HAWKS AND OWLS IN OKLAHOMA 1939–1942: FOOD HABITS AND POPULATION CHANGES

BY A. MARGUERITE BAUMGARTNER AND
FREDERICK M. BAUMGARTNER

BETWEEN May, 1939, and June, 1942, a population and food-habits study of hawks and owls was made on the Lake Carl Blackwell Cooperative Land Use Project approximately 10 miles west of Stillwater, Oklahoma. During the period 1935-1939 this area of 21,000 acres of submarginal land was entirely closed to agricultural practices, hunting, and trapping. The primary objective of the Project was to demonstrate proper land use, emphasizing controlled grazing and the recreational aspects of a large impounded lake. It was also designated as a wildlife refuge and as a study area, particularly for investigations on the Bob-white (*Colinus virginianus*), Oklahoma's most widely hunted game bird. The work reported in this paper was limited in the main to 3,000 acres in the northeast corner of the project.

The area consists of rolling prairie cut by numerous shallow ravines. Four major plant associations are present: little bluestem prairie (*Andropogon scoparius*); abandoned fields dominated by annual grasses, particularly the triple-awned grasses (*Aristida* spp.), annual brome grass (*Bromus tectorum*), wire-grass (*Poa compressa*), and annual and perennial weeds, particularly the small ragweed (*Ambrosia artemisiifolia*), the rough button-weed (*Diodia teres*), sunflowers (*Helianthus* spp.), gumweed (*Aplopappus ciliatus*), and fleabanes (*Erigeron* spp.); patches of black jack oak (*Quercus marilandica*) and post oak (*Q. stellata*) on the sandy slopes; and timbered stream beds dominated by American elm (*Ulmus americana*), slippery elm (*U. fulva*), and hackberry (*Celtis* spp.).

1939

In late April of 1939, a trap line for predatory birds was set up on a representative 100-acre area. The traps were set on top of posts in old fence lines totaling approximately two miles in length. These fence lines bounded or intersected the area trapped. In order to make the traps most effective, all posts and other perches were removed except those selected for trap sites. Trapping was intensive. Number 0 steel traps were modified by weakening the spring with heat and by padding the jaws with sponge rubber. Although a few birds suffered lacerated legs and feet, injuries did not appear to be serious. A few owls died in the traps during periods of extreme heat during the summer. (Such losses were kept at the minimum by running the traps early in the morning, since most of the owls had been caught during the night.) A few birds were killed by mammals, probably striped skunks (*Mephitis mephitis*) or opossums (*Didelphis virginiana*).

Between April 21 and the middle of December, 1939, a total of 154 predatory birds of 13 species were trapped. These comprised 78 Barn Owls, 26 Marsh Hawks, 19 Short-eared Owls, 8 Screech Owls, 8 Red-tailed Hawks, 5 Swainson's Hawks, and one to three each of six other species of predatory birds (Table 1).

In addition to trapping, a daily record was kept of the number of hawks and owls seen on a 3,000-acre tract set aside for special studies. Barn Owls were abundant. Thirteen, including both nestlings and adults, were caught in the steeple of a deserted church less than a mile away. Marsh Hawks were seen at all hours of the day, beating back and forth over the meadows of bluestem grass and old weedy fields.

TABLE 1

PREDATORY BIRDS TRAPPED ON THE LAKE CARL BLACKWELL PROJECT APRIL 1939 TO DECEMBER 1939

Barn Owl, *Tyto alba*	78
Marsh Hawk, *Circus cyaneus*	26
Short-eared Owl, *Asio flammeus*	19
Screech Owl, *Otus asio*	8
Red-tailed Hawk, *Buteo jamaicensis*	8
Swainson's Hawk, *Buteo swainsoni*	5
Sparrow Hawk, *Falco sparverius*	3
Barred Owl, *Strix varia*	2
Long-eared Owl, *Asio wilsonianus*	2
Red-shouldered Hawk, *Buteo lineatus*	1
Ferruginous Rough-leg, *Buteo regalis*	1
Great Horned Owl, *Bubo virginianus*	1
	154

During the fall migration it was often possible to count as many as 25 individuals in one square mile. During November and December Short-eared Owls appeared to be as numerous by night as the Marsh Hawks were by day, and several roosts were found on the grassy slopes. Red-tailed Hawks were also seen daily in considerable numbers, but since they did not regularly use the fence posts as perches only eight were trapped. Nine other species were seen, though in less notable abundance. In May, 1939, only 1.05 predatory birds were counted per mile; in August, 2.70; in September, 7.59; and by December the number had risen to 17.85 per mile (Table 2).

At the same time, population trends of rabbits and small rodents were ascertained by trapping at regular intervals as well as by continuous field observations. Even to a casual observer, the year 1939 was throughout the state a period of unusual abundance of rodents, particularly of the cotton rat (*Sigmodon hispidus*). Cotton rats were seen almost daily on the study area throughout November and December, 1939, and 500 trap nights in November yielded an average of eight cotton rats for 100 trap nights, an indication of a high population according to the findings of Blair (1938).

TABLE 2

HAWKS AND OWLS SEEN PER MILE, MAY 1939 TO JUNE 1942

May, 1939	**	1.05	
June, 1939	*	.66	
July, 1939	***	1.39	
Aug. 1939	*****	2.70	
Sept. 1939	**********	7.59	
Oct. 1939	**********	10.26	
Nov. 1939	**********	16.49	
Dec. 1939	**********	17.85	
Jan. 1940	********	4.00	
Feb. 1940	***	1.37	
Mar. 1940	*	.46	
Apr. 1940	*	.66	
May 1940	*	.24	
June 1940	*	.07	
July 1940	*	.19	
Aug. 1940			
Sept. 1940	*	.83	
Oct. 1940	**	.60	
Nov. 1940	*	.71	
Dec. 1940	*	.55	
Jan. 1941	*	.50	
Feb. 1941	*	.39	
Mar. 1941	*	.37	
Apr. 1941	**	1.16	
May 1941	*	.37	
June 1941	*	.07	
July 1941	*	.52	
Aug. 1941			
Sept. 1941	*	.45	
Oct. 1941	*	.67	
Nov. 1941	**	.96	
Dec. 1941	**	1.16	
Jan. 1942	**	.90	
Feb. 1942	*	.69	
Mar. 1942	*	.57	
Apr. 1942	**	.84	
May 1942	*	.20	
June 1942	*	.53	

That these small mammals had made up practically the entire food of the majority of the predatory birds was shown by hundreds of pellets collected in 1939. Table 3 enumerates the food items and number of pellets for six of the predators. In every case the preponderant figures are in the cotton rat column, representing over 66 per cent of the total food items. The harvest mouse (*Reithrodontomys montanus*) was second (17 per cent), with the remaining 16 per cent distributed among 14 species of vertebrates and a few invertebrates.

The great bulk of the pellet material found was from Barn Owls, which were the most abundant species and offered opportunities for intensive collecting at nest sites. Material was also obtained from Marsh Hawks, Buteo hawks, Screech Owls, Great Horned Owls, Barred Owls, and Short-eared Owls. Pellets were analyzed according to the methods described by Errington (1930). For reference specimens we are indebted to the Zoology Department of Oklahoma Agricultural and Mechanical College.

Marsh Hawk. Thirty-one pellets collected from winter roosts of the Marsh Hawk consisted chiefly of fur. One pellet was composed largely of woodpecker feathers, and the remains of one carabid beetle were also found. The skeletal material was almost entirely cotton rat; in the field, Marsh Hawks were frequently flushed from cotton rat kills.

Unidentified Buteos. Large numbers of pellets of Buteo hawks were examined in the field and laboratory. These may be attributed chiefly to Red-tailed Hawks, which were abundant; in limited numbers to Swainson's, American Rough-legs (*Buteo lagopus*), and Ferruginous Rough-

TABLE 3

FOOD ITEMS OF PREDATORY BIRDS ON THE LAKE CARL BLACKWELL PROJECT

	Marsh Hawk	Screech Owl	Great Horned Owl	Barred Owl	Short-eared Owl	Barn Owl	Totals
Common mole (*Scalopus aquaticus*)			1			2	3
Little shrew (*Cryptotis parva*)			2		6	29	37
Short-tailed shrew (*Blarina brevicauda*)			1			7	8
Pocket mouse (*Perognathus hispidus*)			2		3	32	37
Harvest mouse (*Reithrodontomys montanus*)	2	1	1		12	171	187
Deer mouse (*Peromyscus* sp.)		1	1		7	39	48
Cotton rat (*Sigmodon hispidus*)	11	2	36	3	69	592	713
House mouse (*Mus musculus*)					4	2	6
Cottontail rabbit (*Sylvilagus floridanus*)			10			3	13
Black-tailed jack rabbit (*Lepus californicus*)			1				1
							1053 (97.86%)
Duck sp. (*Anatidae*)			1				1
Woodpecker sp. (*Picidae*)	1						1
Meadowlark sp. (*Sturnella*)			1				1
Blackbird sp. (*Icteridae*)			1				1
Fringillid sp. (*Fringillidae*)			2		1		3
Small bird sp.			2				2
							9 (0.84%)
Fish sp.				1			1
							1 (0.09%)
Crayfish sp. (*Cambarus*)						2	2
Beetle sp. (*Carabidae*)	1		5				6
Beetle sp. (*Calosoma* sp.)			1				1
Beetle sp. (*Trogidae*)			3				3
Beetle sp.						1	1
							13 (1.21%)
Total food items in pellets	15	4	71	4	102	880	1076 (100.00%)
Number of pellets	31	3	67	3	130	662	896

legs; and a few to Red-shouldered Hawks. Prey species were found in these pellets in proportions similar to those in the identified pellets, with a preponderance of cotton rats. Mice, shrews, and cottontail rabbits were noted in very limited numbers. No bird remains were found.

Screech and Barred Owls. Data on the Screech and Barred Owls, although meager, suggest that they also were depending upon cotton rats for their major food items.

Great Horned Owl. Some of the 32 Great Horned Owl pellets found in 1939 were taken from nests, but the majority were taken from under roosts. Cotton rats constituted 33 of the 44 food items found. Nine beetles were taken from the nest debris, and are listed with the food items, but it is possible that these insects were not eaten by the owls. (See Table 4.)

Short-eared Owl. During the spring and fall of 1939, 130 pellets were collected from Short-eared Owl roosts in the bluestem prairies. Almost 70 per cent of the 102 food items consisted of cotton rats, the rest being made up of five species of small mammals and one small bird.

Barn Owl. During 1939, Barn Owls were by far the most abundant owl on the area, furnishing almost 75 per cent of the total pellets collected. Because the volume of disintegrated pellets found at Barn Owl nest sites was too great to be disregarded, we attempted to deduce the number of pellets contained in the debris. The following simple equation, we believe, gives a reasonably accurate figure.

$$\frac{\text{409 complete pellets collected}}{\text{366 cotton rats found in pellets}} = \frac{\text{x pellets in debris collected}}{\text{226 cotton rats found in debris}}$$

Then x equals 253 pellets in the debris, which, added to the 409 complete pellets collected, make a total of 662 pellets.

Of the 880 food items included, 67 per cent were cotton rats. There were three young cottontail rabbits and three invertebrates. The remainder was made up of small mammals of seven species.

In comparing food items of the Barn Owl month by month, seasonal trends could be observed in the use of two species. Harvest mice rose from 10 per cent of the total food items in April to 33 per cent in July, and thereafter dropped steadily to 8 per cent in October. Cotton rats, fluctuating between 50 per cent and 66 per cent of the total food items during spring and early summer, began to rise steadily in August and by October made up 83 per cent. By the end of 1939, Barn Owls were apparently subsisting almost entirely on cotton rats.

JANUARY 1940

Thus we have an abundance of predatory birds accompanied by an abundance of rodents, shown by pellet analysis to constitute the major portion of the birds' food. But abruptly this situation changed. During late December, 1939, and early January, 1940, several inches of snow blanketed the ground, accompanied by unusually low temperatures.

January, 1940, was the second coldest month on record at Stillwater, with an average temperature of 13° F. below the 48-year average for the month. Sub-zero temperatures were recorded on two dates, and during a nine-day period the maximum temperature was below freezing.

The duration and severity of this period brought on a crisis in the small animal populations on which the hawks and owls had been feeding. Cotton rats almost completely died off, and the several species of mice suffered heavy losses. A total of 5,000 trap nights from the middle of January through July did not yield a single cotton rat (Schendel, 1940), and cotton rats were not seen at all in the field during the spring and summer of 1940.

Similarly, only 11 hawks and owls were trapped between mid-December, 1939, and June, 1940. In the field, an average of only four hawks and owls per mile was recorded in January, only 1.37 in February, and since that time, except for April and December, 1941, when the average was 1.16, the average figure has been consistently less than one predatory bird per mile (Table 2). Barn Owls, which had been the most plentiful species, were not recorded at all between February 1, 1940, and September, 1941, with the exception of one that was trapped on April 12, 1940.

One Short-eared Owl was seen in February; another was trapped in March, and the species was recorded again, and for the last time, on April 18, 1940. By the end of February, Marsh Hawks were seldom seen. Thereafter, 5 in a full day afield was considered a high figure, as contrasted with 25 in a square mile during the previous fall.

TABLE 4

CHANGES IN FOOD HABITS OF THE GREAT HORNED OWL

	No. of pellets	Cotton rats	Rabbits	Other small mammals	Birds	Insects
1939	32	33	1	0	1	9
1940–41	35	3	10	8	6	0

Species such as Cooper's Hawk (*Accipiter cooperii*), which preys chiefly on birds, and the Great Horned Owl, which can overpower larger animals, did not suffer so marked a reduction as the other birds. Beak marks, tracks in the snow, and other evidence indicated that at least 6 of 21 bird kills that were found in the field had been made by Cooper's Hawks. Great Horned Owls were found in their usual numbers following the departure of the other predatory birds. But pellet analysis indicated a definite change in their food habits (Table 4). The 1939 pattern of food items was similar to that of the other predators, with cotton rats preponderating in the diet. But the pellets from 1940-41 contained a notably larger proportion of rabbits, birds, and rodents other than cotton rats.

Later Trends

The trend in 1941 and 1942 for both predatory populations and their food species, appeared to be slightly upward again. In April, and December, 1941, an average of 1.16 predatory birds was recorded per mile, a figure almost twice that for the previous April and December. Also, a few cotton rats were trapped at one station in late June, 1941, the earliest record following the storm.

Summary

A population and food-habits study of hawks and owls was made in northcentral Oklahoma between May, 1939, and June, 1942.

Both trapping and field observation in 1939 indicated an abundance of Barn Owls, Marsh Hawks, Short-eared Owls, and Screech Owls, as well as the presence in smaller numbers of nine other predatory species.

Populations of rodents, particularly cotton rats, were similarly high.

Pellet analysis indicated that over 66 per cent of the total food items of the predatory birds in 1939 consisted of cotton rats.

Following an unusually cold period in late December, 1939, and early January, 1940, both populations of rodents and species of predatory birds whose food had consisted primarily of cotton rats showed a notable decrease or disappeared altogether.

The Great Horned Owl, whose food habits are more generalized, and the Cooper's Hawk, which feeds primarily on small birds, were recorded in their usual numbers after the period of unusual cold.

In 1941 and the spring of 1942 populations of predatory birds showed a slight increase, and a few cotton rats were again trapped in late June, 1941, the earliest record following January, 1940.

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Oklahoma Agricultural and Mechanical College, Stillwater, Oklahoma