

## OWL STUDIES AT ANN ARBOR, MICHIGAN

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THE main purpose of this study was to determine the economic status of five species of owls found in the vicinity of Ann Arbor, Michigan. It considers their behavior when flushed, their food and feeding habits, their distribution by cover types and the distinguishing characteristics of their respective pellets and the effects of weathering upon these. The methods employed in this investigation have varied but little for the different species. The period of study extended from September, 1932, to May, 1933. An attempt was made to locate all of the individual owls in the region studied.

## DESCRIPTION OF THE AREA

The country along the Huron River valley is flat to rolling. It was originally covered with hardwoods, and deciduous woodland tracts still extend intermittently for miles, bordered here and there by farm land. These wooded areas consist of second-growth hardwoods most of them from forty to sixty years old and others up to one hundred years old or older. Some of the common species are: pignut and shagbark hickory, swamp white oak, red oak, white oak, bur oak and American elm. The majority of such trees yield seed and nut crops which help support a considerable rodent population, most numerous of which are the meadow mice and deer mice.

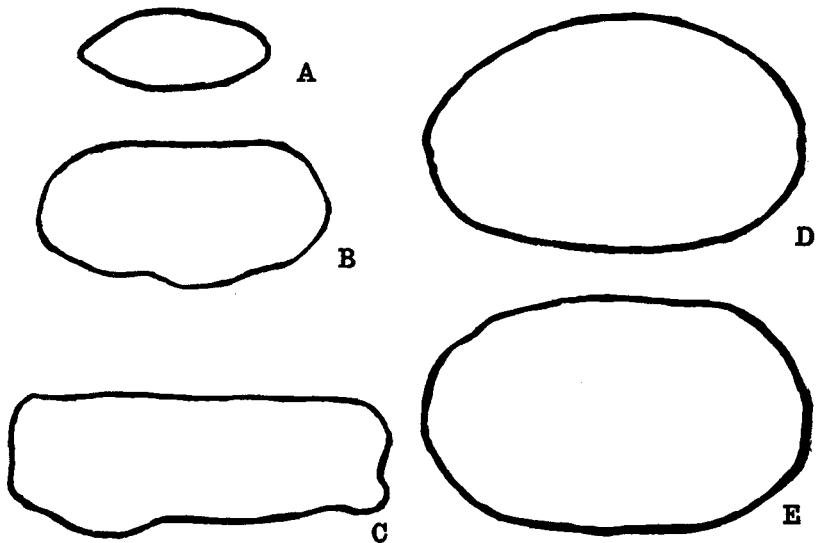
Although few evergreens are indigenous to southern Michigan (red cedar, ground juniper, black spruce) approximately three hundred acres have been planted to conifers within the area covered by this investigation. These plantations consist mainly of white pine and red pine with occasionally Scotch pine and Norway spruce. They vary in height from ten to fifty feet and in age from ten to twenty-five years.

Wooded areas farther from the river are in scattered blocks of from five to ten acres. The ages here are about the same as those in the river-bottom hardwoods; the older stands occupy about one-fifth of the total area and are generally located within moist or semi-swamp sites where the American elm and black ash predominate. The forty to sixty age-class stands are on well-drained soils and consist for the most part of oak and hickory. Marsh and agricultural lands border the wooded areas.

LONG-EARED OWL (*Asio wilsonianus*)

Long-eared Owls were found in two distinct habitats. During the late summer, fall and winter months they inhabited the coniferous woods and during their nesting and brooding seasons from March until June, they were found in the hardwoods.

Two families of this species were observed consistently. One was located along the Huron River close to Ann Arbor in a five-acre Scotch- and red-pine plantation. This stand, which was bordered on two sides by marsh land, was from ten to fifteen feet high and had frequent open areas within it. The other area was a large spruce and tamarack swamp about one hundred acres in extent and also adjacent to marsh and agricultural land. The owls were located in the evergreen growth through the presence of pellets, feathers and the ureal deposits on the trees. Accurate location of areas used by owls was possible only by a complete survey of the area. Where the stands were too large to cover completely, random sample plots were established.



TEXT-FIG. 1.—Average outlines of owl pellets. A, Saw-whet Owl; B, Screech Owl; C, Long-eared Owl; D, Barred Owl; E, Barn Owl.  $\times 1$ . For limits of dimensions see text.

The typical pellet of this owl is oblong and narrowly cylindrical, 5 to 6 cm. long by 1.5 cm. in diameter. This pellet may be confused with that of the Screech Owl, as there is a close similarity in the form of the bolted matter of the two birds (Text-fig. 1). There are marked variations in the length of the Long-eared Owl's regurgitations but the diameter of the pellet seldom varies more than a few millimeters. In the case of the Screech Owl there was no typical shape and in some cases pellets resembled the smaller regurgitations of a larger owl.

When roost trees were found, they were marked with a white cloth and

recorded on the field map. They were then visited weekly and all pellets found under them were collected. Pellets of questionable origin were discarded unless the owl was actually observed or its identity made certain by the presence of feathers. Because pellets of the Long-eared Owls were frequently broken in their fall to the ground, an accurate pellet count was found to be impossible. An attempt was made to establish some criterion for a quantitative measure of the pellets by averaging 82 randomly picked regurgitations of this owl. The same procedure but with varying numbers of samples was finally adopted for the other owls. The extreme range in sizes of pellets from the Long-eared Owl, for example, was: maximum length, 8.4 cm.; minimum length, 2.7 cm.; maximum diameter, 2.2 cm.; minimum diameter, 1.3 cm. Owls never used any one roost more than two or three weeks, yet as many as 125 pellets were found at the same tree. The explanation for this is that the birds are gregarious. It is known, for instance, that the offspring remain with their parents for eight or ten months or until the next mating season.

Since the owls left the coniferous cover about the middle of March, no pellets were found there after this time. Also persistent search for the next two months in the adjacent hardwoods disclosed only a few pellets. Only one nest of this species of owl was discovered. This was late in May when the writer's attention was first attracted to it by the excited calls of a group of Crows. This nest contained five young owls. Subsequent observations disclosed that no harm was done to the young owls by Crows.

From the 1,138 pellets collected from this species of owl, 1,935 skulls were taken or an average of 1.7 per pellet. These skulls were identified as follows: meadow mice (*Microtus pennsylvanicus*), 1,458 skulls; deer mice (*Peromyscus* sp.), 209; Cooper lemming mice (*Synaptomys cooperii*), 184; short-tailed shrew (*Blarina brevicauda*), 41; least shrews, 2; jumping mice (*Zapus hudsonius*), 25; little brown bat (*Myotis lucifugus*), 1; Norway rat (*Rattus norvegicus*), 2; and 13 birds, mostly Fringillidae.

#### SCREECH OWL (*Otus asio*)

The Screech Owls were found to inhabit both hardwood and coniferous cover. Of the seven known occurrences in hardwoods, five were within the larger mature timber. Signs of this bird's presence were seldom noted in the smaller hardwood growth and the two occurrences were apparently attributable to transient birds. Every coniferous stand investigated harbored this owl and within mixed stands of white and red pine the former was usually chosen by the Screech Owl as roost trees. Of fifty-six roost trees found in such a stand, forty were white pine. Another choice roosting site was a pure Scotch-pine stand where 112 pellets were found under fifty-two trees concentrated on half an acre. This area, however, was abandoned in

January when the owls moved to a thick spruce stand a quarter of a mile away. Later 257 pellets were found under eight trees. Ureal deposits were found on all roost trees and were especially noticeable in areas of dense stocking, a characteristic which is found most helpful in locating roosts. A five-acre stand of red cedar and ground juniper also seemed to be a favorite site for this species, where they apparently used the red cedar for roosting purposes as was evidenced by the general presence of pellets. It was difficult to determine the presence of this species in hardwoods, and the detailed reconnaissance used in coniferous growth was found to be impracticable in hardwoods because of the extensive areas of the type. The most likely areas including the ground beneath decapitated, hollow and non-defoliated beech trees were searched for pellets. Few were found, however, and apparently most regurgitations were deposited within hollow trees which were numerous in the larger hardwood stands. No marked sign of gregariousness was ever noted in this bird. During the fall months single birds only were flushed and it was not until January and the commencement of the mating season that they were seen in pairs.

The food taken by this bird is indicated by an examination of 1,408 pellets containing 1,549 skulls. The following animal remains were identified: meadow mice (*Microtus pennsylvanicus*), 1,344; deer mice (*Peromyscus* sp.), 73; Cooper lemming mice (*Symaptomys cooperi*), 48; short-tailed shrew (*Blarina brevicauda*), 49; jumping mice (*Zapus hudsonius*), 10; least shrews, 5; red squirrel (*Sciurus hudsonicus loquax*), 4; eastern mole (*Scalopus aquaticus machrinus*), 3; Norway rat (*Rattus norvegicus*), 2; birds, 4; parts of crawfish, 4; and insects, 3.

#### SAW-WHET OWL (*Cryptoglaux acadica acadica*)

The Saw-whet Owl was not abundant. The few birds located were found in small coniferous cover and usually in the more dense stands. The observer, by approaching quietly, could very often get as near as two feet from the bird before it flew and, on one occasion, one of these birds was captured by the writer. There was no set method used in finding this bird; the discoveries were made always while the writer was searching for some other owl.

Its regurgitations were small, 2 to 2.5 cm. long by 1 cm. in diameter and quite typical. The pellets of the Screech Owl, which were of this size, lacked the characteristic compactness of the Saw-whet Owl's pellet. However, some confusion exists in distinguishing between this owl's pellet and that of the Sparrow Hawk (*Falco sparverius*).

#### BARRED OWL (*Strix varia*)

Barred Owl pellets were most frequently found in coniferous stands, though on rare occasions they were located in hardwoods contiguous to

these. During the nesting season, however, coniferous cover was abandoned and in one case a nest was located in a hollow elm close to the Huron River. There was a marked tendency toward the utilization of coniferous cover in instances of mixed stands and in a thick growth of white pine and spruce of the ten- to fifteen-year age class, ten to twenty feet high, pellets were deposited in the more dense areas, and fifty of the sixty pellets gathered were found beneath white pines. There were exceptions, however; for instance, during stormy and foggy days the Barred Owl seemed to choose the more open habitat. At such periods pellets were commonly found under a few volunteer locusts, mixed within the thicker cover of the pines. A variable number of roosts was used and seldom for more than a week at a time. In one instance, however, records show the distribution of 124 pellets beneath eight trees, with a maximum count of thirty-five regurgitations at one roost.

A total of 249 Barred Owl pellets was collected, in which were identified 777 skulls, as follows: meadow mice (*Microtus pennsylvanicus*), 648; deer mice (*Peromyscus* sp.), 29; Cooper lemming mice (*Synaptomys cooperii*), 7; jumping mice (*Zapus hudsonius*), 8; red squirrel (*Sciurus hudsonicus loquax*), 1; house mouse (*Mus musculus*), 1; short-tailed shrew (*Blarina brevicauda*), 53; least shrews, 8; amphibians, 5; insects, 9; and birds, 8.

#### BARN OWL (*Tyto alba pratincola*)

The majority of Barn Owl pellets were found in a red- and white-pine stand, twenty to thirty years of age. During the late summer and fall, pellets were located under the red-pine, while during the winter and early spring months, they were more frequently located within the more dense white-pine cover. Although most of the pellets were located on less than one acre of land, over fifty trees in an adjoining fifteen-acre stand of pine yielded pellets. During the winter months the Barn Owl seemed very consistent in its use of the same roost; one owl used the same tree on eighteen successive days. Hardwoods and spruce in a cemetery bordering the residential section of Ann Arbor, were inhabited by Barn Owls. Spruce trees in the area were used almost exclusively, where ninety-one pellets were collected beneath fifteen trees and thirty were taken from under one. Barn Owls also roosted in a nearby church steeple.

It was difficult to distinguish between the pellets of this owl and the pellets of several of the larger owls (Text-fig. 1). Regurgitations of the Snowy Owl (*Nyctea nyctea*), although larger than the average Barn Owl pellet were, however, identical in shape and pattern. Measurements were made of one hundred each of Barred and Barn Owl pellets, gathered from roosting sites positively known to be occupied by these birds. A final average of each lot revealed a difference in average length of less than one millimeter. Such close similarity calls for other means of identification.

As in the case of the Barred Owl, the Barn Owl also exhibited a marked solitary tendency and like the Screech Owl it did not tolerate another of the same species until the mating season. It was approached with more success than any other owl studied and one bird became so accustomed to my presence that it would stare for seconds before flying.

The food of this bird did not vary and during the nine months that its pellets were analyzed no marked change in diet was noted. The diet of other species, especially the Screech Owl, showed a definite cycle; during the spring many of these birds fed upon insects and amphibians. Quantitatively the average Barn Owl pellet contained 3.05 skulls. A collection of 619 pellets containing 1,888 skulls was gathered. The analysis of these pellets showed the following: meadow mice (*Microtus pennsylvanicus*), 1,710; deer mice (*Peromyscus* sp.), 43; Cooper lemming mice (*Synaptomys cooperii*), 37; jumping mice (*Zapus hudsonius*), 5; red squirrel (*Sciurus hudsonicus loquax*), 1; short-tailed shrew (*Blarina brevicauda*), 73; least shrews, 7; snail, 1; weasel, 1; and birds, 10.

#### EFFECT OF WEATHERING ON PELLETS

From the beginning of this investigation it was apparent that a knowledge of the resistance of pellets to weathering would be valuable. This would indicate how long a pellet remains intact after regurgitation. In this study, only the well-formed pellets made up of mammal remains are considered. Those made up of crawfish, insects, fish and frogs do not hold together readily even when fresh. Apparently the degree of protection provided by cover is the most important factor in determining the relative rate of deterioration. Pellets under museum conditions, unless infested by insect larvae, seem to remain unbroken almost indefinitely. Freezing and thawing and rainfall readily decompose the pellets. The smaller pellets remained intact in the open only four to six weeks during the spring. Larger ones, such as those of the Barred and Barn Owls, remained whole from eight to ten weeks. Pellets of all owls remained whole during the winter for from three to five months. After the pellets have weathered away it is natural to expect greater numbers of skulls and animal parts on the surface of the ground than are usually found. This should be especially true in coniferous forests where nothing but the needles forms the ground cover. However, the reverse of this seems to be true as shown by observations made during the spring of 1932. Several dozen Long-eared Owl pellets were cached beneath a Scotch pine for about a year, at the end of which only a few of the larger skulls were found. The pellets had been broken down by weather, insects, mice and other agencies, and the smaller skulls were buried beneath the needles.

## RELATIONSHIP OF OWLS TO SONGBIRDS

One of the interesting findings in this study is the fact that birds were so unimportant in the diet of the owls. Songbirds were numerous in each owl habitat studied. Many birds used the same cover for roosting and nesting but in spite of this, songbirds actually averaged less than one per cent of the total food found in all the pellets studied. However, the examination of pellets from a pair of nesting Barred Owls with a family shows that twenty per cent of their food at this time consisted of birds, mostly woodpeckers. A Barn Owl roosted in a tree for nearly a week overlooking an adjacent white pine that held a Mourning Dove's nest containing two downy young. No harm to the doves resulted and six pellets gathered beneath the roost contained only mice. Quail were common in or adjacent to each of the owl-inhabited areas, but pellets analyzed indicated that the quail were not eaten. The tendency of the owls in this vicinity to ignore birds can possibly be explained by the abundance of mice, and should the supply of mice and shrews become reduced, it is possible that any of the species of owls studied might take a larger number of songbirds than was indicated in this study. With the exception of the nesting Barred Owls previously mentioned, at no period during the study did the few birds consumed appear in the pellets at any particular time but they were distributed in about equal proportions from September to May. A large number of songbirds' roosts were discovered and many of these were in the very roost trees used by the owls.

## RELATIONSHIP OF OWLS TO MAMMALS

The 3,418 pellets analyzed contained 6,153 skulls and animal parts from which the individual animals were identified. Of this aggregate, rodents made up 95 per cent; shrews and moles, 4 per cent; birds, 0.62 per cent; crawfish, 0.15 per cent; weasel, bats, frogs, salamanders, snails, and insects, 0.23 per cent.

Considering the rodents separately, only 84 pellets of the total analyzed contained none. Of the seven species represented, 88.25 per cent were meadow mice (*Microtus pennsylvanicus*); 6.00 per cent deer mice (*Peromyscus* sp.); 4.70 per cent Cooper lemming mice (*Synaptomys cooperii*); 0.82 per cent jumping mice (*Zapus hudsonius*); 0.15 per cent red squirrel (*Sciurus hudsonicus loquax*); and 0.08 per cent Norway rat (*Rattus norvegicus*) and house mouse (*Mus musculus*). The largest number of individual animals found in a single pellet (Barn Owl's) was seven, all of them meadow mice. Frequently, pellets of the Barn and the Barred Owls contained four and five individuals, though many of these were often composed of small shrews, mostly *Sorex* sp. The larger animals, such as rabbit, muskrat, mink and skunk, although numerous were found not to be among the owl foods. The

only larger mammal represented was a weasel, the bones of which were found in two large Barn Owl pellets.

Greffinius (1932, unpublished manuscript, 'A preliminary report on a method of censusing mice'), making a study of small-mammal populations in the vicinity of Ann Arbor, and along a marsh hunted by a family of Long-eared Owls reported upon in this study, demonstrated that a close frequency ratio existed between the species of mammal foods consumed by this owl and the smaller mammal species trapped from an area.

The following proportions of animal life (individual animal densities) were found by Greffinius: meadow mice (*Microtus pennsylvanicus*) ninety-two per cent and short-tailed shrew (*Blarina brevicauda*) eight per cent. Comparing these figures with data obtained from the analyses of 671 Long-eared Owl pellets taken in the same vicinity, eighty per cent contained meadow mice and three per cent short-tailed shrew, which indicates that in the case of mammals, owls apparently feed upon the food that is most readily available.

#### ECONOMIC IMPORTANCE

The importance of owls to the farmer is relative and is determined by the quantitative values of the average pellet. The Barn and Barred Owls, for instance, which average three small mammals to a pellet, would be of as much value to the farmer as four Saw-whet Owls, three Screech Owls and two Long-eared Owls, providing that they regurgitated the same number of pellets.

#### SUMMARY

##### *Traits and Relationships*

##### Barn Owl

*Relationship to hawks.*—None observed.

*Relationship to other owls.*—Occupied a one-acre area used by a pair of Screech Owls,—no animosity discovered. Pellets of both birds found beneath the same trees. Barred Owls likewise frequented adjacent conifers without apparent animosity.

*Relationship to small mammals and other animal life.*—Game birds, none; small game, none; fur bearers, a weasel; songbirds, ten. The three Barn Owls studied ate of a small-rodent and shrew diet during every season.

*Roosting cover preferences as determined by the pellet.*—Conifers, 597 pellets; barn, 14 pellets; church, 8 pellets.

*Migration tendencies.*—No real migration observed; one owl did considerable wandering, however, as was noted in the periodic absence of pellets.

*Gregariousness.*—None observed; a solitary bird except during the nesting season. Birds were seen together as early as January and in pairs.



### Barred Owl

*Relationship to hawks.*—Two Sharp-shinned Hawks (*Accipiter velox*) found in pellets during the early winter.

*Relationship to other owls.*—All three habitats occupied by this bird also inhabited by the Screech Owl; both birds seemed tolerant of each other.

*Relationship to small mammals and other animal life.*—A mouser the year round except during and after the nesting season; at this time one-fifth of its diet was songbirds, also amphibians. Songbirds, 8.

*Roosting cover preferences as determined by the pellet.*—Conifers, 190 pellets; hardwoods, 59 pellets, most of these found after the mating season.

*Migration tendencies.*—None observed except during the nesting season, and this was local.

*Gregariousness.*—None observed; a solitary bird except during and after the mating season.

### Long-eared Owl

*Relationship to hawks.*—Occupied and hunted the same areas used by Marsh Hawks (*Circus hudsonius*), and the Red-shouldered Hawk (*Buteo lineatus*).

*Relationship to other owls.*—Occupied the same locality used by a Great Horned Owl (*Bubo virginianus*); nothing found in the pellets of either birds that would signify animosity.

*Relationship to small mammals and other animal life.*—Area of habitation and hunting grounds occupied by a covey of quail, pheasants, many rabbits, several opossums, a family of skunks. None of these was found in the analysis of pellets. Birds, 13.

*Roosting cover preferences as determined by the pellet.*—Conifers, 1,136 pellets; hardwoods, two pellets, both of which were found in an adjacent hardwood forest during March after commencement of the mating season at a time when no pellets were being found in the conifers.

*Migration tendencies.*—Marked; extent unknown; returned in November to old roosting area of the spring before.

*Gregariousness.*—Marked, offspring remained with the parents until January of the next mating season when all but the mated adults disappeared.

### Screech Owl

*Relationship to hawks.*—None observed.

*Relationship to other owls.*—Was found in every owl habitat studied excepting those of the Long-eared and Saw-whet Owls.

*Relationship to small mammals and other animal life.*—Winter months, rodent life and an occasional bird. Spring months, rodent life, crawfish, insects and an occasional bird. Summer months, ? Fall months, rodent life, crawfish and insects. Birds, four.

*Roosting cover preferences as determined by the pellet.*—Conifers, 1,361 pellets; hardwoods, 47 pellets, most of these beneath beech trees that had retained their autumn foliage, the tawny-colored leaves blending perfectly with the owl. During cold and inclement weather, however, such owls doubtless roosted in several of many hollow trees in the area for few pellets were found beneath these trees at any time.

*Migration tendencies.*—None observed.

*Gregariousness.*—None observed; pair together during the late winter.

#### Saw-whet Owl

No adequate records.

#### *Flight Characteristics*

##### Barn Owl

*Flushing distance.*—Upon intrusion the bird flushes at from five to one hundred feet. It alights again at from three hundred to five hundred feet.

*Appearance on the roost.*—There was no attempt to simulate a branch, but the bird would stare, until some movement caused it to fly.

*Character of flight.*—When flushed the flight is slow and clumsy into the open and above the trees; when pursued by Crows it is slow, flapping and irregular. Ordinary flight is noiseless, moth-like and effortless, about ten to fifteen miles per hour.

##### Barred Owl

*Flushing distance.*—Disturbed to flight during the nesting season, parent birds flushed at from five to one hundred fifty feet, at other times at from twenty-five to one hundred feet, alighting at from two hundred to one thousand feet.

*Appearance on the roost.*—Stares wild-eyed, body barrel-shaped.

*Character of flight.*—When flushed, the flight is slow but faster than that of a Barn Owl and in conifers, usually just above the tops of the trees. Pursued by Crows in conifers, it flies above the trees with no decided effort to be rid of the pursuers.

##### Long-eared Owl

*Flushing distance.*—Took to flight upon intrusion at from ten to twenty-five feet and alighted at from seventy-five to three hundred feet.

*Appearance on the roost.*—Stiff and straight, simulating the branch of a tree; difficult to distinguish from a background.

*Character of flight.*—When flushed, the bird takes off in a downward swoop to earth, thus getting away very rapidly; pursued by Crows in conifers, its flight is noiseless, effortless, zigzag in and out among the trees and too fast for the Crow. In the open, the flight is less zigzag and the Crows keep up. Ordinary flight is slow, about ten to fifteen miles per hour.

### Screech Owl

*Flushing distance.*—Disturbed to flight in conifers, it flushed at from ten to one hundred feet, alighting at from two hundred to five hundred feet.

*Appearance on the roost.*—Similar in appearance to the Long-eared Owl but smaller.

*Character of flight.*—When flushed, a downward flight gets it away rapidly. Ordinary flight is slow and graceful, ten to fifteen miles per hour.

### Saw-whet Owl

*Flushing distance.*—Upon intrusion the bird flushed at from two to fifty feet, alighting at from seventy-five to one hundred feet.

*Appearance on the roost.*—Very tiny, about as large as a Robin! Like other small owls, it also tries to minimize its size and often looks at the intruder in a squint-eyed, sleepy manner; a sudden movement, however, opens the eyes widely.

*Character of flight.*—When flushed it gets away fast, the momentum in flight gained by a downward swoop similar to that of a flying squirrel.

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