half an acre was measured out and the same procedure repeated here, until six units of this size, together covering an area of three acres, had been examined. A month or so later the census was repeated in the same locality. I avoided using exactly the same rectangular units, but new ones were measured out at random in the vicinity and within the same type of habitat. This was done to avoid, as much as

possible, having the results influenced by the effects of the previous removal of animals. Thus the word "locality" is used in the sense of a larger area including all the examined half-acre units and of a certain uniformity in topography and vegetation.

The different localities, all within a few miles of the Station but representing divers types of habitat, were:

LOCALITY I.—Overgrown field bordering the eastern side of Station property; vegetation mostly grass and weeds with small clusters of palmetto and a few young orange trees.

LOCALITY II.—Open pine forest in southern end of Station property, with scanty grass, palmetto, prickly pear cactus and some clusters of oak scrub.

LOCALITY III.—Open pine forest northeast of Station property, mostly covered with low scrub oak, hickory and palmetto, with a few open sandy patches or patches with scanty grass.

LOCALITY IV.—Road grade of sand about three to four miles east of Station property, overgrown with grass, sandspurs and different weeds, but with big patches of open sand. The grade is twenty-five yards wide. On both sides is mixed scrub, with sand pine, oak, hickory and palmetto.

The results are tabulated as follows:

TABLE III

Locality	Date	Size of area	Occupied burrows	Old abandoned burrows	Fresh empty burrows	Short incomplete burrows	Total number of burrows	Number of adults	Number of young less than 28 days old	Total number of mice	Average number of mice to an acre
I	Aug. 25-26	3 acres	6	12	5	7	30	11	12	23	
I	Sept. 30	3 "	7	10	5	12	34	10	8	18	
I	Oct. 7	2 "	2	4	1	4	11	4	3	7	
I	Nov. 25	3 "	4	8	2	9	23	6	5	11	
II	Oct. 3	3 "	1	—	—	1	2	1	—	1	5.40
II	Nov. 20	3 "	1	—	—	2	3	2	—	2	
II	Jan. 13	3 "	none	—	—	—	—	—	—	none	
III	Oct. 1	3 "	2	1	—	5	8	4	4	8	0.33
IV	July 25	3 "	12	6	1	8	27	17	12	29	2.70
IV	Aug. 13	2 "	4	4	none	7	15	7	3	10	
IV	Oct. 4	3 "	12	5	3	10	30	20	14	34	
IV	Dec. 5	3 "	7	11	2	13	33	8	5	13	
IV	Jan. 4	3 "	11	8	none	5	24	17	7	24	
			69	69	19	83	240	107	73	180	7.90

As can be seen, all four localities are representative *polionotus* habitats; both burrows and animals are found in all of them. The population density, however, is very different in the four localities. By taking the average, we find in Locality IV the highest density, 7.9 individuals to the acre, considerably lower in Locality I, 5.4 individuals to the acre, and lowest in Localities III and II, with 2.7 and 0.33 individuals to the acre, respectively.

An important factor in determining these differences in the concentration of *polionotus* at the localities examined is, no doubt, the difference in the possibilities they offer the animals for making burrows. For their burrows these mice require sand that is easy to dig and without too many roots and other obstacles. Examination of several hundred burrows has shown that *polionotus* usually give up further construction of the burrow when meeting roots or other obstructions. Occasionally they may avoid these by changing the main course of the burrow, but those cases are exceptions. In forested areas with a dense vegetation of different kinds of scrub the many roots in the ground make it impossible for them to construct their burrows in the usual way. Accordingly, in Locality III the only complete burrows were found on the wider patches with grass on open sand. In examining the selected areas great care was taken to find every single burrow, whether in dense vegetation or not, and if there had been any burrows in the ground in the dense scrub, they would have been found.

Locality IV, the sandy grade, had obviously, for this very reason, a higher density of *polionotus* than the other characteristics of this habitat seemed to justify. As was evident from other observations (numbers of acorns and hickory nuts stored in the burrows) the *polionotus* in this locality were feeding to a large extent in the scrub on both sides of the grade. In this scrub no burrows could be found. Thus a *polionotus* population actually belonging to a much larger area had concentrated their burrows on the sandy grade, because here digging was easy.

On Locality II were many places suitable

for burrows, so here some other factor or factors may be responsible for the very low density of *polionotus*.

Locality I, the overgrown field with the second highest population density of the four, possibly represents the type of habitat most universally suited to *polionotus*. Most of the ground here offered good conditions for burrowing. And as the type of vegetation was fairly uniform over a large area on all sides of those used as samples, one may safely conclude that the relatively high number of *polionotus* counted here were seeking their food within the same areas where their burrows were found.

In any area with *polionotus* the many burrows give the appearance of a population density much higher than actually is the case. Most of the burrows are unoccupied, as is also evident from the table. From all the localities combined the number of burrows examined was 240, of which only sixty-nine or about twenty-nine per cent were occupied. Most of the burrows were short and not completed. The greater number were short diggings from one to three feet in length, but a few burrows that were complete except for the nest were included here.

Another fact that the table brings out is the low reproductive rate. The number of adults found exceeds that of the young, owing to the many single adults or couples without young. The table includes data on this from every month beginning with July and ending with January. While litters of young have been found in all these months, every month gives a smaller number of young than of adults.

OBSERVATIONS ON REPRODUCTION.—In this climate *P. polionotus* seems to breed at all times of the year. Our regular observations cover the period from the beginning of July to the middle of January. In every one of these months both pregnant females and females nursing litters were found in the field. The number of young found in the litters varies from three to five. Our observations include thirty-two litters and examinations of thirteen females with embryos. The numbers of young in the different litters were: fifteen litters with four young; eight litters with five; and nine

litters with three. Of the pregnant females examined five had four embryos, four had five, and four had three.

The age at which different species of *Peromyscus* attain sexual maturity has been studied by Clark (1938, Jour. Mammalogy, XIX, pp. 230-234), who found by the method of vaginal smears that females of *polionotus* get into their first oestrus at as early an age as twenty-three days. In the young we have raised in captivity this has not been systematically checked, but I found one female with open vagina at an age of twenty-six days. The earliest date for actual reproduction among females raised in captivity was found in one killed when she was fifty-eight days old. She showed four embryos eight to ten days old. Among the field observations I have one from December 3 of a female weighing 8.2 grams that had four small embryos. The weight, pelage and whole appearance of this female suggested that she could hardly have been much more than forty days old. She was dug out from a burrow she occupied together with an old male that weighed 15.4 grams. The records of size and general appearance of pregnant or nursing females dug out from burrows in the field seem to indicate, however, that reproduction at an age as early as indicated by the observations cited above are exceptions rather than the rule. Clark mentions that in his laboratory experiments the youngest female of *polionotus* was 102 days old when conception took place.

Because of the strictly nocturnal habits of these animals, we have no direct observations on the mating. Observations of periods between litters as short as twenty-four to twenty-six days show that mating and conception can take place very shortly after the young are born, probably within two to four days after parturition. As we have no actual observations on mating, the gestation period could not be determined, but in other species of *Peromyscus* it is known to be twenty-two days. Our observations indicated that conception within a short time after parturition was not uncommon, but this cannot be said to be a general rule. In September six nursing females dug out in the field, with litters of

an estimated age varying between five and twenty days, were killed and examined. Two of them were pregnant, while four did not show any signs of new embryos.

Also the number of young found in burrows as compared with the number of adults shows that the litters do not usually follow each other at such brief intervals as they would if conception shortly after parturition were the normal.

It has been mentioned earlier that on the areas studied for population density the number of adults found in burrows exceeded that of the young. In Table IV I have put together all observations I have from different months on numbers of young and adults in burrows. We see from this table that every month when observations were made more adults than young were found. The table also indicates that reproduction shows no tendency to be concentrated at any particular season but seems to be evenly distributed throughout the year.

TABLE IV  
*Peromyscus polionotus*  
Proportion of Young and Adults Found in Burrows

Date	Adults	Young less than 28 days old
July	25	16
August	35	23
September	19	14
October	33	21
November	13	8
December	19	10
January	17	7
Total	161	99

In Table V I have tabulated 103 burrows according to their occupants. Litters were found in only twenty-nine of these burrows, while the rest were occupied by adults without young. How many of the females of this latter group were pregnant cannot be decided, however, as examinations for determining this were not made in every case.

In *polionotus* I have never observed any fighting between males, even when several males have been kept together with the same female. In one instance a female in oestrus was placed in the terrarium to-

gether with three males late in the afternoon. At 11 p.m. they were all running back and forth on the surface of the sand, and there was no evidence of fighting. The next morning they were dug out from a burrow where all four were peacefully occupying the same nest.

naked, except for the vibrissae that are visible at this early age. On the second day the back became pigmented and gradually grew darker until by the fourth day it was dark lead-colored. On the fourth day fine hair began to be visible on the back. The ventral side was naked up to the eighth or

TABLE V  
*Peromyscus polionotus*  
Burrows Tabulated According to Their Occupants

Date	Couple with young	Couple without young	Single female with young	Single male	Single female	Two males
July	3	5	2	4	3	1
August	5	9	1	4	2	—
September	3	3	—	4	3	—
October	6	7	1	2	4	—
November	1	3	2	2	—	—
December	2	4	1	4	2	1
January	2	2	—	2	3	—
Total	22	33	7	22	17	2

GROWTH, DEVELOPMENT AND CARE OF YOUNG.—Six litters of young raised in the laboratory, with a total of twenty-three individuals, were used in a study of growth and development. They were all from parents caught in the wild. With some of these young, weights and measurements were taken every day, while with others records were made once a week. Weight observations were taken from the day of birth, but measuring started when they were four days old.

The data collected in this way are illustrated in the graph (Fig. 1). On the same graph appear the corresponding figures for thirty-five adults. Among these were included only specimens showing signs of reproductive activity, as a proof that they had reached full maturity. All the parents of the young measured were included among these.

The graph shows that the young grow rapidly until they are about twenty-eight days old, and then the growth rate slows down. When they were sixty days old, the weighings and measurements were discontinued. At this age they had still not reached the average of the adults in weight or different sizes, but they were well within the variation limits of the adults.

Newborn young are pink in color and

ninth day, when for the first time white hair could be seen coming here. The pinnae of the ears, that in the first days were folded flat down over the orifice, unfolded on the fourth or fifth day. The eyes opened in the majority of cases on the fourteenth day, although in a few they were already open on the thirteenth, and in some cases opened as late as the sixteenth. On the sixth day the lower incisors started to break through, and the tips of the incisors in both upper and lower jaws could in most cases be seen on the eighth day.

From the seventh to the eighth day the mammae, one pair of pectoral and two pairs of inguinal, became clearly visible in the females, which made it easy to tell the sexes apart. This could be done even earlier however, by examining the genitals, and by examining them under some magnification sexes could in the majority of cases be determined even in the newborn young.

Up to the fourth day the young lay on the side or on the back when taken away from the mother, and the tail curved ventrally between the hind legs. From the fourth day they lay on the belly and tried to roll over into this position again when placed on the back or on the side. From the eighth, day they actually stood on their feet alone



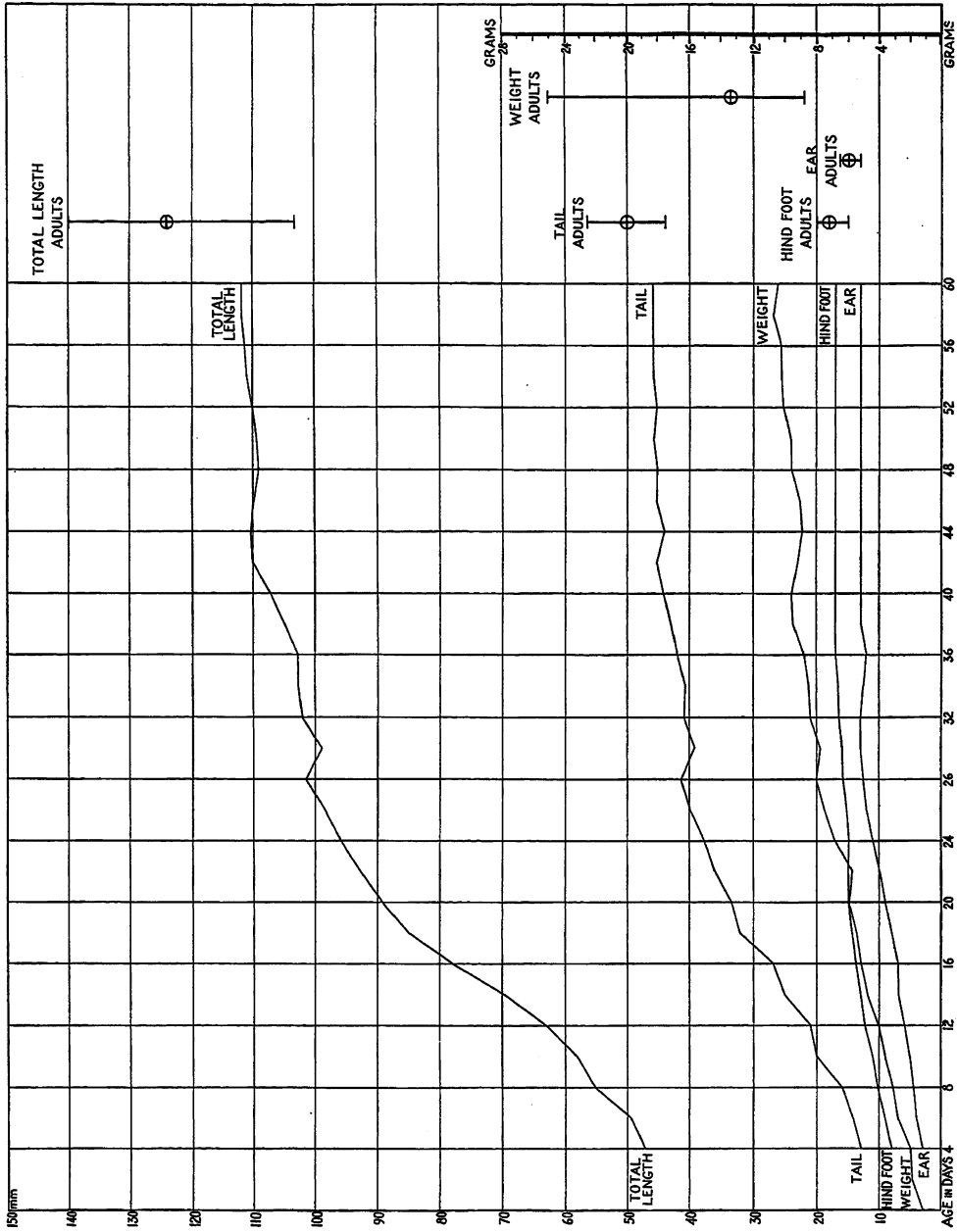


Figure 1

without supporting the body by letting the under side touch the ground. They now walked about with good coördination but with very slow movements compared with the adults. From the tenth day they frequently could be seen sitting up on their hind feet and "washing the face" with the front paws in the same manner as the adults. At two weeks of age, when their eyes opened, they were very active, running about in the same manner as the adults and even jumping. When dropped they turned in the air and landed on their feet. A young fourteen-day old fell down from a height of four feet to the floor, landed on its feet and started running. In a few seconds it had run about eight yards across the room before it was caught.

When taken away from the mother and placed on sand, the first digging movements were observed in young ten days old. They threw sand with the characteristic movements of the hind legs observed in the adults, but they did not use their fore-feet and thus did not accomplish any actual digging. At an age of fifteen days they dug with good coördination of both fore-feet and hind legs but could make only small cavities and no actual burrows. A young twenty-day old was seen digging efficiently in the same manner as the adults and when left alone made a burrow six inches deep. Most of the young of that age when taken away from the mother did not dig real burrows, however, only shallow caves where they huddled together.

In the first two weeks the young were found in the nest almost constantly attached to the mother's teats. They were so firmly attached that they were dragged along when the mother started running. A young, about six days old, was lifted by the tail when suckling and held the mother and three other young suspended in the air for three to four seconds before it loosened its grip and let the mother drop. The combined weight of the mother and the three young was 23.4 grams. Another young, eight days old, when lifted in the same manner, kept the mother (weighing 17 grams) suspended in the air for thirty seconds and still did not let go. Both were then put back in the nest where the young

was found loose a few minutes later. In some rodents the ability of the young to stay attached to the mother's teats has been correlated with a particular shape of the incisor teeth of the young. This is not the case with *P. polionotus*, however, as the incisors do not start to break through until the young are about a week old, while they possess the ability of retaining their firm grip on the teats even from birth, and the ability is seen to reach its highest development about the time the first incisors can barely be seen. This way of transporting the young may be of some importance in an emergency, when the nest is threatened by an invading enemy, as, for instance, a snake. Our experience when excavating burrows, however, did not give too much support to this. In most cases the mother jumped out through the exit tunnel alone, leaving all the young in the nest. In a few cases the young were found scattered along the exit tunnel. Only in a single case did we observe one young still attached to the mother when she broke the surface and ran out, and this young was dropped in the exit opening. From the shorter and more shallow burrows in the terrarium, however, females often rushed out with all young attached when I tried to reach down to the nest with my hand. In one instance the mother started digging a new burrow again right away, with the young still attached. The digging was made alongside the glass, and I was able to follow it for several minutes. She was seemingly not hampered by the young at all, digging in the usual way, scratching the sand in a heap under her with rapid movements of the front paws, then throwing it backward violently with a few jerks of the hind legs, and the young remained attached all the time until she finally stopped when the burrow was about eight inches long. Then she lay down with the young, but after a few minutes she walked out again leaving the detached young at the bottom of the burrow. However, in most cases when females in the terrarium had their burrows and nests destroyed they settled down for some minutes with the young in a corner. Then they left them in a heap there and dug a new burrow. When

the burrow was completed, the mother came back to the young and carried them down into the burrow one by one, holding the skin of the back between her teeth. If the disturbance occurred in the daytime, she sometimes stayed down in the new burrow until after dark, while the young were left on the surface of the sand. Next morning, however, I usually found the young in the burrow together with the parent. The male, who was present in most of these cases, usually aided in digging the new burrow and stayed down in it with the female but was never seen transporting young and did not seem to pay any attention to them when he passed the heap of them lying on the surface of the sand. In a few cases when the mother seemed to have settled down in the new burrow without transporting the young with her, I took one of the young and placed it close to the entrance of the burrow. In most of these instances the mother then came out to the young after a few minutes and carried it down in her mouth, obviously in response to the tiny squeaks the young was uttering. I have seen the same thing happen with young that were big enough to crawl a little, when they, crawling about, had come close enough to the opening of the burrow.

Both the method of transporting the young attached to the teats and carrying them in the mouth might be of importance when moving from one burrow to another. Many observations in the field indicate that a *polemonotus* family—even when undisturbed—does not occupy a single burrow for the whole period a litter is nursed but sometimes moves from one burrow to another. And I have evidence that a couple with young four days old moved with the young overnight from a burrow that had been halfway excavated to another burrow and nest they had made about fifty feet away.

Normally the young seem to be weaned when they are between twenty and twenty-five days old, although this appears to be subject to quite a wide variation, possibly depending on the condition of the mother, whether she is pregnant or not. Young between two and three weeks old are not

so strongly attached to the mother's teats when suckling as before; they can easily be pulled loose, and when the mother runs, they are usually left behind. I have seen young twenty-day olds occasionally nibble at other food between periods of suckling. When a female is isolated with the young and prevented from becoming pregnant again, the young will occasionally suckle up to an age of about thirty-two days. In one instance I have seen it in a young thirty-five days old. If the female has been mated again soon after the young were born—which seems to happen quite often, as our observations both in the field and in the laboratory indicate—the young seem to be weaned as soon as the new litter appears. We had two cases of this among our captive mice. In one instance the new litter was born when the young of the first litter were twenty-four days old, in the other case they were twenty-five days old. In both instances the first young were not driven out of the nest but stayed there with the rest of the family until I removed and isolated them. In the wild I have never found young of an earlier litter together with females nursing small young. Normally the family seems to break up and scatter before that time, and the appearance of the nests and burrows seemed to indicate that the couple always moves to a new burrow and makes a new nest before a new litter is born. From September 29 I have some observations indicating that the family, even in the field, sometimes does not break up until about the time when the new litter is ready to be born. At 1 p.m. I started excavating a burrow from which the exit tunnel was open to the surface. This practically always is an indication that the burrow has been abandoned. I have, however, found this condition in a few cases with the family still in the burrow, but then always with young of about the age when they are ready to leave. In the case in question the entrance hole was plugged. Possibly the grown young leave the burrow through the exit tunnel and also use it as an entrance during their last stay in the same nest with their parents. I found male, female and five young in the burrow, the young having an

average weight of about 6 grams. The whole family was moved to the terrarium, where the female the following night gave birth to three young. At 8 a.m. on September 30 I found the whole family, including the five young of the first litter, together in a new underground nest constructed overnight. When disturbed they all moved out, starting to dig a new burrow in the opposite corner. The female, who had gathered the newborn young in another corner, took part in the digging and was several times seen running back and forth between the newborn young and the new burrow. While this was going on, she must have given birth to one more young, as a fourth newborn later was found at the entrance of the new burrow. All the newborn had disappeared the next morning, evidently killed and eaten.

**STORING FOOD.**—We have very few observations on the food of *P. polionotus* in the field. A number of stomachs examined contained vegetable matter, but it was all so finely chewed that accurate classification was not possible. Examination of the burrows and nests for the possibility of finding stored food or traces of food brought down there was entirely negative up to December 3, when four acorns were found in a burrow occupied by a male and a female. On December 5 acorns were found in three different burrows, and in such numbers that it indicated actual storing of food. One of the burrows was occupied by a single male, and about twenty acorns were stored in the escape tunnel, plugging it so that the animal could not escape in the usual way. In an empty burrow 306 acorns were found. They must have been there several days, as about twenty per cent of them had sprouted. The distance from this burrow to the nearest oak scrub was about eighty feet.

Between December 5 and January 5 acorns were found in twelve out of nineteen occupied burrows, and acorns or remains of acorns were also found in several abandoned burrows. They were found in nests both with single individuals and with families; in two cases acorns were found in nests with newborn young. Hickory nuts were found in four burrows together with

acorns, in one instance nine hickory nuts and four acorns.

### *Peromyscus gossypinus* (Le Conte)

#### Cotton Mouse

Perhaps the most common and most generally distributed of the small mammals. It occurs wherever there is shrubbery or palmetto cover. In December these animals and *Mus musculus* invaded Rand's house, set in an oak grove by Lake Stearns. About twelve of this species were trapped before the nuisance was abated. The weather had not been severe, and the invasion can be correlated only with the end of the plentiful supply of food from the acorn crop.

Stomach contents of eight specimens examined consisted for the most part of very finely chewed indeterminable vegetable matter, but two stomachs also contained scales from myrtle berries, and two, a few insect remains, including those of an ant.

Parasites found included small nematodes in the intestines of four specimens and a dipterous larva 10 mm. long embedded in the abdominal wall of another.

Four litters of young were born to females held in captivity as follows:

September 2: 4 young.

October 16: 4 young.

November 10: 3 young.

November 16: 3 young.

All the young were eaten by the parent within a few days of birth. Weights of seven newborn young varied between 1.5 and 1.7 grams. Weights of three young eight days old were 3.6, 3.8 and 4.1 grams. Weights of six males in adult pelage were 23, 24, 27, 27, 29, 29 grams, and of four females 28, 31, 36 and 40 grams.

### *Peromyscus nuttalli* (Harlan)

#### Golden Mouse

The taking of three golden mice on the Station property somewhat extends the known southern limit of the range of this species. They were taken in sand scrub, with some spruce pine scattered through it, and with a plentiful palmetto under growth. One very fat female weighed 19 grams.

**Peromyscus floridanus** (Chapman)

Florida White-footed Mouse

Our only records are of those trapped (about twelve) in light sand scrub of the hill country. One male in adult pelage weighed 44 grams. Four stomachs examined contained finely chewed vegetable matter; in one, remains of palmetto berries were found, and another also contained a few insect remains. One specimen had a large cestode in its intestine.

**Oryzomys palustris** (Harlan)

Rice Rat

Common in all the damper areas where there is at least fairly dense cover of palmetto and grass or grass growth, even in such places in the sand hill country on the Station. The nature of the stomach contents examined varied greatly with the individual; one specimen had its stomach filled with insect remains, another, with vegetable matter, another, with grass seeds, insect fragments and meat. Ectoparasites included mites, lice and ticks; endoparasites, nematodes of at least two species. Two large males weighed 89 and 98 grams, respectively; one large female with a full stomach and five large embryos weighed 97 grams on December 17. Three of the embryos were in the right, two in the left horn of the uterus.

**Sigmodon hispidus** Say and Ord

Cotton Rat

Common, somewhat more restricted to damp, heavily grassed areas than the rice rat. One stomach examined was filled with what appeared to be pine mast; another, with palmetto berries. This species sometimes has heavy infections of internal parasites. One kept in captivity for some months died apparently from the effects of cysticercus infection that filled the liver, heart and whole body cavity; one wild specimen had numerous (more than fifty) small nematodes and one big nematode in the stomach and numerous (more than fifty) cestodes in the intestine; another had numerous small nematodes in the stomach, and nematodes and numerous cestodes of at least two species filling most of the in-

testinal tract; another had only a few cestodes in the intestine. One large female weighed 122 grams. A female taken September 9 had two well developed embryos; another taken October 15 had five embryos in the right, four in the left horn of the uterus. They were about 4 mm. long (crown-rump) and were estimated to be about one-third developed. One large male, killed on the highway by a motor car, weighed 163 grams.

**Neofiber alleni** True

Round-tailed Muskrat

In the marshes about the north end of Lake Okeechobee we found many houses of the species. They inhabit the suitable parts of the large marshes of the prairie to the east of Hicoria, and we have a specimen from there. On October 13 a full grown male, weighing 210 grams, was killed near a walled ditch running through the sand hill country on the Station property, several miles from any extensive area of suitable habitat; and on January 11 a marsh hawk killed and ate one in the ditch along the railroad beside the property. This may indicate that they wander widely in the fall, or that, as well as being common in the larger marshes, this species lives less conspicuously along smaller ponds and streams.

**Rattus rattus** (Linnaeus)

Black Rat, House Rat

Common about and in the buildings on the Station property. Previous to our occupation the grain-fed riding horses supplied abundant food for them. Only occasionally were they taken in trapping operations away from buildings. Of the thirty or so rats seen only three had a grayish black, not white, belly, suggesting *Rattus r. rattus*.

**Mus musculus** Linnaeus

House Mouse

None was taken in the open. A few were received that had been taken in houses in Lake Placid. However, they must live in the field, for Rand's house on Lake Stearns is isolated and while during the

summer there were no mice in it, in December many house mice, along with *P. gossypinus*, invaded the house. He then caught about six of them in the house.

Two males and a female each weighed 12 grams. A female with five nearly fully developed embryos on December 12 weighed 20 grams.

A young mouse, just able to run about, was taken January 8, 1942, in a store in Lake Placid.

### ***Sylvilagus floridanus* (Allen)**

#### Cottontail Rabbit

Common in the sand scrub and the flatwoods. They are occasionally a nuisance about both flower and vegetable gardens, and are sometimes used as food. A typical nest containing two young was found April 11 in a flower bed on the Station property. Despite frequent observations of the nest between then and April 22, when the young left it, no sign of the parent was seen at the nest during the daytime.

The young were naked and blind on April 11; by the 16th they were fairly well covered with fur; the eyes began to open on the 19th but were not fully open until the 22d, when they left the nest. Up to the 17th touching the nest covering made the young rabbits kick spasmodically. When they became larger this kicking threw off fur and leaves of the nest that covered them. When on the 22d day they left the nest at our approach, it recalled the nest-leaving of altricial birds. The young crouched motionless until we were close, then dashed suddenly some distance away with locomotion like that of the adult. One then crouched and allowed itself to be picked up. At this stage the

young continually tried to crawl under objects, such as branches. Introduced to a thirty-six-inch king snake at this time the rabbit paid no attention to it. This young rabbit was kept captive for a time. Between the 22d and the 27th it received some milk, fed from a medicine dropper, but it quickly began to eat green stuff, and after the 27th did so entirely. Evidently they can be independent shortly after leaving the nest.

### ***Sylvilagus palustris* (Bachman)**

#### Marsh Rabbit

Common about the grassy marshes bordering the sand hill country. Host saw the remains of several marsh rabbits, apparently eaten by wildcats, on the banks of a canal November 27. One wildcat taken in January had remains of a marsh rabbit in its stomach.

### ***Odocoileus virginianus* (Boddaert)**

#### Virginia Deer

Up to a few years ago deer were plentiful in the sand hill country about the Station, but they were practically extirpated in this area by the paid hunters of the tick eradication program. Five were shot within a half mile of the property. A few live about Highland Hammock State Park and in the hammock and prairie country east of Venus, but in the ten months during which we have done considerable field work about Venus, Hicoria and Lake Placid we have seen only two deer tracks. Cooper estimates there are twelve to fifteen in the game preserve (the country south of Route 8 and east of the railway that passes through Childs, Hicoria and Venus).