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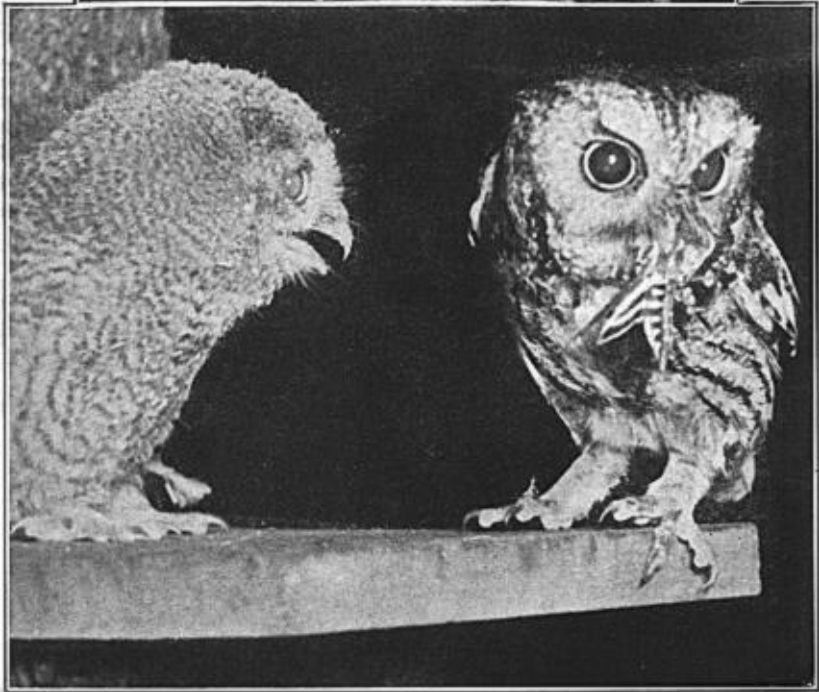
A CONTRIBUTION TO THE LIFE HISTORY AND
ECONOMIC STATUS OF THE SCREECH
OWL (*OTUS ASIO*).

BY A. A. ALLEN, PH.D.

Plates I-V.

DURING the past six years we have maintained at our home in Ithaca, N. Y., a bird sanctuary. It consists of about four acres of rather rough ground on a hillside facing the west. A rather deep ravine passes through the north side of the grounds and the whole area is scatteringly covered with pine, hemlock, maple, elm, ash, and basswood. Near the house the stream has been dammed to form a small waterfowl pond and about one half acre of the open land is used for enclosures for upland game birds. There are plenty of tangles and shrubbery for nesting places so that, without much further inducement, there has always been an abundance and a considerable variety of birds making it their home.

Each year we have maintained a map of the area upon which the location of the nest of each bird has been accurately charted so that we have come to have a rather personal interest in each pair of birds. The making of these maps and the histories of the different bird families is a long story which will be omitted at this time and it is mentioned only to give the setting for a pair of Screech Owls (*Otus asio*) which are the subject of this article. For it is impossible to make an intensive study of any bird without

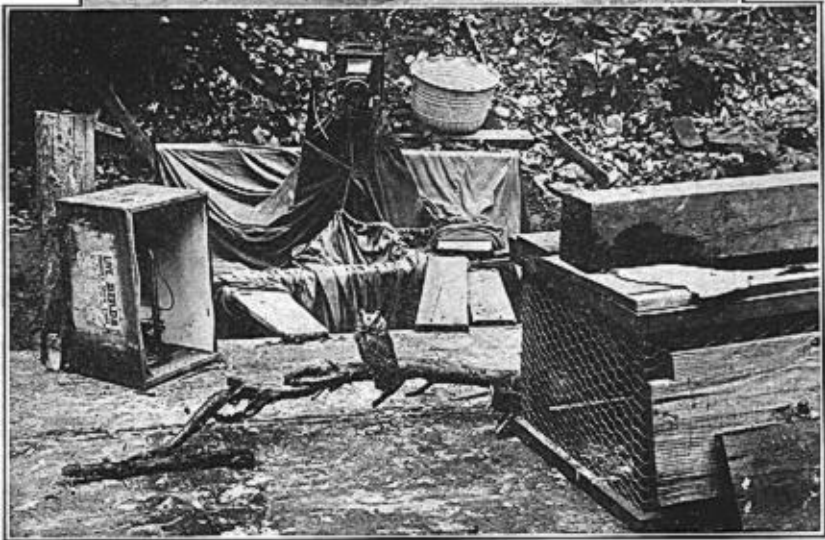


1. SCREECH OWL AT NIGHT (FLASH-LIGHTED) WITH A SALAMANDER FOR ITS YOUNG.
2. THE SAME BIRD WITH HAWK MOTH.

involving its neighbors, especially when that bird happens to be an Owl.

A pair of Screech Owls appeared in the sanctuary first in 1921 when they made their nest in a hollow basswood about a hundred yards up the ravine from the house. They were rather quiet neighbors, so much so, in fact, that we did not suspect their nesting until the first young left the nest and perched in the hemlock close by. This year we were looking for them but they did not return to their former nest which was occupied by a pair of red squirrels. It was not until the first of May that we discovered the nest and then, to our surprise, found it in a Flicker box on a large pine by the pond. The box was about twenty feet from the ground but in plain sight of the house and the path which was followed each day in feeding the ducks. There was nothing about the box to indicate that it was in use, but the presence of the male bird in a hemlock close by for several days in succession led us to investigate and we found that the young birds were already nearly half grown. After that we watched the box more closely and, though the male bird sat each day in the same place, there was no sign of life in the box until just before dark when the head of the female appeared in the opening. For five or ten minutes she sat thus, her big eyes following the movements of the Phoebes that nested on the cliff at the opposite side of the pond. Occasionally she stretched her neck to watch a tardy Mallard duckling trying to guzzle a last worm out of the bank below her, before retiring to the protection of its mother's wing. Again she turned her head to follow the flight of a Robin across the ravine, but she never seemed to pay attention to any of us and, at almost the same minute (7:50) each evening, she pitched out of the box and glided silently up the ravine. During the last week in May, when the young had begun to develop juvenile feathers in place of their natal down, and when the sun began to beat rather warmly on the sides of the box, the female moved to the hemlock for the days, perching close against the trunk a few feet below her mate.

At about this time I found the remains of a Veery cached on a horizontal branch of a hemlock in the ravine. The next day it was gone but in another tree I found the remains of a Phoebe. Circumstantial evidence pointed toward the Screech Owls being



1. RAVINE SHOWING LOCATION OF OWL'S NESTING BOX ON PINE MARKED BY CROSS. THE YOUNG OWLS WERE LATER PLACED IN CAGE ON ROOF OF THE SHED IN BACKGROUND.
2. OBSERVATION STATION ON ROOF OF SHED. NOTE THE CAGE WITH YOUNG OWL TETHERED IN FRONT, THE LANTERN IN A BOX. CAMERA, FLASH-LIGHT, ETC.

the culprits although I had had no evidence previously of their destroying birds. Upon examining the nest in the box, however, I found a great many feathers and I recalled examining three or four nests of Screech Owls in previous years and always finding a quantity of feathers in the bottom of the nesting cavities. It is common parlance among economic ornithologists that Screech Owls destroy some birds during the nesting season when mice are difficult to secure, and published information bears this out. Just what the "some" means is not often explained, so I determined to find out, definitely, just what part this pair of Screech Owls were playing in maintaining "the balance of nature" in our bird sanctuary. Accordingly I lowered the nesting box, containing the young Owls, a little each night until it was on a level with the top of a blind erected at the foot of the nesting tree. Whether the old Owls relished the change or not, they continued to feed their young, even when a lighted lantern was added to the equipment.

In returning to the nest the parent birds always did so with a direct swoop, landing with the head inside the opening and clinging to the side of the box like a Woodpecker so that it made it difficult to see what food was being brought. We, therefore, removed the young birds, of which there were three, and tethered them to the top of the box or to a branch in the open where it was possible to see just what was being brought to them. On June 3, when they began to leave the nesting box of their own accord, we transferred them to a cage on the roof of a low building close by where they would be safe from marauding animals and yet where they could be conveniently watched. The cage, a modified "run" for a Pheasant hatching coop, was covered with one inch wire through which food could be passed to the young. For convenience in watching, the cage was at times closed with boards on all sides save one. At other times the young birds were tethered to a branch outside of the cage and in front of the lantern which was ever kept burning in a box. The Owls soon became accustomed to these changes and fed their young as though nothing had happened. Whenever my time permitted I entered the blind at eight P. M. and remained until ten or eleven. Upon two occasions I entered the blind at 2:30 A. M. and remained until daylight. Owing to my other duties, it was impossible for me to remain up all night

with the Owls and so Mr. George McNeill volunteered his services and for seven nights he relieved me in the blind at 10 P. M. and remained until daylight. His observations on the birds are incorporated in this paper, his remarks upon the mosquitoes and the chilliness of the small hours have been omitted for fear of discouraging other less enthusiastic young ornithologists from carrying on similar observations.

In addition to the direct observations made on the feeding birds, each morning I collected all feathers, bones, pellets or other remains that were to be found in or about the cage representing the previous night's revels.

Observations of this kind would be incomplete without photographs of the happenings and accordingly on many nights I focussed a camera upon the young birds and connected the shutter with an "imp flash gun" so that exposures of $1/300$ of a second could be made during the feeding operations by either Mr. McNeill or myself. The accompanying photographs showing the Owl with the hawk moth and with the birds were secured by Mr. McNeill.

Method of feeding: From the outset it was obvious that both parent birds were engaged in caring for the young. In the dim light of the lantern it was impossible to tell them apart but the frequency with which the young were sometimes fed indicated that the parents shared about equally in feeding. They never both came together to feed but frequently when the flash light disturbed one bird before it had time to feed, the other would return with food and both would be near with food in their bills at the same time. The old birds were ordinarily silent in their hunting and feeding but the young birds, after they had been put in the cage, kept up a continuous humming during the night which lasted as long as they were hungry. If one of the young did not give this food call, the old birds paid no attention to him but fed the ones that called. The food was always brought in the bills of the old birds and placed directly into the mouths of the young. Large objects like birds or mice were often brought already partially torn or eaten or they were sometimes torn to pieces in front of the cage before being passed through the wire. Just as often, however, the entire bird was given to the young and they would fight among themselves for it. It was after one such tug-of-war that two of the

young attacked the third and picked most of his bones by morning.

An interesting observation incident to the method of feeding, and one that shows conspicuously in the photographs, was the way in which the old bird half-closed its eyes at the moment of feeding as though it were necessary, upon such close approach to the young, to put the dimmers on its head lights. At such times the upper eyelid was dropped, the lower eyelid remaining immovable and the pupil remaining distended in its characteristic nocturnal form.

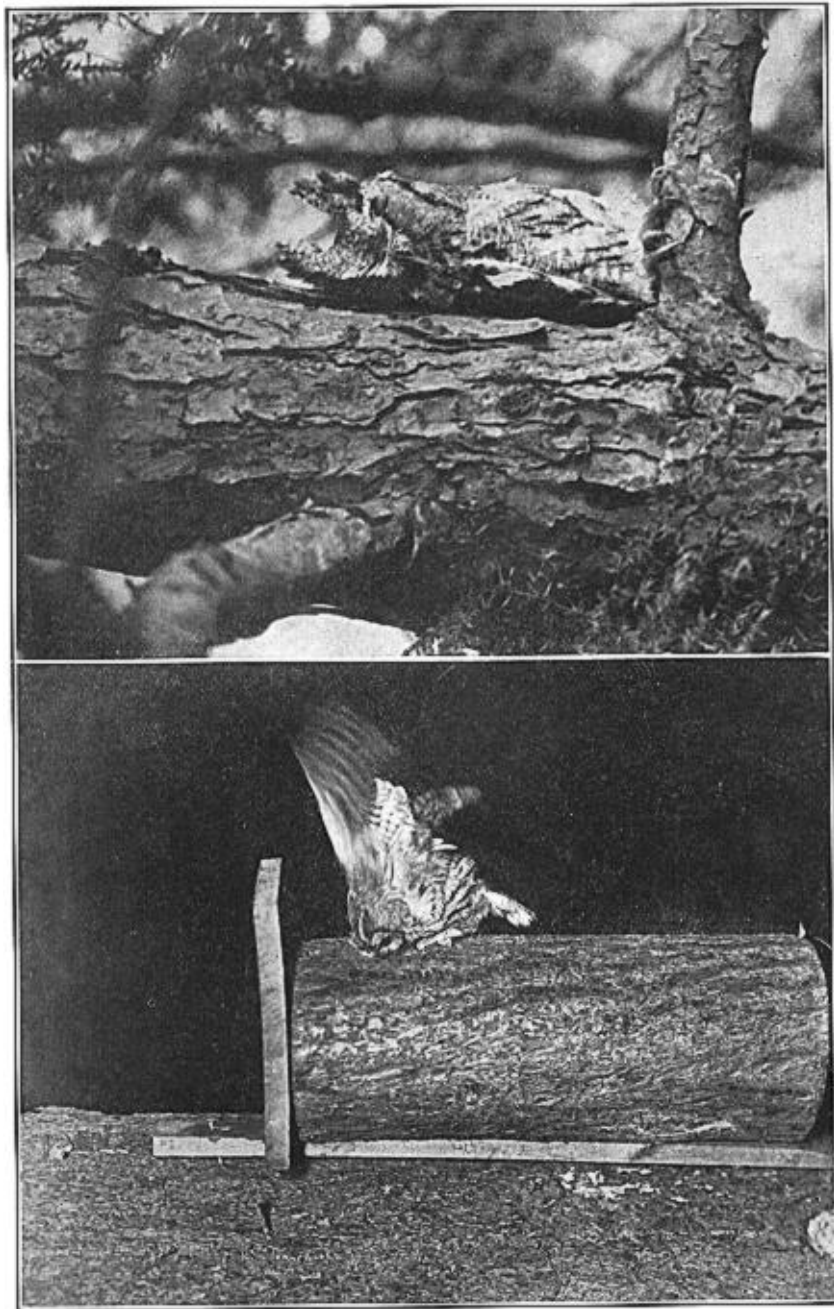
Nature of the food: As before stated the nature of the food brought to the young was determined in two ways: by direct observation, and by gathering the remains left about the cage each morning. The debris in the nest was likewise examined and all feathers, bones or other identifiable material was recorded.

Perhaps no better idea of the food of the young can be given than by enumerating the various articles gathered each morning from June 4 to July 18, the period during which the young were in the cage until they were finally deserted.

MEMORANDUM OF FOOD MATERIALS GATHERED IN OR ABOUT THE CAGE IN WHICH THE YOUNG SCREECH OWLS WERE CONFINED.

- June 4: Red-backed salamander, dusky salamander, hawk moth, crayfish, feathers of female Scarlet Tanager.
- June 5: Dusky salamander, crayfish, fish bones and scales (probably alewife), dragonfly, feathers of Phoebe.
- June 6: Dusky salamander, noctuid moths, green caterpillar, cockroach, feathers of Song Sparrow and House Sparrow. One small pellet, the first.
- June 7: Red-backed salamander, noctuid moths, June beetle, crayfish, large spider, feathers of female Redstart and Catbird, two pellets.
- June 8: Dusky salamander, crayfish, noctuid moth, feathers of Swamp Sparrow.
- June 9: Crayfish, bones and scales of small fish, noctuid moth, feathers of Wood Pewee.
- June 10: Parts of young rat, cricket, spider, crayfish, no feathers.
- June 11: Four crayfish, one large earth worm, two June beetles, no feathers.
- June 12: Two crayfish, one earth worm, one purple salamander, feathers of Yellow Warbler.

- June 13: Four crayfish, one stonefly, feathers of immature Song Sparrow.
- June 14: Piece of skull and lower jaw of young rat, dusky salamander, parts of alewife.
- June 15: Remains of young rat, two June beetles, crayfish, feathers of female Tanager.
- June 16: Remains of young rat, fish bones, crayfish, cutworm, two pellets.
- June 17: Flesh (probably rat or mouse), crayfish, fish bones and scales.
- June 18: Crayfish, remains of young rat, cricket, 3 June beetles, head of Chipping Sparrow, one pellet.
- June 19: Crayfish, cricket, bodies (minus heads) of two juvenile Phoebes.
- June 20: Dusky salamander, two crayfish, large spider, land snail, earth worm.
- June 21: Crayfish, two earth worms, skin of meadow mouse, feathers of Robin, Downy Woodpecker, female Goldfinch, House Sparrow, two pellets.
- June 22: Wood frog, pelvis of young rat, entire Chipping Sparrow, three pellets.
- June 23: Crayfish, dusky salamander, scapula of young rat, feathers of Chipping Sparrow.
- June 24: Crayfish, stonefly, dusky salamander, wing of juvenile House Sparrow, headless body of juvenile Field Sparrow.
- June 25: Two crayfish, two stag beetles, one small garter snake, feathers of Chipping Sparrow and leg of female Tanager, one pellet.
- June 26: Crayfish, earth worm, dusky salamander, ribs of young rat, entire short-tailed shrew, feathers of Field Sparrow, one small pellet.
- June 27: Feathers of immature Yellow Warbler and Chipping Sparrow, small pellet.
- June 28: Fur of shrew and feathers of House Sparrow.
- June 29: Dusky salamander, earth worm, June beetle, fur of meadow mouse and feathers of Redstart and female House Sparrow.
- June 30: June beetle, feathers of Chipping Sparrow and of young Owl eaten by his brothers, two pellets.
- July 1: Seven noctuid moths, one orange underwing moth, scavenger beetle, crayfish, feathers of Redstart and Phoebe.
- July 2: Three noctuid moths, one underwing moth, feathers of male Redstart, Downy Woodpecker, Yellow Warbler, and Field Sparrow, two pellets by evening.
- July 3: Four noctuid moths, one underwing moth, feathers of House Sparrow, Yellow Warbler, Downy Woodpecker, and Goldfinch.
- July 4: Cecropia moth, feathers of female Tanager, two Goldfinches, two Waxwings, two Phoebes, and female Redstart, two pellets.
- July 5: Many moths fed the night before but none spilled. Feathers of Catbird, female Tanager, Phoebe, Waxwing, male Redstart, and Chipping Sparrow, two pellets.



1. SCREECH OWL ALIGHTING AT ENTRANCE TO NEST, 1/300 SECOND EXPOSURE DURING THE FLASH.

2. THE SCREECH OWL ROOSTING DURING THE DAY IN A HEMLOCK NEAR NEST.

- July 6: Entire Chipping Sparrow, two pellets.
 July 7: One noctuid moth (many moths were fed the night before).
 July 8: Crayfish, one noctuid moth and one gray underwing.
 July 9: Seven noctuids, feathers of Field Sparrow, Chipping Sparrow and Yellow Warbler.
 July 10: Two noctuids, feathers of Yellow Warbler, Goldfinch, Chipping Sparrow, and male House Sparrow.
 July 11: Feathers of Yellow Warbler, Goldfinch, Waxwing and House Sparrow, three pellets.
 July 12: Crayfish, feathers of Barn Swallow and Waxwing.
 July 13: Two pellets, nothing else.
 July 14: Feathers of Phoebe and Yellow Warbler, four pellets.
 July 15: Helgramite, feathers of Waxwing, Phoebe, and Red-eyed Vireo.
 July 16: Feathers of House Sparrow, one pellet.
 July 17: Nothing, no pellet.
 July 18: Two Red-eyed Vireo feathers, no pellet. Bird then deserted.

To summarize: remains of birds were found on 35 days, insects on 28 days, crayfish on 24 days, amphibians on 15 days, mammals on 12 days, fish on 6 days, and spiders, snails, and reptiles on one day each.

The preponderance of bird remains is, of course, due to the fact that it was impossible for them to eat a bird without dropping some of the feathers, especially as they usually fought over it before it was eaten. Insects, on the other hand, were not recorded unless they happened to be dropped outside of the cage where the young could not reach them. The quantity and variety of the food consumed is merely intimated by what was left each morning, any estimate of the amount eaten based upon it would be far from exact. The number of birds, however, is doubtless a nearly accurate record of what were eaten although occasionally birds were brought to the cage rather cleanly picked and some of these may have been swallowed without leaving any traces. During the 45 days that the young Owls were in the cage, 77 birds of 18 species were brought to the young, as follows:

Screech Owl	1	Swamp Sparrow	1
Downy Woodpecker	3	Scarlet Tanager	5
Phoebe	9	Barn Swallow	1
Wood Pewee	1	Cedar Waxwing	6
House Sparrow	10	Red-eyed Vireo	2
Goldfinch	6	Yellow Warbler	8
Chipping Sparrow	9	Redstart	6
Field Sparrow	4	Catbird	2
Song Sparrow	2	Robin	1

An examination of the nest debris which had accumulated prior to June 2 was made and found to consist chiefly of feathers. There were a few bones of mice and young rats, a few of the heavy mandibles of beetles, and the feathers of 16 species of birds, as follows: Phoebe, Baltimore Oriole (male and female), Goldfinch, White-throated Sparrow, Chipping Sparrow, Song Sparrow, Indigobird, Scarlet Tanager (male and female), Cedar Waxwing, Red-eyed Vireo, Yellow Warbler, Redstart (male and female), Veery, Olive-backed Thrush, Hermit Thrush, and Robin. Add to this list a male Tanager fed June 2 and a Red-eyed Vireo fed June 3 and it brings the total of birds eaten to 24 species and at least 98 individuals. Since the feathers in the nest undoubtedly represent many more than one bird of each species, the grand total of birds required to feed the three young Owls from the time of hatching until left by the old birds was certainly over a hundred.

Amount of food: In order to determine the amount of food consumed by the young, and the period of activity during the night Mr. McNeill remained in the blind, as before stated, the nights of June 29 and 30, July 1, 3, 4, 5, and 6.

The night of June 29, the young were first fed at 8:49 and between then and 2:50 they were fed 20 times mostly on moths and beetles but including one deer mouse and one Chipping Sparrow. At 2:50 the young Owls began to fight and eventually killed and ate one of their brothers, the old birds not coming to feed again that night.

The night of June 30, the young birds were first fed at 8:39 and between then and 4:15, when it began to rain, they were fed 73 times, mostly on moths and beetles but including two salamanders, a mouse, and two birds.

The night of July 1, they were first fed at 8:40 and between then and 3:49 were fed 36 times at rather regular intervals. The food was mostly noctuid moths but it included one mouse and four birds.

The night of July 3, the young Owls were first fed at 8:44 and last at 4:15. They were fed but 14 times, eight birds and six insects. The birds were brought at fairly regular intervals during the night, as follows:

9:35 female Redstart	3:15 Cedar Waxwing
11:00 Goldfinch	3:39 Goldfinch
1:45 female Tanager	4:00 Cedar Waxwing
2:30 Phoebe	4:15 Phoebe

The night of July 4, the young Owls were first fed at 8:34 and between then and 1:40 were fed 75 times, two beetles and 73 moths. The birds then became quiet and as it was very chilly Mr. McNeill left. The next morning I gathered the feathers of six birds that had evidently been fed to the young after 1:40: Phoebe, Scarlet Tanager, Cedar Waxwing, Chipping Sparrow, Redstart, and Catbird.

The night of July 5, the birds were first fed at 8:25 and last at 3:55. There were 67 feedings, mostly moths with a few beetles interspersed, and one salamander, one frog, and one Chipping Sparrow.

The night of July 6, the birds were first fed at 9:12 and last at 4:03. There were 72 feedings entirely of moths with the exception of three salamanders.

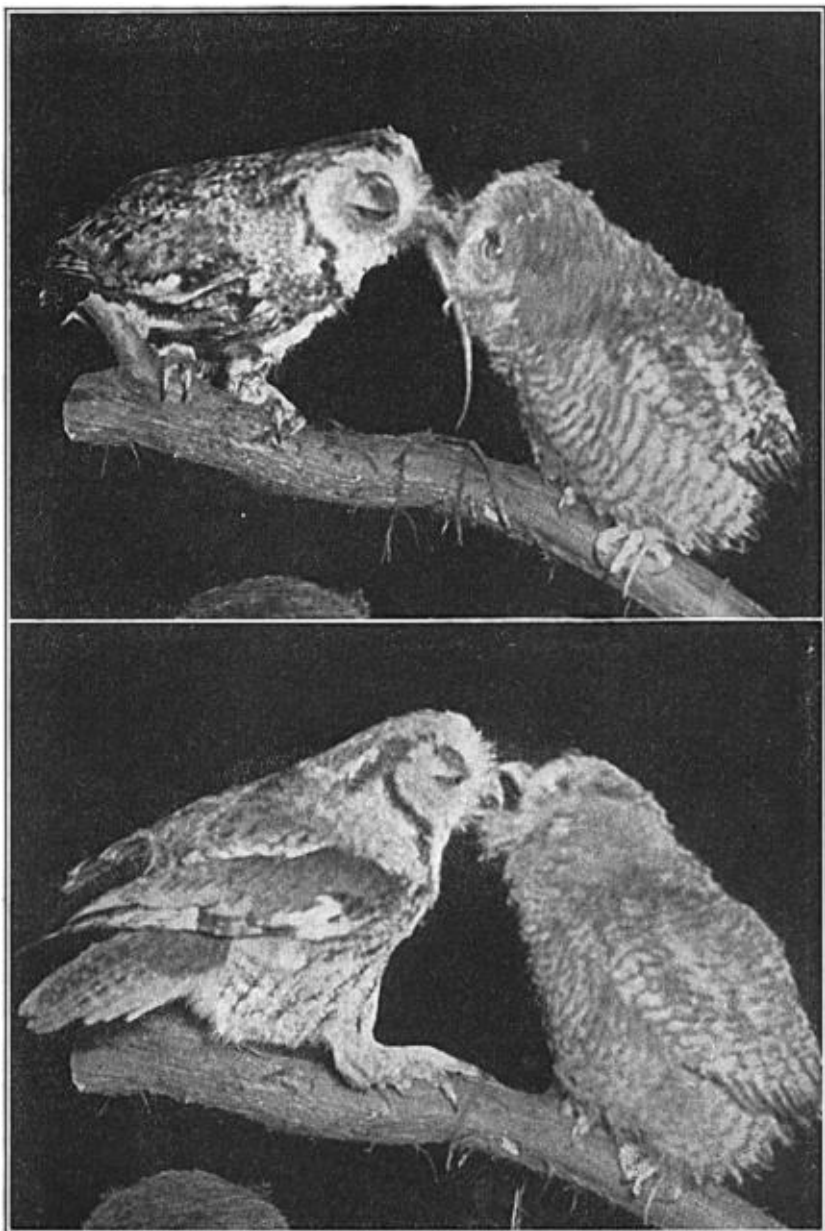
From these data it is seen that the Owls were active all night but that the amount and nature of the food varied considerably from night to night, so much so, in fact, that one hesitates to make any general deductions. The nature of the food evidently depends upon what is most easily secured and is largely a matter of chance. The dying of the alewives in Cayuga Lake during early June made available a food supply at that time; the night wanderings of salamanders and crayfish throughout the month of June made them available until the first of July when they disappeared from the dietary almost as suddenly as did the alewives. Then the warm nights of early July brought out the Noctuid moths by the thousands and they then became the main article of diet. The presence of the young rats in the menu during the last two weeks of June is accounted for by the several litters that then appeared about the hatching coops by the pond where the corn for the setting hens attracted them.

The presence or absence of birds in their food seemed to depend entirely on chance. There were many more adult birds than young or immature and they were taken on clear nights and cloudy nights alike and at all hours of the night. More of the dull-colored

female than bright male Tanagers were captured but an equal number of male and female Redstarts were taken. The majority of birds doubtless came from the immediate vicinity, but the Swamp Sparrow and the Barn Swallow must have come from at least half a mile away. The largest number was taken between the 2nd and the 11th of July, but on the 7th and 8th not a bird was taken. All of these contradictory facts seem to point to the element of chance being most important in deciding whether or not birds appear in their food.

If chance is so important in deciding the Screech Owl's menu, it may well be that in a region or area where there are fewer birds and more mice, birds form a smaller percentage of their diet. It would not be fair to the Owls to decide their economic status upon observations of a single pair where conditions for catching birds are very favorable. I will have to admit, however, that the supply of rats and mice in the vicinity of the nest was not in the least exhausted by the inroads of the Owls nor did they, in fact, make any visible impression upon their numbers. I will likewise have to admit that of three other Screech Owl's nests examined in previous years, one in an orchard, one in a woodland, and one in a lone tree in a swampy field, all contained quantities of feathers. The last mentioned was ideally situated for a mouse-loving bird, for field mice were extremely abundant about the low lying ground. In spite of this fact, upon examining the debris of the nesting cavity, Mr. L. A. Fuertes and I were able to pick out easily the feathers of nineteen species of birds that had been victims of the Owls, and there were a number of others of which we were in doubt as to the exact species. The birds identified with reasonable certainty were as follows: Downy Woodpecker, Phoebe, Kingbird, Red-winged Blackbird, Baltimore Oriole, Song Sparrow, Field Sparrow, House Sparrow, Scarlet Tanager, Barn Swallow, Red-eyed Vireo, Nashville Warbler, Yellow Warbler, Myrtle Warbler, Magnolia Warbler, Chickadee, Veery, Olive-backed Thrush, and Bluebird.

A number of careful observers to whom I have confided the wickedness of this pair of Owls have informed me that they have had Owls nesting near their homes and have never known them to catch birds. In reply, I have to admit that, except when I found the two birds cached on the branches of the hemlocks



1. SCREECH OWL FEEDING RED-BACKED SALAMANDER TO ITS YOUNG.
2. SCREECH OWL FEEDING BEETLE. NOTE THE HALF-CLOSED EYES OF THE
ADULT BIRD IN EACH PHOTOGRAPH.

already mentioned, I never had any intimation that these Owls caught birds either. I have always been delighted to have them about and have put up boxes to attract them. Indeed after I had watched them for many evenings until ten or eleven o'clock and seen them bring dozens of moths and beetles and salamanders, but no birds, I was almost willing to believe that they had not killed all the birds whose feathers lined their nests.

The effect of the Owls on the bird life of the sanctuary was not what one might expect from the number of birds which they devoured. True, a pair of Baltimore Orioles that had nested in the maple by the house for five years disappeared, and there seemed to be fewer Chipping Sparrows than usual. But there was the Phoebe undisturbed just across the pond, and Yellow Warblers, Redstarts, Song Sparrows, Robins and Veeries nested almost as close. The number of birds nesting in the sanctuary was but three pairs less than the year before and it was four pairs higher than any other year. The number of species was greater than the year before, though less than other years, but this I account for by the increase in House Wrens whose fondness for breaking eggs has driven out several species that regularly nested before the Wrens became so numerous. A summary of the nesting birds of Glenside follows:

1917, 34 pairs of 18 species	1920, 38 pairs of 19 species
1918, 34 pairs of 22 species	1921, 45 pairs of 15 species
1919, 27 pairs of 16 species	1922, 42 pairs of 17 species

It is true that relatively few young were raised this year but so far as casual observations might go, there were nearly as many birds at the end of the summer as at the beginning. At any rate there was not enough difference to lead one to suspect any great holocaust. The fact that few young were raised and that the number of old birds remained about constant might lead one to suppose that the Owls fed upon the young, but such was not the case. The seeming persistence of the old birds was not real. The Phoebes that nested in plain view of the Screech Owls succeeded in raising one young and got their second brood nearly to maturity. The Yellow Warblers persisted until a high wind dislodged their nest. Three Scarlet Tanagers continued singing all summer; and all this in spite of the fact that the Owls fed their young nine Phoebes, eight Yellow Warblers, and eight Scarlet Tanagers.

The fact that birds nested in apparent safety so close to the Owls led me to suppose that the Owls did their hunting far from home, but such again was not the case. More careful observation showed that the Phoebes and Yellow Warblers and Tanagers that finished the season were not necessarily the same ones that started it. How many times new mates were secured by each bird, I am unable to say, but a few examples of what happened will indicate how a large percentage of the Owls' food may have come from the vicinity without affecting materially the total bird population of the area.

On May 6, the Phoebes had completed their nest and laid one egg. Just what happened first I do not know but no more eggs were laid and this egg did not hatch for nearly three weeks. Not knowing about the destructiveness of the Owls at the time, I merely wondered at the single egg and the long period of incubation. Had I been suspicious of anything I probably would have noticed the disappearance of the first female and the appearance of another. It was the last of June before a second brood got started and then after the eggs had hatched one of the birds lost its tail and became quite disheveled as though it might have had a midnight encounter with the Owl. It continued to help feed the young for several days, however, until July 5, when it disappeared and its place was taken by a bird with a full tail. This bird did not last long, however, nor did the mate, the two birds disappearing on successive nights July 14 and 15. The young were nearly fledged at this time but before I realized what had happened they had died in the nest.

About a month later, the middle of August, another Phoebe appeared at the pond, visited the nest and lingered about the cliff for several days before it moved on. Now, had I not known what happened to the original birds, I might have supposed that they had raised their young in safety and had taken them away to other feeding grounds, and that this August bird was one of the old ones coming back again to visit the old nest. As a matter of fact, the young birds had died in the nest and the Owls had feasted on at least four old Phoebes and possibly others.

In the case of the Scarlet Tanagers, there were three pairs that nested in the vicinity and the males had regular singing stations

where they could be heard every morning without fail. One of these birds stationed himself in the elm in front of the house where he sang regularly every morning and most of the day. The morning of June 3 he was silent and an examination of the Owl box showed fresh Tanager feathers. The very next day, however, a male Tanager took up his stand 100 feet away in the oaks across the street and was undoubtedly mated to the same female. Had I not been looking for trouble, I probably would not have noticed the day's absence of the Tanager and would have assumed that he had merely moved his singing station a hundred feet.

The ease with which birds find new mates when they have been bereaved is one of the marvels of bird life that is rather difficult to understand. I believe that practically all birds are much more attached to their nesting sites than they are to their mates and that the death or disappearance of the mate does not affect the other bird seriously. This does not, however, explain how there can be so many free unmated birds around to fill in the gaps.

The only explanation which I can offer to this problem is based upon the study which I made of the Red-winged Blackbird some years ago. In this paper¹ I pointed out the long migration period of a bird that is supposed to be an early migrant: how, though the migrant adult males arrive early in March, there are still immature resident females arriving as late as the middle of June. My suggestion would be that the migration of almost all birds is similar and that Nature provides for the catastrophes that may happen to mated birds by causing the immature birds to feel the migrating instinct later, so that they arrive on the nesting grounds after all the adult birds are mated. Then they are able to fill in the chinks that have been made by Hawks and Owls and cats and other agencies of destruction.

If such is the case we would explain the disappearance of the Orioles from the tree which had sheltered them for five years by the fact that they were both taken the same night or on successive nights before the survivor had time to find a new mate. In a similar way several pairs of Chipping Sparrows disappeared while one pair apparently lived through the season, though no one knows

¹ The Red-winged Blackbird: A Study in the Ecology of a Cat-tail Marsh by A. A. Allen. Proc. Linn. Soc. N. Y. April 15, 1914.

with how many rematings. And similarly with all the other birds. It would really be possible for the Owls to live entirely upon birds without it necessarily showing conspicuously on the bird life of the vicinity.

A year has passed since the foregoing was written. Publication has been delayed so that the effect of the Owls' destruction to the bird life of the Glenside Sanctuary in 1922 could be determined. Once more an accurate record of the nesting birds has been kept and charted on the map of the area with the following result for 1923: 44 pairs of 18 species. This is an increase of two pairs and one species over 1922 so that grossly the destruction by the Owls in 1922 had no apparent effect on the total number of birds nesting in the area.

An analysis of the different species shows an increase of one pair of Wood Pewees, Cowbirds, Redstarts, Veeries, and Robins and the appearance of one pair of Downy Woodpeckers, Red-eyed Vireos, Chickadees, and Bluebirds which did not nest within the area in 1922. There was a decrease of one pair of Screech Owls, Indigo-birds, and Louisiana Water-Thrushes and two pairs of Song Sparrows and Catbirds, while Chimney Swifts, Phoebes, Goldfinches, Chipping Sparrows, Scarlet Tanagers, Yellow Warblers, and House Wrens remained constant.

A comparison with the list of birds destroyed by the Owls the preceding year shows that two of the species which show decrease did not occur in their menu and the other two decreased more than the actual number of birds eaten by the Owls. On the other hand species that were eaten in considerable numbers as the Phoebe and Chipping Sparrow either held their own or as in the Downy Woodpecker and Redstart actually showed a slight increase. This leads us to the belief that the decrease in certain species must be accounted for in some other way than by destruction by the Owls, and that while the Owls may have prevented much of an increase in the number of birds nesting in the given area, they did not materially affect the normal population.

A further analysis of the species nesting within the sanctuary in 1923 shows that the Baltimore Orioles which were exterminated in 1922 by the Owls catching both birds the same night were not replaced in 1923. Chipping Sparrows which were reduced in the



1. SCREECH OWL TEARING HEAD FROM BIRD (CEDAR WAXWING ?) FOR ITS YOUNG.

2. SCREECH OWL THE SAME NIGHT, JULY 3, 1922, WITH FEMALE REDSTART. YOUNG IS HERE ABOUT TEN WEEKS OLD.

same way from five pairs in 1921 to one pair in 1922 likewise did not recuperate, though Veeries, which were reduced from four pairs to one, advanced to two pairs in 1923. The pair of Phoebes which nested in 1923 were obviously new birds for all of the 1922 crop were destroyed by the Owls. It was interesting to observe that they first went to an entirely new place to nest, on the back of a building where Phoebes had never nested before, but that, when their eggs were thrown out of this nest by the House Wrens, they betook themselves to the old nest of the 1922 Phoebes, put in a new lining, and raised two broods in it successfully.

Just where the Owls nested this year I was unable to ascertain though they made occasional visits to the sanctuary. That they did most of their hunting elsewhere, however, was evidenced by the fact that the majority of our birds were successful in raising their young on schedule time without having to find new mates. But one instance of this kind fell under my observation this year, that of a Goldfinch where there was apparently a change of mates during incubation, the second female being considerably darker than the first. This second female was apparently secured so rapidly after the disappearance of the first that the eggs were not even chilled to the point of killing the germ for they hatched eight days after the change took place, the new female having laid two eggs of her own in the meantime which naturally did not hatch.

SUMMARY.

1. A pair of Screech Owls nested in a Flicker box close to the author's home and a record was kept of the food brought to the young between June 4 and July 18.
2. The food consisted of birds, insects, crayfish, amphibians, mammals, fish, spiders, snails, and reptiles.
3. The record of food brought to the young included 98 birds of 24 species.
4. The Screech Owls were engaged in feeding their young from shortly after dusk until just before dawn in all kinds of weather.
5. Birds were brought at no definite intervals nor in definite numbers, chance seeming to determine the time of feeding and the number fed.

6. The Owls were very quiet and inconspicuous in their feeding operations and gave little intimation to the casual observer of the destruction to bird life that they were committing.

7. When both of a pair of birds were killed the same night by the Owls, that pair ceased to be represented in the sanctuary, but if only one was taken, the survivor secured a new mate almost immediately so that the destructiveness of the Owls was in this way covered up.

8. Birds are able to secure new mates rapidly because of the unmated, immature birds which are usually available on account of their later migration period and the later maturation of their reproductive organs.

9. A census of the birds nesting in the sanctuary in 1923 showed a slight increase in the total number rather than a decrease, though all species exterminated in 1922 failed to reappear in 1923.

CONCLUSION.

In making the statement that the total bird population of the area under consideration was not materially affected by the inroads of the Owls, I do not wish to minimize the destructiveness of the birds. It may well be that, had it not been for the Owls, there would have been a very substantial increase in the bird population. The facts merely express in different words the time-honored phrase that the carnivorous birds help "to maintain the balance of nature." There can be little doubt that the number of insects and small mammals destroyed by this pair of Owls could never compensate for the destruction of one tenth of the insectivorous birds eaten by the young. Though the Owls might spend the rest of the year feeding entirely upon insects and meadow mice, they could not possibly consume the equivalent of what would have been eaten by the 93 birds destroyed during the short space of eight weeks.

From the data here presented it seems evident that the Screech Owl is a powerful factor in maintaining the balance of nature but, from the standpoint of increasing insectivorous birds, he is an equally powerful menace.

Laboratory of Ornithology, Cornell University.