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FOOD OF THE SNOWY OWL

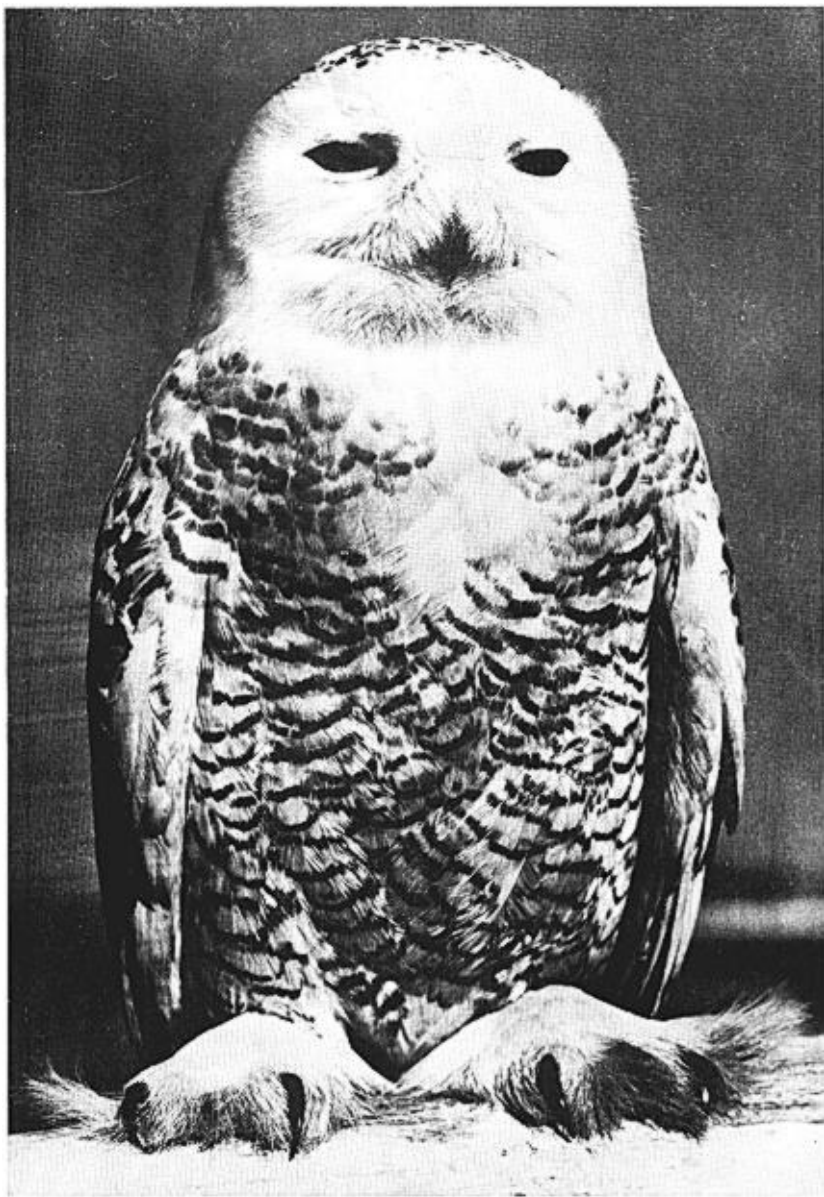
BY ALFRED O. GROSS

Plate 1

THE Snowy Owl has elicited great interest during its periodic migrations to southern Canada and northern United States. The economic status of the owl is an important factor in considering legislation that may be passed by various states for its protection. Therefore it seems advisable to ascertain from field observations and examinations of a representative series of stomachs, the present-day food habits of the species.

During the recent Snowy Owl invasions of 1926-27, 1930-31, 1934-35 and 1941-42, Bowdoin College received 205 of the owls for examination of their stomach contents. Of the 205 stomachs, 78 were empty and 127 contained various items of food which are listed in a following table. The vast majority of the stomachs contained only one kind of food; the remainder had two or more items represented in their contents. I am greatly indebted to the numerous persons who contributed entire owls or owl stomachs which they collected, and also for the field observations submitted. I am especially grateful to Mr. Remington Kellogg of the U. S. Fish and Wildlife Service for the determination of the contents of 91 of the stomachs received during the 1926-27 migration.

Mr. L. L. Snyder, Assistant Director of the Royal Ontario Museum, has contributed records of the stomach contents of thirty-two Snowy Owls collected in Ontario, and Dr. Dayton Stoner has submitted data on twenty-four of the owls collected or observed in New York State. A summary of the results of the examinations of sixty stomachs of Snowy Owls obtained in Pennsylvania, reported by George M. Sutton (1927), is also included. For additional details of the food of the Snowy Owl, consult the references in the bibliography at the end of this paper.



SNOWY OWL. PERCHED ON THE ROOF OF THE NEW ENGLAND MUSEUM OF NATURAL HISTORY, BOSTON, MASSACHUSETTS, DECEMBER, 1941.

Photograph by Bradford Washburn.

FOOD OF SNOWY OWLS SECURED IN NEW ENGLAND

The following table shows the kinds of food and the number of occurrences of each in the series of 127 stomachs.

TABLE 1

MAMMALS	
Norway Rat, <i>Rattus norvegicus</i>	38
Meadow Mouse, <i>Microtus pennsylvanicus</i>	18
Snowshoe Rabbit, <i>Lepus americanus virginianus</i>	5
Red Squirrel, <i>Sciurus hudsonicus</i>	3
Cottontail Rabbit, <i>Sylvilagus transitionalis</i>	2
House Mouse, <i>Mus musculus</i>	2
White-footed Mouse, <i>Peromyscus</i> sp.....	2
Foot of mammal, unidentified.....	1
	—
Total.....	71
BIRDS	
Dovekie, <i>Alle alle</i>	16
Snow Bunting, <i>Plectrophenax nivalis</i>	6
Ruffed Grouse, <i>Bonasa umbellus</i>	5
Domestic Chicken, <i>Gallus gallus</i>	5
Unidentified feathers.....	5
Black Duck, <i>Anas rubripes</i>	5
Domestic Pigeon, <i>Columba livia</i>	4
Old Squaw, <i>Clangula hyemalis</i>	4
American Scoter, <i>Oidemia americana</i>	3
Leach's Petrel, <i>Oceanodroma l. leucorhoa</i>	3
Robin, <i>Turdus migratorius</i>	3
Ring-necked Pheasant, <i>Phasianus colchicus</i>	3
Feathers from the owl's own body.....	3
White-breasted Nuthatch, <i>Sitta carolinensis</i>	2
Unidentified bird flesh.....	2
Meadowlark, <i>Sturnella magna</i>	1
Murre, <i>Uria aalge</i>	1
Horned Grebe, <i>Colymbus auritus</i>	1
Junco, <i>Junco hyemalis</i>	1
Migrant Shrike, <i>Lanius ludovicianus migrans</i>	1
Sanderling, <i>Crocethia alba</i>	1
Unidentified duck feathers.....	1
Unidentified parts of duck.....	1
	—
Total.....	77
MISCELLANEOUS	
Vegetable debris.....	3
Mussel, <i>Mytilus edulis</i>	1
Fish bones.....	1
Fir and balsam needles.....	1
Sand.....	1

One Snowy Owl, collected at Silver Lane, Connecticut, on December 5, apparently had swallowed the stomach of a bird, presumably a Ruffed Grouse. The owl's stomach contained a piece of the grouse's stomach and the following items which are characteristic of the food eaten by a grouse: 5 fruits of the skunk cabbage, *Symplocarpus foetidus*; 2 fruits of the sour gum, *Nyssa*; 1 grape seed; 3 dogwood seeds; 1 bunchberry seed; 4 *Ambrosia artemisiaefolia* seeds; 2 caterpillars; 1 cricket, *Gryllus assimilis*; a piece of bone; and a considerable amount of gravel. The weight of the contents was 5 grams.

In order to make a comparison with Mr. Snyder's results, which follow, the food contents are summarized in the following table which gives the proportionate mass of each food.

TABLE 2

<i>Mammals:</i>		
Destructive.....	46.1%	
Beneficial.....	5.3%	
Unidentified.....	1.9%	53.3%
<i>Birds:</i>		
Protected.....	37.2%	
Unprotected.....	4.9%	
Unidentified.....	1.2%	43.3%
<i>Miscellaneous:</i>	3.4%	3.4%
	Total	100.0% 100.0%

In the following table are the items of food and the number of times they occurred in 32 stomachs of Snowy Owls collected chiefly in Ontario, Canada, and examined by L. L. Snyder.

TABLE 3

MAMMALS

Rats, <i>Mus decumanus</i> and <i>Rattus norvegicus</i>	8
Meadow Mouse, <i>Microtus pennsylvanicus</i>	6
White-footed Mouse, <i>Peromyscus</i> sp.....	7
Small mammals (pellets or traces of hair).....	3
Star-nosed Mole, <i>Condylura cristata</i>	1
Mole Shrew, <i>Blarina brevicauda</i>	1
Muskrat, <i>Ondatra zibethica</i>	1
Vertebrae and fragments of rat or squirrel.....	1
	Total..... 28

BIRDS

Bonaparte's Gull, <i>Larus philadelphia</i>	2
Herring Gull, <i>Larus argentatus</i>	1
Coot, <i>Fulica americana</i>	1
Black Duck, <i>Anas rubripes</i>	1
English Sparrow, <i>Passer domesticus</i>	1
Snow Bunting, <i>Plectrophenax nivalis</i>	1
Domestic Pigeon, <i>Columba livia</i>	1
Unidentified feathers	1
	9

Total 9

MISCELLANEOUS

Lake Trout, <i>Cristivomer namaycush</i>	1
Noctuid moth	1
Vegetable matter, buds, and twig	1
	3

Total 3

Mr. Snyder sums up the results of his examinations of the 34 Snowy Owl stomachs as follows.

TABLE 4

Mammals:

Destructive (rat, <i>Microtus</i> and <i>Peromyscus</i>)	53%	
Beneficial (muskrat, mole shrew and star-nosed mole)	9%	
Unidentified	10%	72%

Birds:

Protected	15%	
Unprotected (pigeon and English Sparrow)	4%	
Unidentified	3%	22%

Miscellaneous:

Fish, insects and vegetable matter	6%	6%
	100%	100%

Total 100% 100%

Compare with the summary of examinations of stomachs collected in New England, shown in Table 2.

Dr. George Sutton (1927) reported on the examination of 123 stomachs of Snowy Owls taken in Pennsylvania. Of the 123 stomachs, 63 were empty and the remaining 60 contained the items of food listed in Table 5.

The list of mammals is interesting when compared with the mammals found in the stomachs of New England Snowy Owls. First there is a total absence of rats in the Pennsylvania specimens whereas these rodents were the commonest item of food in the New England birds, appearing in the latter twice as many times as any other one item of food.

TABLE 5

BIRDS

<i>Poultry:</i>	
Chicken.....	9
Pigeon.....	3
Duck.....	3
<i>Game birds:</i>	
Bob-white.....	4
Ruffed Grouse.....	3
Pheasant.....	1
<i>Small birds:</i>	
Sparrows or unidentified species.....	8
Blue Jay.....	1
<hr/>	
Total.....	32

MAMMALS

Cottontail Rabbit.....	26
Field mice.....	9
Rodent remains, unidentified.....	9
Gray Squirrel.....	3
Fox Squirrel.....	1
Skunk.....	1
<hr/>	
Total.....	49

TABLE 6

<i>Birds:</i>	
Ducks.....	6
Chickens.....	4
Pheasants.....	2
Herring Gull.....	1
Pigeon.....	1
<hr/>	
<i>Mammals:</i>	
Rabbits.....	4
Mice.....	2
Red Squirrel.....	1
Skunk.....	1
Brown or house rat.....	1
<hr/>	
<i>Amphibians:</i>	
Frog.....	1
<hr/>	
Total.....	24

In New England there were only two of the 127 stomachs which contained cottontail-rabbit remains, whereas Sutton's list shows that 26 of the 60 Pennsylvania Snowy Owls had eaten this rodent. These and other differences can be correlated with the relative abundance of the types of food in the places where the owls were collected.

Dr. Dayton Stoner has submitted the data on the food of twenty-four Snowy Owls killed or observed in New York State during the 1941-42 invasion. The items of food noted are listed in Table 6.

Dr. Stoner's records reveal that the owls collected or observed in New York were very destructive to birds, especially to the ducks. In his report he writes as follows:

"Since the Snowy Owl apparently prefers territory in the vicinity of bodies or streams of water, it is not surprising that a goodly number were seen or taken in the act of pursuing or actually feeding upon wild ducks. In addition to the records contained in the table above, a considerable number of similar reports have been recorded in corroboration of that habit. In his report on three Snowy Owls shot in Greene County, between November 8 and December 12, 1941, Laughryn Stokes writes that 'They were all shot at the water's edge, all eating ducks; but what seemed strange to us was that while dead and crippled ducks were common enough, the owls preferred to catch their own and would not eat a dead one.'"

WEIGHTS OF STOMACH CONTENTS

The weighings of the contents of the stomachs of 78 Snowy Owls were made in grams. Of these 78 stomachs, 69 contained a single item of food and 9 contained two or more items. In the following table, the kind of food, the number of stomachs in which it was found and the minimum, maximum, and average weights are indicated in cases where two or more stomachs are represented.

TABLE 7

<i>Kind of food</i>	<i>Number of stomachs</i>	<i>Weight in Grams:</i>		
		<i>Minimum</i>	<i>Maximum</i>	<i>Average</i>
Rat.....	28	6	185	86.1
<i>Microtus</i>	10	5	49	22.8
Dovekie.....	9	4	132	56.6
Chicken.....	3	84	158	116.6
<i>Peromyscus</i>	2	5	6	5.5
Petrel.....	2	55	60	57.5
<i>Oidemia</i>	2	50	131	90.5
Robin.....	2	12	30	21.0
Rabbit.....	2	107	137	122.0
Red Squirrel.....	1			32.0
Horned Grebe.....	1			154.0
Old Squaw.....	1			67.0
Unidentified duck.....	1			82.0
Pheasant.....	1			47.0
Murre.....	1			182.0
Pigeon.....	1			70.0
White-breasted Nuthatch....	1			16.0
Vegetable debris.....	1			2.0

Following are the contents of nine stomachs in which two or more kinds of food were present. The identification of the food and determinations of percentages were made by Mr. Remington Kellogg; the weighings were made at Bowdoin College.

TABLE 8

<i>Kind of food</i>	<i>Percentage</i>	<i>Weight of entire contents in grams</i>
1 <i>Oidemia</i>	93	
1 Junco.....	2	
1 Rat.....	5	85
1 Migrant Shrike.....	95	
1 Rat.....	2	
1 Mouse.....	1	
1 <i>Microtus</i>	2	37
1 Rat.....	20	
1 Snow Bunting.....	40	
1 Leach's Petrel.....	40	85
1 Rat.....	30	
1 Dovekie.....	70	88
1 <i>Microtus</i>	15	
1 Dovekie.....	85	94
1 Cottontail Rabbit.....	75	
1 <i>Microtus</i>	25	177
1 Foot of mammal.....	2	
Fish bones.....	98	14
1 <i>Microtus</i>	5	
1 Dovekie.....	95	20
1 Robin.....	88	
<i>Mytilus edulis</i>	12	26

These weighings give us information on how much food may be contained in the Snowy Owl's stomach at any one time, but they are also important in the consideration of the relative amounts of food on the basis of mass percentages. The mass or weight of a particular item depends, of course, on the amount of the animal eaten and the stage of the digestion of the food. A bird or mammal has been destroyed whether it is represented by the entire animal or by a very small amount of material. Therefore, in the case of a carnivorous bird such as the Snowy Owl, the question arises as to whether the percentage of food based solely on mass or weight gives us a truly comparative basis. In the case of the rats, for example, whether the stomach contents are represented by 6 grams (the minimum) or 185

grams (the maximum), the results in the two cases are the same, as far as the economy of nature is concerned. In both cases a rat was destroyed. Take the first case in Table 8 as another example. Here *Oidemia* represents 93 per cent of the contents, the rat 5 per cent, and the Junco only 2 per cent. In a summary of food percentages in a series of stomachs, this would give *Oidemia* too great importance while the other two items would contribute too little to the total. A direct comparison of the numbers of animals found in the stomachs gives us a truer picture of the economic status of the Snowy Owl. The case of a seed- or fruit-eating bird is different.

FIELD OBSERVATIONS

In the course of obtaining data on the distribution of the Snowy Owls during the 1941-42 migration, a number of interesting field observations were obtained concerning the food habits of the owls. Dr. Josselyn Van Tyne contributed the correspondence he received from Michigan; Dr. Harrison Lewis, that which he received from the Canadian provinces; and numerous individual reports also were received.

These observations are important in presenting a more complete picture of the economic status of the Snowy Owl. The Snowy Owl is adaptable in the choice of its food. Ordinarily, rodents such as the lemming, rats, mice, and rabbits offer the most accessible supply, but when these fail or at times when unusual demands are made upon the owls by large families of growing young or by their semi-starved condition after a long migration journey, they quickly turn to other types of animal life such as birds. Presumably a lemming or a mouse is captured with a minimum of effort, whereas an active, flying bird presents a more difficult problem to be attempted under unusual conditions. To be sure, many of the birds eaten are those that have died from other causes or which are found in a weakened or crippled condition.

On the breeding grounds of the Arctic tundra, the staple diet of the Snowy Owl is rodents, but the following observations, selected from many similar ones, give evidence that even on their home grounds these owls often resort to birds to supplement their food supply.

Frank Dufresne (1922) reports that the food of the Snowy Owl during the nesting period consists mainly of moles and ground squirrels with only an occasional ptarmigan, curlew, or plover, but he continues:

"As soon as the young Ptarmigan hatched my observations of the Snowy Owl became a record of slaughter. I had no way of telling exactly how many were eaten

on account of the softness of the bones, but I do know that rodent regurgitations practically ceased at this time. Ptarmigan, both old and young, became the main stay of the seven pairs of owls and their combined families which I had under observation. I estimate carefully and with no wish to exaggerate that a single Snowy Owl will destroy three hundred game birds in a year. The average conception among hunters is that it is twice as many, and they may be right. I myself have seen one bird kill three full grown Ptarmigan within an hour."

O. J. Murie (1929) in writing of the food of nesting Snowy Owls observed by him in the region of Hooper Bay, near the mouth of the Yukon River, Alaska, writes as follows:

"The food of the Snowy Owl varied with the character of the nesting ground. Those on the marsh in the immediate vicinity of great numbers of nesting water birds fed extensively on birds, both old and young. Others nesting in drier ground farther from the concentration of waterfowl maintained throughout the season a diet consisting almost exclusively of mice. In marshy areas remains of young Emperor Geese and Cackling Geese and adult Old-squaws, Eiders and other ducks were found."

T. Pleske (1928) states that on the Eurasian tundra the food of the Snowy Owl is not only rodents such as lemmings but when the latter are scarce it feeds on ptarmigan, Willow Grouse, and guillemots.

The following notes have been gleaned from correspondence received during the recent migration of 1941-42.

BIRDS

Pheasant.—In southern Canada and the middle-western states the pheasant appears to be a frequent victim of the Snowy Owl. In correspondence received by Dr. Harrison Lewis there are numerous reports from sportsmen and especially taxidermists in Ontario and Quebec stating that pheasant remains were found in the stomachs of many owls examined by them. On November 6, 1941, Mr. Gordon C. Wilson of Oshawa, Ontario, observed a Snowy Owl killing a pheasant. Mr. Wilson killed three owls, all of which contained remains of pheasants. Dr. Josselyn Van Tyne received reports from points throughout Michigan which clearly indicated that Snowy Owls were a menace to pheasants in that state. The following are typical of many of the reports. Near the limits of Detroit, Mr. W. J. Moulton shot a Snowy Owl that was seen attacking a pheasant. Four taxidermists in Detroit reported examining the stomach contents of owls many of which contained the remains of pheasants. Mr. E. C. Belding stated that two Snowy Owls killed in Onaway, Michigan, had their stomachs filled with pheasant remains. Mr. Miller Empey of Freeland, Michigan, reported that two Snowy Owls contained remains of pheasants and that one of the birds was feeding on a pheasant at the time it

was shot. Extracts from a letter received from Mr. Richard Gottleber of Saginaw, Michigan, are of interest. He stated that the chief food of the owls consisted of pheasants which are very abundant in his section of the state. He saw several of the owls capture hen pheasants that were crouching on the ground. He observed one of the owls strike an adult male pheasant in mid-air. He stated that the pheasant rose rapidly as it took off and that when it was about ten feet above ground, the owl struck and killed it. Mr. Gottleber found in the snow the remains of many pheasants that presumably had been killed by the owls. The owls hunted by perching on convenient vantage points in an open field. As the pheasants came into the open area to feed, the owls swept along to intercept them before they reached the dense cover. When a pheasant squatted in the open field, the owl attacked and invariably captured it.

No field reports of the Snowy Owl feeding on pheasants were received from New England although the stomachs of three owls from this section contained pheasant remains.

Ruffed Grouse.—The Ruffed Grouse is more alert than the pheasant and, since it frequents woodlands and dense cover, we would not expect it to be a common victim of the Snowy Owl; nevertheless a number of reports have come to our attention. Mr. Lester Tate of Ingall's Head, Grand Manan, New Brunswick, observed a Snowy Owl pursue and kill a Ruffed Grouse and later saw it feeding on its prey. Mr. Harold Frahm writes that the food in the stomach of a Snowy Owl killed at New London on January 24, 1942, was composed entirely of remains of grouse. E. C. Belding of Onaway, Michigan, also reports that an owl examined by him had eaten grouse. Howard Bartley of Westmount, Quebec, writes that the stomachs of Snowy Owls which he examined contained grouse, and H. Bedard of Ottawa likewise reported pheasant and grouse in four stomachs of the owls.

Bob-white.—Mr. Hinds of Saybrook, Massachusetts, saw a Snowy Owl capture and eat a Bob-white.

Ducks.—In correspondence received by Dr. Van Tyne, there are several reports of the destruction of ducks by the Snowy Owls. At Saginaw, Michigan, one of the owls was seen to capture a Mallard which it carried for a distance of half a mile before the owl was finally shot. Gilbert Vanderlin of Gladstone, Michigan, reports that he saw the owls capture a large number of wounded ducks, and stomachs of owls examined by him contained the remains of ducks. George Burin of Hamtramck, Michigan, states that the owls were seen to take three tame ducks.

At Toronto, Canada, a police officer reported that a Snowy Owl, seen on the shore of Lake Ontario, had eaten four ducks in one day and that he had seen it eat two, one after the other. The owl was killed, but when the stomach was examined at the Royal Ontario Museum of Zoology, it was found to be empty except for a trace of matted hair. Mr. W. J. Clayton of Lincoln, Maine, states that a Snowy Owl received by him was reported to have taken three tame ducks before it was killed, but when the stomach was examined it was found to be empty. These last two instances emphasize the importance of field observations since stomach contents do not always reveal the entire story. It is apparent that the flesh of birds like ducks may be eaten without bones and feathers; the flesh is quickly digested and nothing else remains to reveal the facts.

On October 23, 1941, Mr. Philip T. Coolidge of Boston saw a Snowy Owl in its savage attempts to capture a wounded duck. On November 20, 1941, I saw a nearly pure white Snowy Owl, presumably a male, perched on a rocky ledge about thirty yards from the shore of Back Bay, Portland, Maine. I observed this bird for over an hour as it leisurely picked at the flesh of a Black Duck which it held in its talons. I have no way of knowing whether the owl killed the duck or not, but since no shooting is permitted on the reservation it is possible that the duck was captured and then carried to the rock to be eaten. Under ordinary conditions at that season of the year, this particular rock is frequented by the ducks, but while the owl was enjoying its meal, the ducks had completely deserted that section of the bay.

Numerous reports have come from various places along the New England coast of depredations on ducks especially of birds that had been wounded by hunters. Everton Gott of Southwest Harbor, Maine, writes that he saw a Snowy Owl seize a duck from a large flock and then sail off so quietly and so rapidly that, apparently, the other ducks were not frightened and did not realize what had happened. Mr. Gordon C. Wilson of Oshawa, Ontario, from his duck-hunting blind on October 1 and 15 and November 15 and 28, 1941, watched Snowy Owls capture ducks, and the stomach contents of seven of the owls which he killed contained their remains. Mr. Howard Bartley of Westmount, Quebec, killed a Snowy Owl as it was attempting to take up a wounded duck. Feathers from the stomach of another Snowy Owl that were sent to me proved to be those of a Red-breasted Merganser. Carl R. Edlund, Assistant Biologist, Indian Reservation, while making a survey of the Bad River Reservation marshes on No-

vember 2, 1941, saw three different Snowy Owls that were feeding on wounded ducks crippled by hunters. A Snowy Owl that had been feeding on Scaup Ducks was killed on the reservation. R. W. Tufts, Chief Federal Migratory Officer of Wolfville, Nova Scotia, writes that the stomach of one Snowy Owl examined by him contained the remains of a Black Duck.

Poultry.—W. E. Ginn, Columbia City, Indiana, reports that a Snowy Owl was shot while eating a chicken which it had carried to a corn-field. The farmer claims to have lost many chickens, presumably from depredations by the owls. H. W. Swihart, Jackson, Michigan, writes that a Snowy Owl was killed just after it had caught and killed a hen. Mr. Lester Tate of Ingall's Head, Grand Manan, early in the morning of November 5, 1941, heard a great commotion among his poultry. The hens were squawking and running about wildly. An investigation revealed that an owl had captured one of his largest hens which, he states, was larger than the owl, itself. Mr. A. Grzela, Fauquier, Ontario, captured a Snowy Owl as it was attempting to steal his domestic fowls. In addition to these field observations, a considerable number of reports have come from taxidermists stating that remains of poultry were found in stomachs of Snowy Owls received by them.

Pigeon.—A pair of Snowy Owls took a heavy toll of pigeons sheltering under the eaves of City Hall and adjacent buildings of Lowell, Massachusetts. W. J. Clayton reports that a male Snowy Owl taken in Presque Isle, Maine, on December 12, 1941, had its stomach full of the remains of pigeons. Mr. Lucien Thibaudeau, Quebec, Canada, reports domestic pigeon remains in Snowy Owl stomachs examined by him. These representative reports reveal that Snowy Owls when hard-pressed for food may even enter our towns and cities in quest of their prey.

Black Guillemot.—F. W. Osborne, St. Mary's Island, Gulf of St. Lawrence, reported that during October, 1941, Snowy Owls fed on Black Guillemots.

Dovekie.—W. J. Clayton, Lincoln, Maine, writes that a Snowy Owl taken at New Harbor, Maine, on December 25, 1941, contained the remains of a Dovekie. The stomach examinations of New England Snowy Owls, especially those taken along the coast, indicated that the owls exacted heavy toll of the Dovekies. It is quite possible that many of these birds had perished and had then been washed up on the shores by the winds and tides where they were found by the owls. At times, Dovekies are blown inland by violent storms and when

forced to land are helpless against any attacks from predaceous birds such as the Snowy Owl.

Herring Gull.—Paul Favour reports that a Snowy Owl was seen feeding on a Herring Gull at Trenton, Maine, on October 20, 1941. Dr. Harrison Lewis received a report of a Snowy Owl that was feeding on a Herring Gull at Oshawa, Ontario. In both of these cases it was not known whether the gull was captured or found either dead or in a weakened condition.

Crow.—Observers at Detroit, Michigan, stated that Snowy Owls killed and ate full-grown Crows. Others have reported the Crows 'ganging-up' to pester the Owls.

Shorebirds.—W. A. Clark of Ram Island Ledge saw several of the owls chasing and capturing small shorebirds during November, 1941. Lester Tate of Grand Manan, New Brunswick, examined numerous pellets left by the owls along the shore of the island and found that practically all of them consisted of the feathers and bones of small shorebirds. Mr. Ernest Joy, warden of the Bowdoin Scientific Station, writes that the owls fed chiefly on Purple Sandpipers during an unusual flight of the latter during the month of October, 1941. Pellets of the owls that were posted along the shore of the island consisted almost entirely of the remains of the sandpipers, but those of other owls that kept vigil on vantage points in the interior of the island were made up largely of Snow Buntings.

Song birds.—The lightkeeper at St. Paul's Island, Nova Scotia, writes that three Snowy Owls killed and ate small song birds. The owls were shot and the stomach contents were found to consist of feathers and remains of the small birds. Dr. Van Tyne received reports from Lansing and River Rouge, Michigan, of owls' stomachs which contained the remains of song birds. An owl taken at Chester, Maine, on October 20, 1941, contained the tail feathers of a Hairy Woodpecker.

MAMMALS

Rats.—Of the various items of food eaten by the Snowy Owl after its arrival in New England, the common rat is the most frequent. This is especially true of individuals which congregate about the dumps of the larger cities, but reports from field observers in localities remote from cities also reveal that rats are included in the diet of the owls.

Mr. Arthur B. Williams, Cleveland, Ohio, writes that at a refuse dump in the Cuyahoga Valley where the rats were numerous, there were, throughout the months of December and January, a dozen Snowy

Owls which roosted under a bridge and which seemed to feed exclusively on the rats. On December 12, 1941, Mrs. R. J. Seamans of Fall River, Massachusetts, saw a Snowy Owl eating a rat. Kenneth H. Doan of Put-in-Bay, Ohio, saw a Snowy Owl feeding on three different house rats during the course of a single morning. E. D. Eliot of Cape Elizabeth, Maine, observed the owls feeding on the rats in that vicinity. R. W. Tufts, Chief Migratory Bird Officer, Wolfville, Nova Scotia, writes that an owl examined by him contained two medium-sized rats. Similar reports have come from many sections of the migratory range of the owl.

Mice.—Mice, like rats, are frequently taken by the Snowy Owl, for these two rodents probably represent the best substitute for its food, the lemming, on which it largely depends while on its nesting grounds in the Arctic. In the stomachs of New England owls that have been examined, mice take a place second only to that of the common rat. Mr. Snyder found mice to be the most important element of food in owls' stomachs collected in Ontario. Mr. Lester Tate observed several Snowy Owls feeding on field mice and common house mice on Grand Manan Island, New Brunswick. R. W. Tufts reports that at Canso, Nova Scotia, a Snowy Owl was seen with a mouse hanging in its claws. The bird was unusually tame and allowed the observer to approach near enough to identify its victim. E. D. Eliot of Cape Elizabeth, and J. J. Sharon, of Pond Island, Maine, observed Snowy Owls feeding on mice in the open fields of their respective localities. Mrs. L. E. Erbe, of Applegate, Michigan, states that the chief food of the Snowy Owls that visited that section consisted of mice and moles. Messrs. Frank Generou, McMillan, Michigan; J. B. Nunemaker, River Rouge, Michigan; S. W. Swihart, Jackson, Michigan; Howard Bartley and Adelard Bartley, Westmount, Quebec; A. Ranger, Hawkesbury, Ontario; W. E. Wilbee, Toronto; H. Beddard, Ottawa; and W. J. Clayton, Lincoln, Maine, all report finding mice in the stomachs of Snowy Owls.

Star-nosed Mole.—Mr. Amedee Lord, Quebec Bridge, Province of Quebec, reports that he found a star-nosed mole in the stomach of a Snowy Owl killed at St. Fay, Quebec, on November 27, 1941. Mr. Snyder found the remains of a star-nosed mole in the stomach of one of the owls collected at Weller's Bay, Ontario, on December 20, 1941. Moles, no doubt, are a very acceptable article of food for the Snowy Owl and are probably taken more often than the few reports would seem to indicate.

Rabbits and Hares.—Only seven of the 127 New England Snowy

Owls examined had eaten hares or rabbits, but it is apparent that these animals constitute a very important item of food in certain localities. This is shown by owls collected in Pennsylvania and examined by Sutton of which 26 out of 60 had eaten cottontails.

Mr. Paul Favour reports that a Snowy Owl was shot on Great Cranberry Island on October 25, 1941, while it was chasing a hare, and on November 20 a Snowy Owl was seen feeding on a hare at the Bar Harbor airport. Mr. Lester Tate observed a Snowy Owl on Grand Manan Island, New Brunswick, that was feeding on a rabbit. James R. Moore, Old Saybrook, Connecticut, saw a Snowy Owl feeding on a freshly killed cottontail on a ledge near the shore of Long Island Sound, January 12, 1942. On October 24, 1941, Mr. Robert W. Sauer killed a Snowy Owl at eleven o'clock at night while it was feeding on a snowshoe hare. Joseph A. Hagar, Massachusetts State Ornithologist, states that four Snowy Owls were killed on Penikese Island, Massachusetts, in order to protect the cottontails propagated there. No report was made on the stomach contents of the owls killed.

The following persons, many of them taxidermists, reported remains of rabbits or hares in the stomachs of the owls examined by them. M. O. Hunsco and Frank Generou, MacMillan; Stephen Koscielski, Bay City; H. W. Swihart, Jackson; Harold Frahm, Detroit; and taxidermists of Port Huron, Michigan; William Holiday Gueph and Adelaïrd Ranger, Hawkesbury, Ontario; T. Emack, Toronto; and H. Bedard, Ottawa. It will be noted that the majority of the reports came from Michigan and Canadian provinces where it is evident that rabbits and hares constitute an important element of the food of the owls.

Squirrels.—Three of the 127 New England owls examined contained remains of red squirrels. H. Bedard and Howard Bartley, Westmount, Quebec, reported squirrels in the stomachs of Snowy Owls examined by them. Adelaïrd Ranger of Hawkesbury, Ontario, writes that the stomach of one of the owls contained the remains of a flying squirrel. J. B. Nunemaker, River Rouge, Michigan, found a ground squirrel in the stomach of one of the owls.

Muskrat.—George Mariage, Rapid City, Michigan, states that a Snowy Owl ate a muskrat which had been caught in a trap. Dr. Van Tyne received a report that the remains of a muskrat were found in the stomach of one of the owls at Saginaw, Michigan. W. J. Moulton, Detroit, Michigan, caught a Snowy Owl in a trap set for a muskrat. The owl would not have been interested in the bait that was used

and whether it was attempting to capture a muskrat near the trap at the time it was caught can never be known.

Sheep.—The Parkhouse Taxidermy Company, Lansing, Michigan, found wool in the stomachs of some of the owls received by them. These owls probably fed on sheep that had died or been killed.

Dogs.—W. J. Moulton, Detroit, Michigan, writes that a farmer killed a Snowy Owl with a chain while it was viciously attacking a dog. Another correspondent reported that his beagle was attacked by one of the owls when the dog was only ten feet away from him.

Man.—A Snowy Owl swooped down on Robert White while he was duck hunting. When it was seized and captured alive, it made a second attempt to snatch his hat. Whether the man or his hat was the owl's objective we do not know, but it was probably the hat.

MISCELLANEOUS

Mr. W. J. Clayton reports that a male Snowy Owl taken at Chester, Maine, on November 20, 1941, had its stomach filled with ground beetles. Dr. Harrison Lewis received a report of an owl taken at Aylmer, Ontario, on April 15, 1942, which had a leopard frog in its stomach.

Mr. Ernest Joy, warden at the Bowdoin Scientific Station, Kent Island, Bay of Fundy, observed a Snowy Owl actively feeding on barnacles that covered the rocks exposed at low tide. The owl busied itself at this task for some time, indicating that it was hungry and that this unusual food was satisfying. Mr. Joy also reports that he noticed several of the owls turning over the kelp at low tide; apparently they were feeding on the small crustaceans which abound in such places.

Mr. W. J. Clayton found the stomach of one of the owls filled with lichens. This owl was taken at Carroll, Maine, and was seen on the lichen-covered rocks and stumps for two days before it was killed. It evidently had collected these lichens in the absence of more desirable food. Mr. Clayton also examined a Snowy Owl killed at Chester, Maine, on October 20, 1941, and found the stomach full of the terminal buds of the white maple. This probably represents another case in which the owl had swallowed the stomach of a grouse or bird of similar food habits. (For other field observations see Gross 1927 and 1931.)

In summing up the results of the stomach examinations and field observations of food habits, the evidence is about equally for and against the Snowy Owl so far as the economic interests of man are concerned. The species is beneficial by reason of its destruction of

mice and, especially, that most despised of all rodents, the Norway rat, but it is also very destructive to game and song birds, poultry, and certain useful mammals. The total number of birds and useful mammals that are eaten is just about equal to the number of destructive mammals, and hence little can be claimed in favor of the Snowy Owl on the basis of its food habits. However, most of us will agree that this owl does deserve a place on the protected list because of its aesthetic value. Who is there that does not receive a thrill of delight on seeing one of these white visitors from the north?

BIBLIOGRAPHY

- BAILEY, ALFRED M., BROWER, CHARLES D., AND BISHOP, LOUIS B.
1933. Birds of the Region of Point Barrow, Alaska. Program of Activities of the Chicago Academy of Sciences, 4: 15-40.
- BEAMER, L. H.
1937. Observations on the Food Habits of the Snowy Owl. Canadian Field-Naturalist, 51: 59-60.
- BENDIRE, CHARLES.
1892. Life Histories of North American Birds, pt. 1. U. S. Nat. Mus., Spec. Bull., 1: 389-391.
- BENT, A. C.
1938. Life Histories of North American Birds of Prey, pt. 2 (Falconiformes, and Strigiformes). U. S. Nat. Mus. Bull., 170: 358-374.
- BOWLES, J. HOOPER.
1917. The Winter Migration of 1916-17 in the Northwest. Condor, 19: 125-129.
- BROOKS, ALLAN.
1929. On Pellets of Hawks and Owls. Condor, 31: 222-223.
1929. Pellets of Hawks and Owls are misleading. Canadian Field-Naturalist, 43: 160-161.
- CAHN, ALVIN R., AND KEMP, JACK T.
1930. On the Food of Certain Owls in East-central Illinois. Auk, 47: 323-328.
- DUFRESNE, FRANK.
1922. The Snowy Owl—Destroyer of Game. Bull. Amer. Game Protective Assn., 11 (3): 3-12.
- FANNIN, J.
1897. Abundance of Owls on the Coast of British Columbia. Auk, 14: 89.
- FARLEY, FRANK L.
1924. Large Numbers of Mallards remain in Buffalo Lake, Alberta. Canadian Field-Naturalist, 37: 119.
1935. Snowy Owl captures a Crow. Canadian Field-Naturalist, 49: 37.
- FISHER, A. K.
1893. The Hawks and Owl of the United States in their relation to Agriculture. Division of Ornithology and Mammalogy, U. S. Dept. of Agr., Bull. no. 3: 210.
- GREENE, EARLE E.
1931. Snowy Owl in Georgia. Auk, 48: 268.
- GRINNELL, LAWRENCE I., AND PALMER, RALPH H.
1941. Notes on Bird-life of Churchill, Manitoba. Canadian Field-Naturalist, 55: 47-54.

- GROSS, ALFRED O.
 1927. The Snowy Owl Migration of 1926-27. *Auk*, 44: 479-493.
 1931. Snowy Owl Migration—1930-1931. *Auk*, 48: 501-511.
- HANNA, G. DALLAS.
 1917. The Summer Birds of the St. Matthew Island Bird Reservation (Bering Sea). *Auk*, 34: 403-410.
- HICKS, LAWRENCE E.
 1932. The Snowy Owl Invasion of Ohio in 1930-1931. *Wilson Bulletin*, 44: 221-226.
- JOHNSON, R. A.
 1937. The Food of the Snowy Owl (*Nyctea nyctea*) during a Migration to the Gulf of St. Lawrence. *Canadian Field-Naturalist*, 51: 136-137.
- MACFARLANE, RODERICK.
 1891. Notes and List of Birds and Eggs Collected in Arctic America 1861-1866. *Proc. U. S. Nat. Mus.*, 14: 413-446.
- MUNRO, J. A.
 1929. Notes on the Food Habits of certain Raptores in British Columbia and Alberta. *Condor*, 31: 112-116.
- MURIE, O. J.
 1929. Nesting of the Snowy Owl. *Condor*, 31: 3-12.
- ORMSBEE, C. O.
 1893. Something about Owls. *Ornithologist and Oologist*, 18: 137-139.
- PHILLIPS, CHARLES L.
 1906. Snowy Owl. *Nyctea nyctea*. *Oologist*, 23: 53-55.
- PLESKE, THEODORE.
 1928. Birds of the Eurasian Tundra. *Memoirs Boston Society of Nat. Hist.*, 6 (3): 111-485.
- PREBLE, EDWARD A.
 1908. Birds of the Athabaska-Mackenzie Region. *N. A. Fauna*, no. 27: 251-500.
 1923. A Biological Survey of the Pribilof Islands, Alaska. Part 1, Birds and Mammals. *N. A. Fauna*, no. 46: 1-128.
- ROBERTS, THOMAS S.
 1925. Minnesota Region. *Bird Lore*, 27: 190-193.
- SHORT, E. H.
 1906. Unusual York State Records. *Oologist*, 23: 127.
- SNYDER, L. L.
 1932. The Hawks and Owls of Ontario. *Royal Ontario Museum of Zoology, Handbook no. 2*: 1-48.
- SUTTON, GEORGE MIKSCH.
 1927. The Invasion of Goshawks and Snowy Owls during the Winter of 1926-27. *Cardinal*, 2 (2): 35-41.
 1932. The Birds of Southampton Island. *Memoirs Carnegie Museum*, 12 (2) sec. 2: 275.
- TAVERNER, P. A.
 1926. Birds of Western Canada. *Bull. Victoria National Museum*, 41: 380.
- WOODRUFF, FRANK MORLEY.
 1907. The Birds of the Chicago Area. *Bull. Chicago Academy of Sciences*, 6: 221.

Bowdoin College
Brunswick, Maine