Faculty of Science

University of Ottawa

Department of Biology

OBSERVATIONS ON REDWINGED BLACKBIRDS

(*Agelaius phoeniceus phoeniceus*)

DISTRIBUTION IN THE OTTAWA AREA

Submitted to the Graduate School of the University of Ottawa in Partial Fulfilment of the Requirements for the Degree of Master in Science.

by

Candidate

Director

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ABSTRACT

Populations of redwinged blackbirds (Agelaius phoeniceus phoeniceus) vary in density in different habitats in the Ottawa area. Population densities in three sample areas are defined in terms of numbers of breeding birds and numbers of nests. An attempt is made to define environmental factors which influence population densities in the different sample areas and affect census methods. Feeding of wild and captive birds were studied.

INTRODUCTION

The redwinged blackbird (Agelaius phoeniceus phoeniceus) is widely distributed in North America and is a very common breeding species in the Ottawa area. As with most species, its distribution in any region is heterogeneous.

The principal object of the present study was to define the habitats of redwinged blackbirds in the Ottawa area and compare the population in each.

A brief review of the species' life history is a necessary background to this study. Male redwings arrive in the Ottawa area in late March or early April and are followed by the females some two or three weeks later. Their nests are built in May usually near water and very often adjacent to or on cultivated lands. Three to five eggs are laid in the nests, which are built among cattails (Typha), bulrushes (Scirpus), sedges (Carex), shrubby willows (Salix), alders (Alnus), or dogwoods (Cornus). By the middle of July the breeding grounds become entirely deserted; adults and young are scattered in the open country hiding among cultivated plants and occasionally at the edge of woody areas. In fall, flocks of redwings feed on the uplands during the day. They swoop down in clouds on field of corn and other grain. An abundance of ripe grain, especially corn at that time of the year is an important factor influencing the fall distribution of redwings. Such gatherings are preliminary to the building up of flocks that will migrate southward later in September and October.

In order to measure the populations occurring in the different habitats, censuses of the birds and counts of nests were made. Choice and availability of food and nesting sites were considered the factors most likely to cause heterogeneous distribution of this species and thus these were investigated by direct observation and by examination of stomach contents from birds which were collected in the study areas. Observations on the feeding of captive birds were also made.

Most of the earlier work on food consumption and feeding habits of redwings was done to establish whether the species was useful to agriculture and, therefore, to man.

Audubon (2) referring to redwings, wrote: "...That it destroys an astonishing quantity of corn, rice and other kinds of grain cannot be denied; but that before it commences its ravages, it has proved highly serviceable to the crops is equally certain."

As if to confirm Audubon's statement, Goss (9) says of the redwings: "During the fall and winter months they assemble in large flocks, and do much damage in the ricefields, and are often more or less injurious to the grains within their summer homes; but the damage they do in the latter case is overbalanced by the destruction of injurious insects upon which they almost wholly feed during the breeding season; busy hunters of the field and followers of the plow."

The economic status of the redwings is still an issue. It varies from time to time and place to place. It is not the purpose of this work to settle the problem.

Because of its wide distribution in eastern Canada and eastern United States, and also because of its fairly dense population throughout the country, redwinged blackbirds attracted the attention of many biologists during past decades. Hackett (12) published some notes on the breeding habits of the redwinged blackbirds. Allen (1) in a study of the ecology of a cattail marsh, came to the conclusion that although an organism is dependent upon its environment for food and shelter for itself and offspring, the redwinged blackbird is independent of the food supply of its breeding habitat.

Smith (26) tried to establish a relationship between the size of a breeding colony and earliness of egg laying. Synchrony in breeding processes and reproductive success was tested by a field study of reproduction in an extensive breeding colony of redwings in comparision with an equivalent number of individuals breeding in small colonies in 24 marshes and ponds of restricted size. He concluded that, if population density is a factor in the reproduction of redwings, it must necessarily operate in association with numerous other physical or biotic environmental influences.

Mehner (19) made an ecological study of the redwinged blackbird at Pymatuning, Pennsylvania, and Beer and Tibbits (3) observed and described the nesting behaviour of the redwings. Nero and Emlen (21) made an experimental study of territorial behaviour in breeding redwings.

In pursuing the primary objective of this study, there was opportunity to observe other aspects of redwinged blackbird behaviour. Reference is made to the daily movement patterns and roosting habits of late summer flocks. Observations relating to those subjects are included in this thesis as a contribution to the understanding of the species.

STUDY AREAS

The Ottawa area, as referred to in this thesis, could be described as a polygonal area bounded by straight lines between Simmons, Quebec; Blackburn, Piperville, Fallowfield and Eagleson Corners, Ontario (Fig. 1). Most of the work described in this paper was carried on within that 150 square miles although certain observations were made at points outside those limits.

Within the Ottawa area three sub-areas were chosen for intensive study and censusing. These sub-areas were named C.B.O., Deschesnes-Aylmer and Bells Corners Station.

Nests were counted within the sub-areas only in selected sectors which provided suitable nesting cover. These are referred to as Sections A, B, C, etc.

The Ottawa area shows certain geographical characteristics worth mentioning in this work. Three rivers, the Ottawa, Rideau and Gatineau, drain the area and are joined by a considerable number of brooks and creeks. The central part of the Ottawa area is occupied by the cities of Ottawa and Hull. The surface of the whole area is rather flattened. Altitudes vary from approximately 200 to 400 feet.

The natural land type in the Ottawa area is a shaly loam with generally good drainage conditions. The soil acidity ranges from pH 5.0 to pH 5.9 in the eastern part of the Ottawa area (east of Rideau River) while the western part of the area has a soil pH ranging from 6.6 to 7.4.

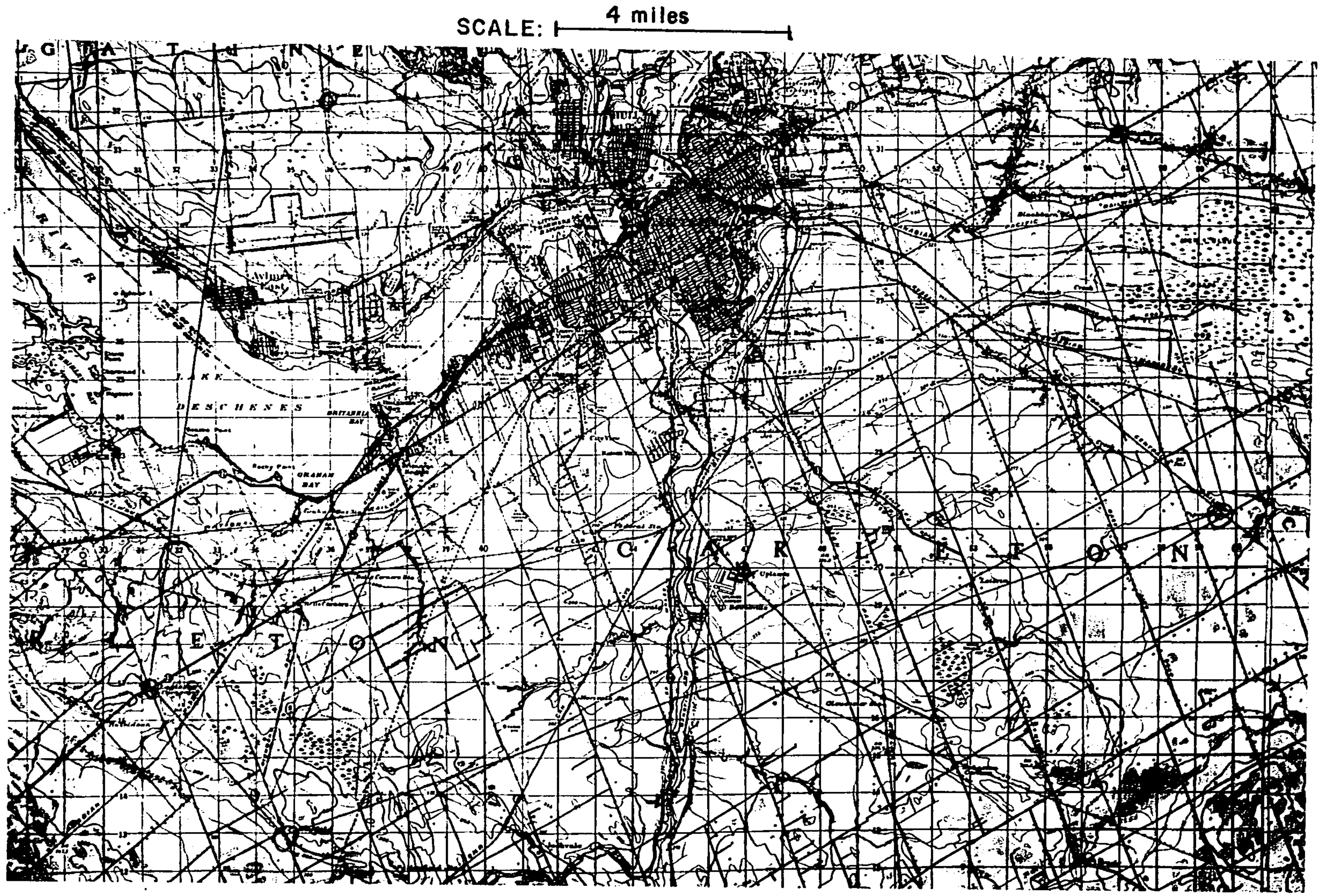


Fig. 1. Map of the Ottawa area as referred to in this thesis. Three polygons indicate the location of the sub-areas.

The forest region within which the Ottawa area is located is the Great Lakes-St. Lawrence Forest Region, upper St. Lawrence Section [Halliday (13)]. Rowe (25) describes the forest region as "...a major geographic belt or zone, characterized vegetationally by a broad uniformity in physiognomy and in the composition of the dominant tree species." The forest section, is conceived by the same author as: "A geographic area possessing an individuality which is expressed relative to other sections in a distinctive patterning of vegetation and of physiography."

In the Ottawa area, mixed deciduous and coniferous woods are typical. Nevertheless, there is a predominance of deciduous trees; Brother Marie-Victorin (17) described the Ottawa area as a tolerant deciduous zone. Maple (Acer saccharum), elm (Ulmus Americana) and pine (Pinus strobus) are the dominant trees in the Ottawa area (Chapman and Putman (6)).

In general, Ottawa has a fairly typical temperate zone climate. In summer, temperature can be expected occasionally to rise to 100 degrees, and during winter to drop once in a while to 30 below zero. The mean annual temperature is 42 degrees.

Heavy snow fall during the winter of 1957-58 and lower mean temperatures for March, April, May and June, 1958, made spring very tardy compared to 1957 (Table I and Fig. 2).

There was less sunshine in spring 1958. The hours of bright sunshine for March, April, May and June were 11%

above normal in 1957 and 11% below normal for the same months in 1958 (Figs. 3 and 4). Rainfall in April 1957 was 30% higher than in April 1958. This fact should not be overlooked as a factor accelerating the rate of snow melting (Fig. 5). Development of vegetation in 1958 was comparatively late.

Table I: Weather Conditions[1]
March, April, May, June, 1957 and 1958

1957	Mean Temp. °F.	Highest Temp. °F.	Lowest Temp. °F.	Total Precipitation	Bright Sunshine
March	30	53	6	0.53 in.	23% above normal[2]
April	45	76	17	1.95	8% below normal
May	54	83	28	1.60	2% above normal
June	67	91	42	4.78	6% below normal
1958					
March	33	53	14	1.40	14% below normal
April	45	76	20	1.75	2% above normal
May	51	82	29	1.42	4% below normal
June	59	84	38	2.75	5% above normal

1) Annual meteorological summary for Ottawa, Department of Transport, Meteorological branch, 1957 and 1958.

2) Normal: Average for the last 59 years.

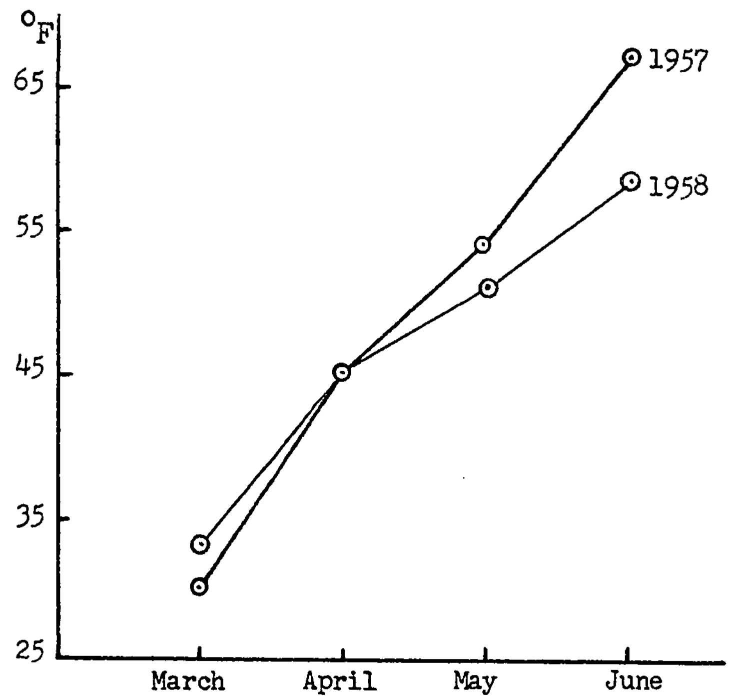


Fig. 2. Ottawa area mean temperature.

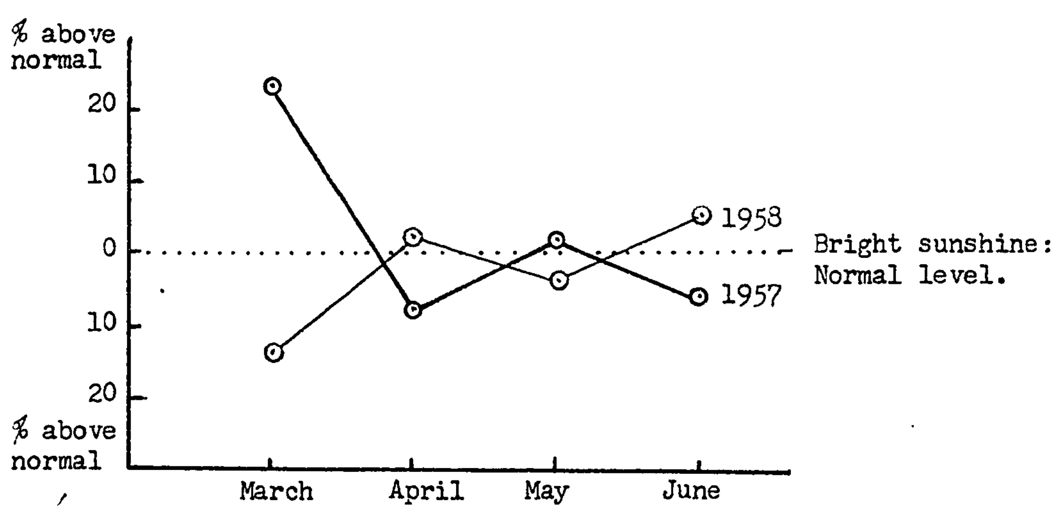


Fig. 3. Hours of bright sunshine above and below normal.

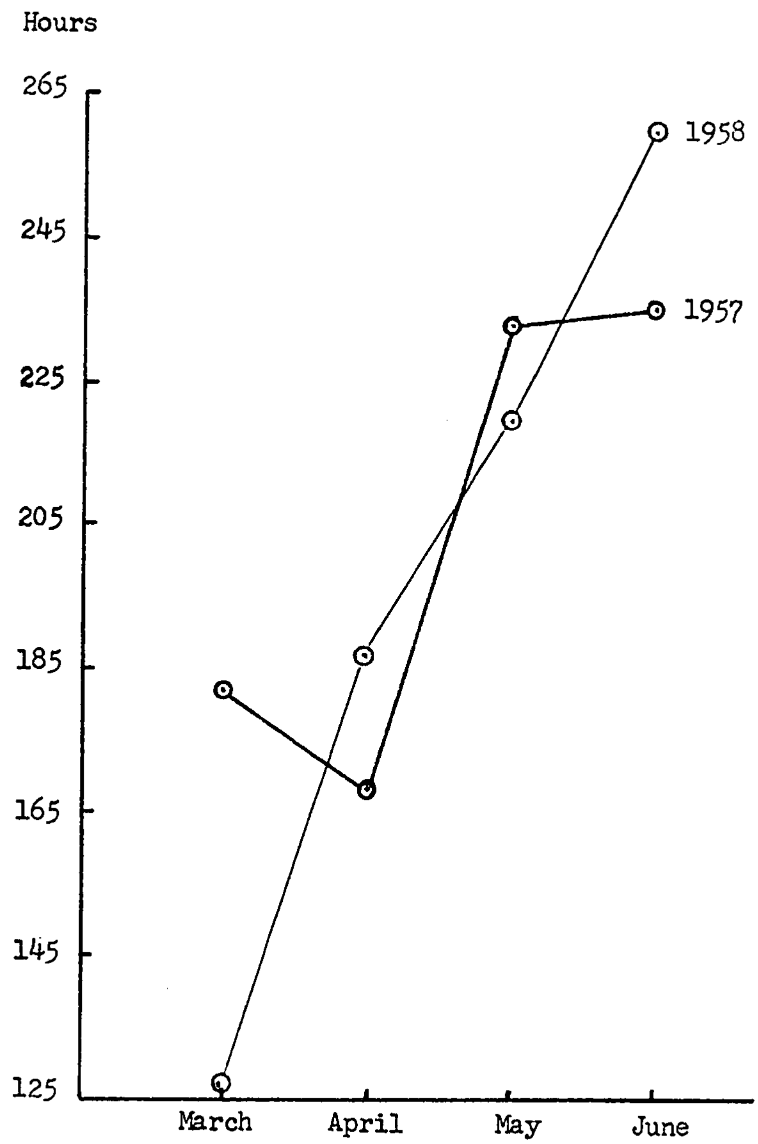


Fig. 4. Hours of bright sunshine.

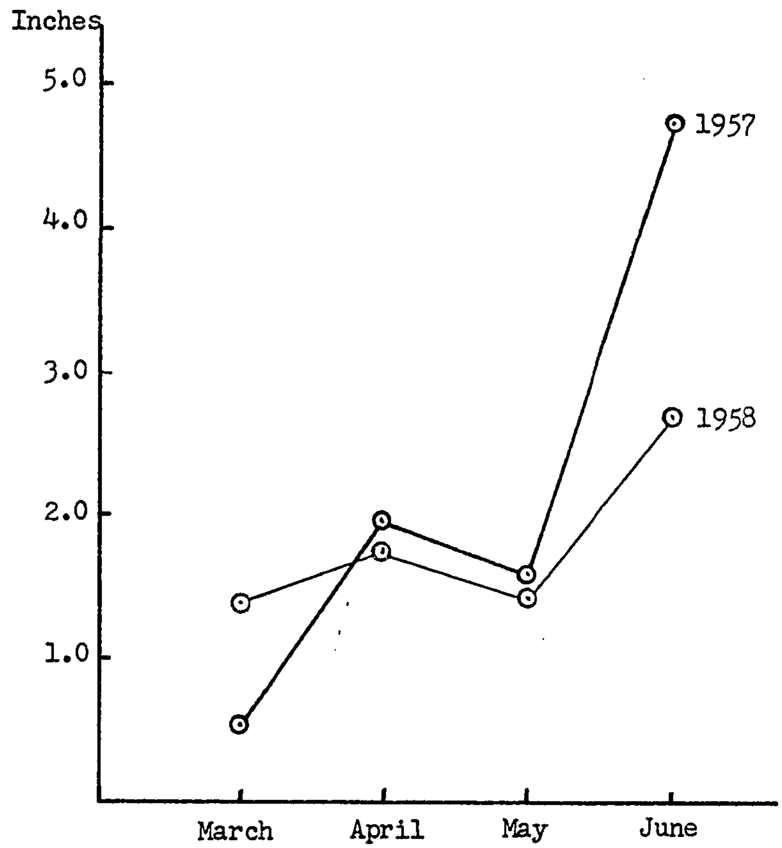


Fig. 5. Total precipitation.

Deschesnes-Aylmer Sub-Area

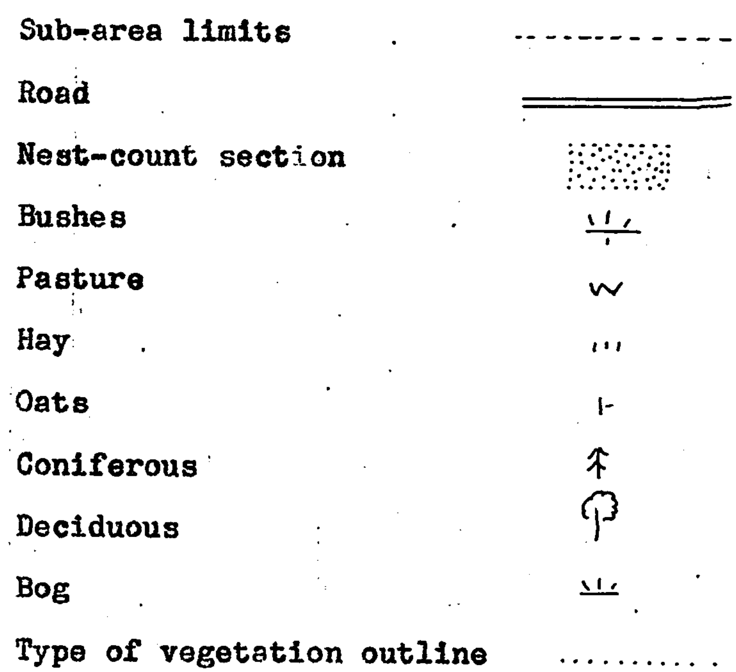
This sub-area of approximately 660 acres is located northeast of Aylmer. Within it, there is a fairly dense woody vegetation of coniferous and deciduous trees covering the northern part of the sub-area about one thousand feet north of McConnell road. The rest of the sub-area consists mostly of pasture, hay, oats and bushes (alder-willow association). Pasture and hay are estimated as about 60 to 65% of the crop.

Within the limits of this sub-area three intensive study areas covering a total of 5.5 acres were chosen and referred to as Sections A, B and C (Fig. 6).

Section A (Fig. 7): This section on the north side of McConnell road was approximately 320 feet long and 100 feet wide. Temporary run-off water covers the ground at most places during April, May and June. Eastern white cedar (*Thuja occidentalis*), shrubby willow (*Salix petiolaris*), white pine and white spruce (*Picea glauca*) are the common species of shrubs and trees found in that section.

Section B (Fig. 8): This is a very narrow area some 20 feet wide and approximately 450 feet long. This narrow patch of woody vegetation separates two cultivated areas on the south side of McConnell road. Alders (*Alnus incana*) occupy 90% of the surface of this section. Willows (*Salix lucida*) and a few elms make up the rest of the cover vegetation of this section.

Fig. 6. List of symbols.



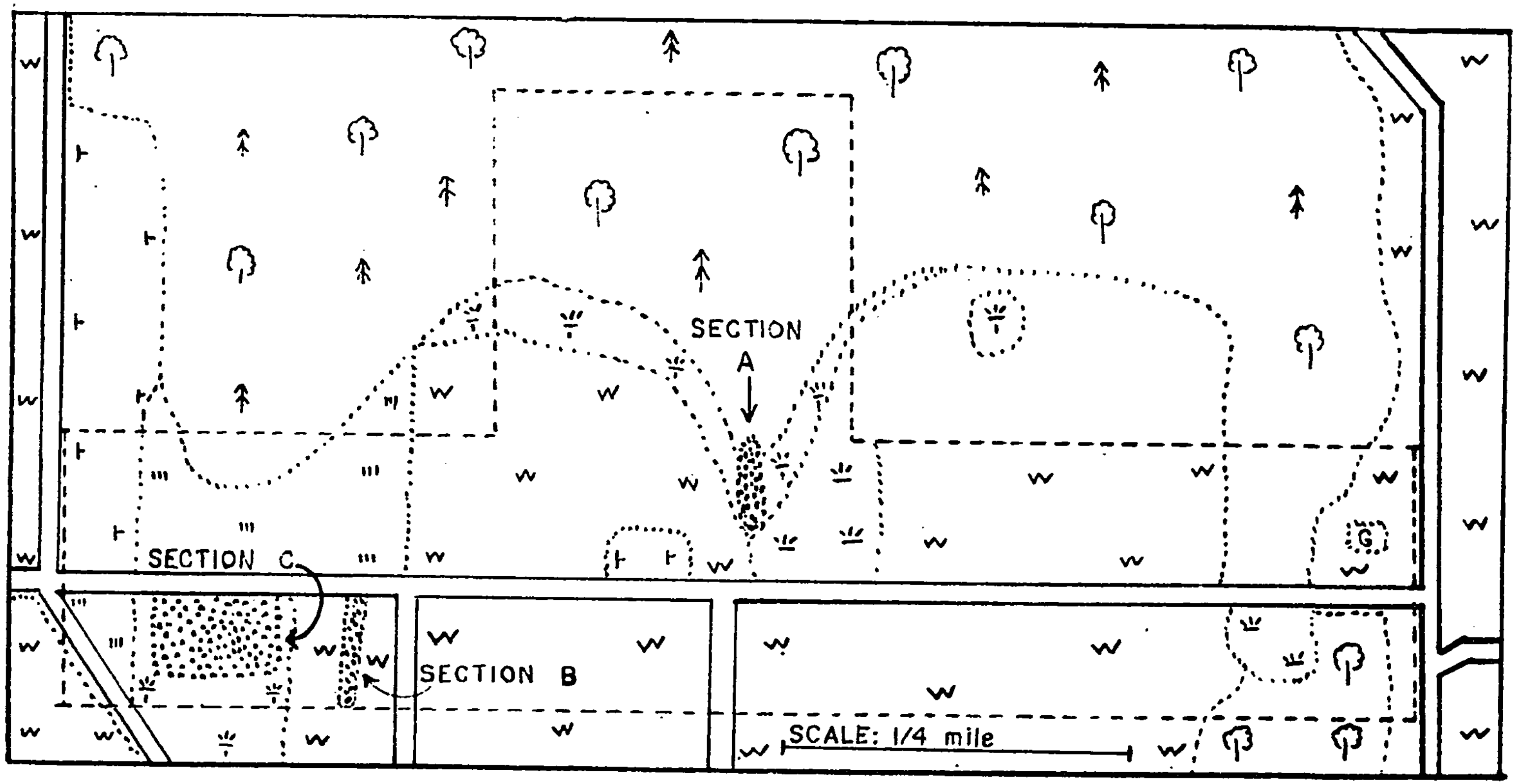


Fig. 6. Deschesnes-Aylmer sub-area. Major vegetation habitats.

Fig. 7. Deschesnes-Aylmer sub-area.
Section A.

Fig. 8. Deschesnes-Aylmer sub-area.
Section B.

Section C (Fig. 9): This section also on the south side of McConnell road measures approximately 400 feet wide and 500 feet long. It is a flat area with patches of cattails (*Typha latifolia*), several species of sedges and different types of shrubs such as stalked willows and red-osier dogwood (*Cornus stolonifera*). A few large elms grow on the south and east ends of the area.

C.B.O. Sub-Area (Figs. 10 and 11)

This sub-area is eight miles southeast of Ottawa and three-quarters of a mile northeast of the C.B.O. radio station transmitter on Russell road. In the spring the area is covered with one to two feet of standing water. In July, if the season is exceptionally dry the marsh will dry out, otherwise, one or two inches of water will cover the soil all through the summer. The vegetation consists mainly of bulrushes, cattails, sedges, rushes (*Juncus nodosus*), alders and shrubby willows.

The marsh is on the north side of the Canadian National Railway tracks to Montreal and is adjacent to a large peat bog well known to the residents of the area as "Mer bleue". The marsh is well protected against the wind by a patch of woody vegetation at the south, that is, next to the railway tracks.

Approximately five acres (730 x 300 feet) of the above sub-area were chosen as intensive study area.

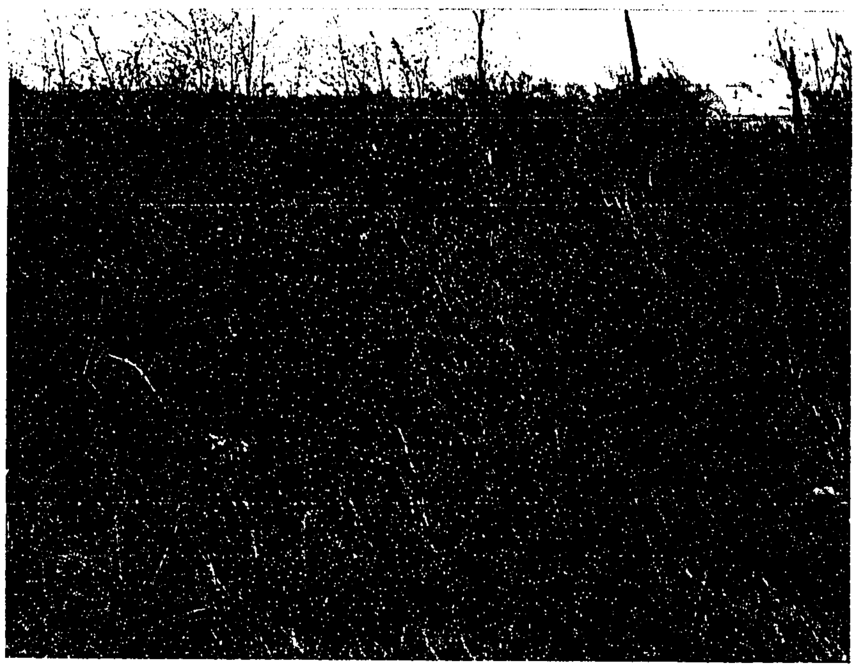
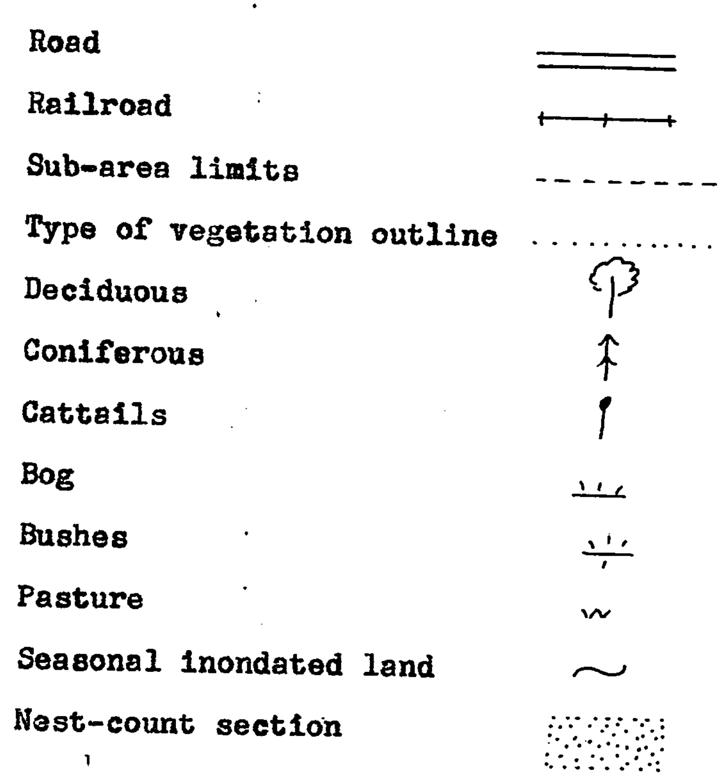


Fig. 9. Deschesnes-Aylmer sub-area.
Section C.

Fig. 10. C.B.O. sub-area.

Fig. 11. List of symbols.



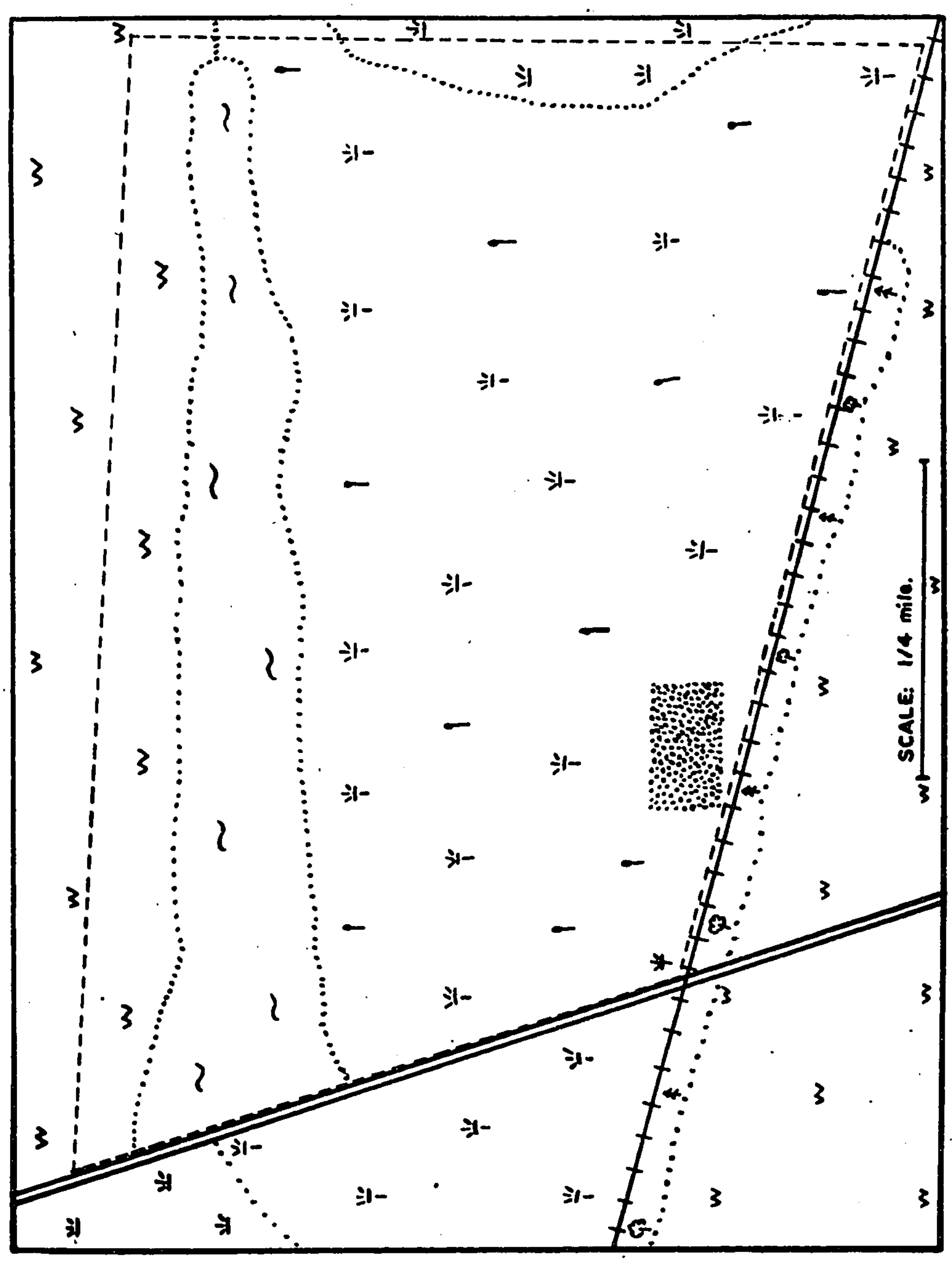


Fig. 11. C.B.O. sub-area. Major vegetation habitats.

<u>Bells Corners Station Sub-Area</u> (Fig. 12)

This sub-area of 790 acres is located about two miles southeast of Bells Corners Station. It is very intensively cultivated. Hay and oats, as well as pastures, constitute the largest part of the crops. Barley and red clover are cultivated but less extensively. Patches of woody vegetation are rather small and scattered.

In this sub-area there is only one known marsh comparable to C.B.O. marsh in term of vegetation. This marsh will be described below under the heading: "Section A". Small patches of shrubby vegetation growing in wet places provide excellent nesting grounds for redwings. These shrubs consist of willows and alders.

Three sections of that sub-area, totalling 3.4 acres, were chosen for intensive study.

<u>Section A</u> (Fig. 13): This ~~area~~ section is, as mentioned above, the only marsh of the sub-area. As far as the vegetation is concerned it is essentially the same as at C.B.O. Separated into two halves by a gravel road, the section measures 170 feet wide (including the width of the gravel road) and 350 feet long. Water level is about twelve inches high in early summer and the marsh dries out completely late in June and July. This section is entirely surrounded by cultivated fields, pastures on the west side of the road and hay on the east side (Fig. 12).

Fig. 12. List of symbols.

Sub-area limits

Road

Private road

Power transmission line

Creek

Nest-count section

Sand pit

Coniferous

Bushes

Pasture

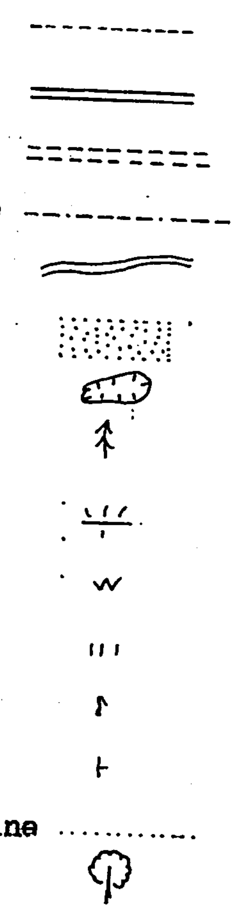
Hay

Wheat

Oats

Type of vegetation outline

Deciduous



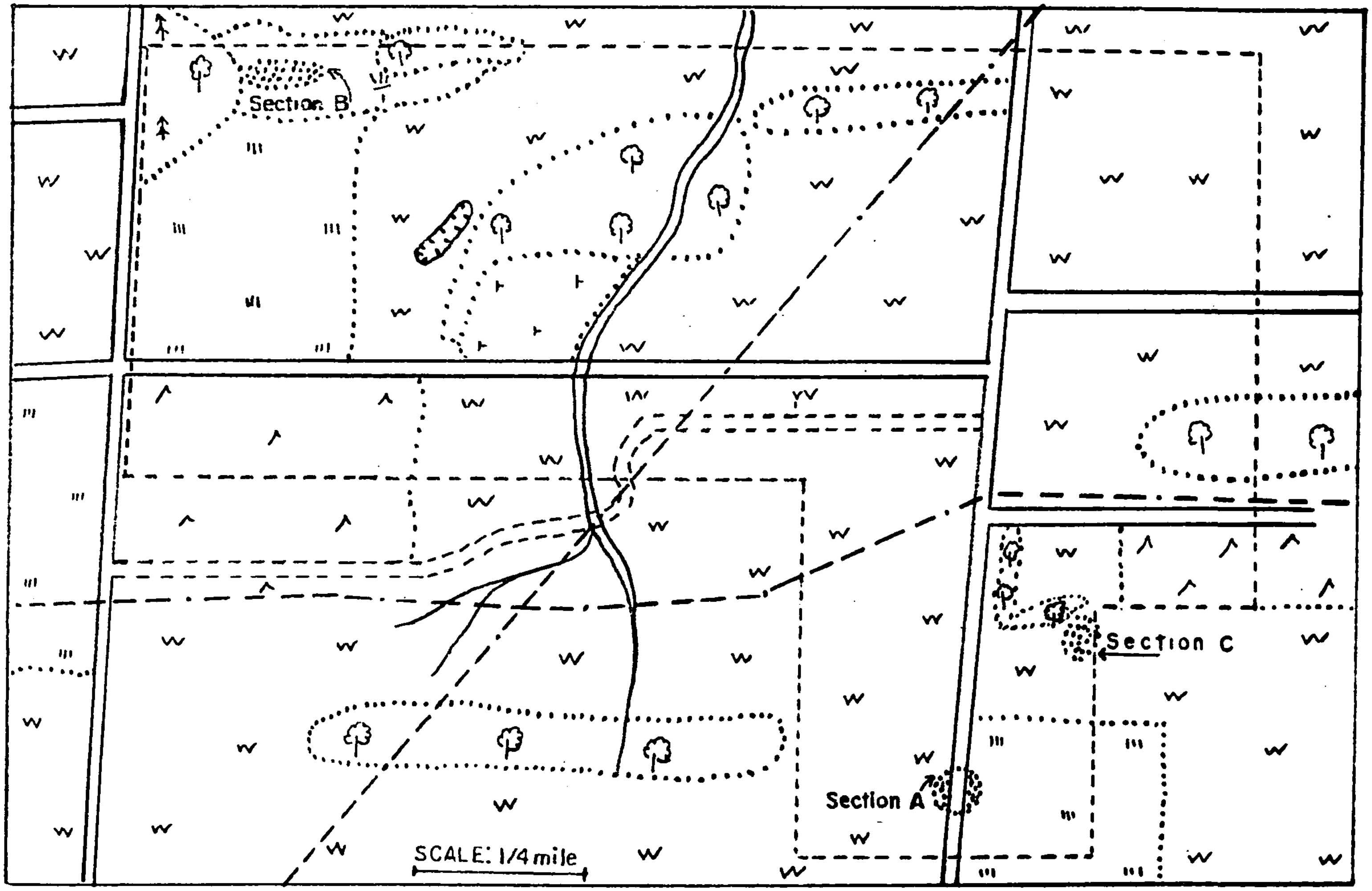


Fig. 12. Bells Corners Station sub-area. Major vegetation habitats.

Section B (Fig. 14): This section is 120 feet wide and 430 feet long. Stalked willows and shining willows (Salix lucida) form a patch of shrubby vegetation dotted with a few wire birch (Betula populifolia), elm and a few largetooth aspen (Populus grandidentata). Water level in this section in April and May was about eight inches high. Evaporation caused the muddy bottom to be exposed late in June.

Section C (Fig. 15): This is an area approximately 150 feet wide by 230 feet long. It has much resemblance to Section B as far as the vegetation is concerned. A few wire birch and largetooth aspen are associated with stalked and shining willows which cover the major part of the section. The water is always more shallow than in Section B of the same sub-area.

METHODS

Bird Census

Redwinged blackbirds were counted in the three sub-areas, that is, Bells Corners Station, Deschesnes-Aylmer and C.B.O. Our intention in censusing the redwings was not to obtain a complete count within each sub-area, but to obtain a series of sample counts so that comparisons between sub-areas could be made on the basis of birds seen per unit time per unit area.

Fig. 13. Bells Corners Station sub-area. Section A.

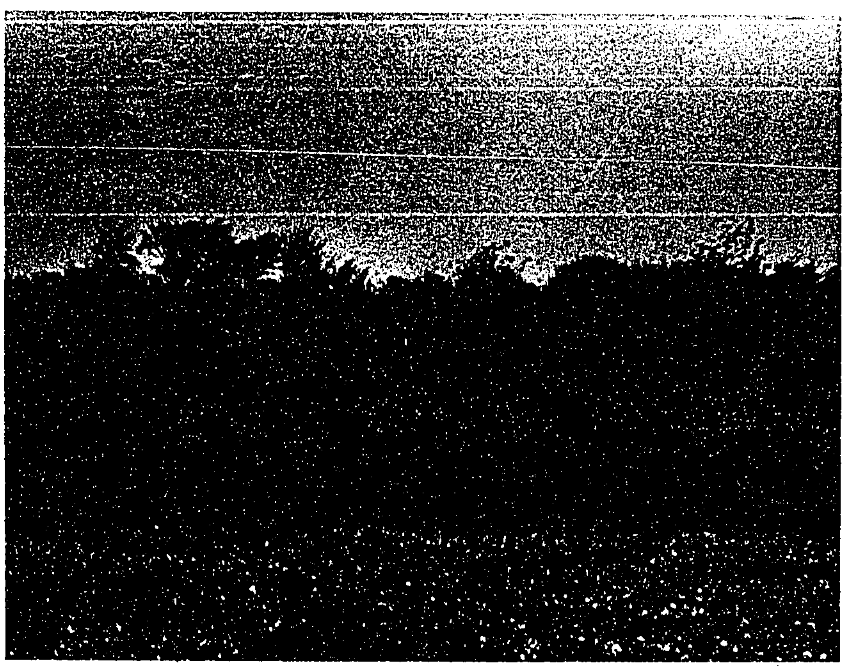


Fig. 14. Bells Corners Station sub-area. Section B.

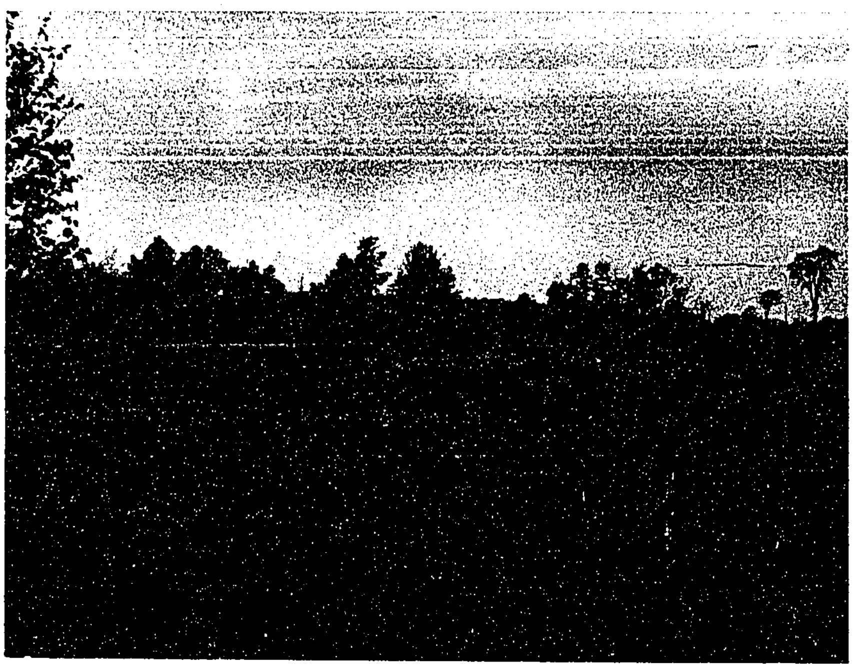


Fig. 15. Bells Corners Station sub-area.
Section C.

Although most observations were done while the observer was proceeding on foot, some data were obtained while driving a car at low speed along secondary roads. The latter procedure is less thorough but it enables one to take a much larger sample of redwinged blackbirds early in spring when the flocks arrive in our latitude.

Foot surveys were made at least twice a week during the nesting season across the lands included within the limits of the sub-areas described above. Bird-counts by foot survey were done along transects spaced some 400 to 500 feet apart.

While counting redwings care was taken whenever possible, not to count the same bird more than once. Even the best precautions could not avoid such "double or triple counts" entirely and the data found in this work are not without a certain amount of error. On the other hand, one may assume that such error may compensate for all redwings not counted that might have been present but not seen within the area during the survey. This statement may be less true with reference to Bells Corners Station where the distribution of cover is quite different from the other sub-areas.

Female redwings are much less conspicuous than males because their plumage is less colourful and their actions less noticeable. During the nesting season when they are not building their nest or sitting on their eggs, they perch on vegetation close to ground level. For these reasons our data show a much larger number of males than females, although it is generally accepted that redwings are polygamous.

Nest Counts

Nest counts were carried out once a week during the nesting season. Such nest counts were limited to the intensive study areas. Transects, ten feet apart were followed by foot across the intensive study areas. Careful search through the vegetation was done in order to find out as exactly as possible the number of nests present.

Stomach Contents Analysis

Redwings were killed with a .410 gauge shot-gun using size number twelve shot. Such shooting took place in April, May and June within the sub-areas and as much as possible not less than five hundred feet from an intensive study area. As soon as the bird was shot, field data were noted on a paper tag. The bird was opened at once and ligatures were placed around the oesophagus and duodenum to prevent any loss of stomach contents. The stomach was removed and then injected with 70% ethyl alcohol with the aid of a hypodermic needle and syringe. Following such treatment, the stomach was placed in a small bottle and preserved in 70% alcohol. Corresponding field tags were placed with each stomach.

Stomach contents were later analyzed in the laboratory using the following method.

a) The stomach contents were divided into four parts: 1) plant parts (usually seeds), 2) insects parts, 3) grit and 4) unidentified particles.

b) Stomach contents of each category were measured by volume. Particles were placed into a graduated cylinder which already contained 0.5 to 1.0 cc. of 70% alcohol. The difference between the original volume of alcohol and the final volume of alcohol and stomach contents was taken as the volume of the latter.

c) Following the volume determination, identification of insects and seeds found in the stomach was undertaken.

<u>Bird Catching Methods</u>

In order to study food consumption under controlled conditions a number of redwinged blackbirds were kept in captivity.

Different trapping devices were used to catch red-winged blackbirds at different times of the year. During the nesting season when birds were flying low to get to their nests, a japanese mist net (Figs. 16 and 17) some 35 feet long and 4 feet wide with 3/4 inch mesh was stretched across a nesting ground between two vertical aluminum poles. Birds flying back and forth to get building material for their nests, or food for their young, were expected to dive accidentally in the net and be captured in one of the pouches. This method was successful to a certain extent but required an excessive time to be spent in the field watching the net.

Another method was the use of an elevator trap. A modification of the Havahart sparrow trap, the device was baited with either cracked corn or chicken feed (mixture of oat, wheat and barley). Redwings never went close to it and never touched the bait. Use of this trap was discontinued after one season.

During the fall a special trap (Fig. 18) was used at the Ottawa experimental farm. This trap was eight feet long, six feet wide and seven feet high. Two three-inch parallel and longitudinal slits on the roof give access to the cage for the birds attracted by the bait. The trap was placed at the edge of a corn field. It was baited with fresh or cracked corn and visited twice a day as soon as possible after sunrise and before sunset. This trapping method was more effective than any other methods described above but could be used only for a restricted period of time, that is, a few weeks in the fall while redwings feed on ripe corn.

Fig. 16 and Fig. 17. Japanese mist net in working position. Strong wind makes the pouches more conspicuous.

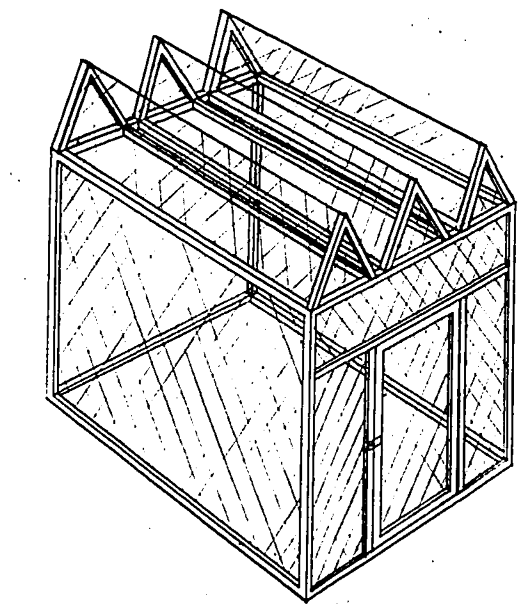


Fig. 18. Trap used in the fa?l during flock formation.

DATA OBTAINED

Bird-Counts vs Nest-Counts

From information presented in Tables II and III and Fig. 19 it is quite evident that redwing populations in the Ottawa area vary from one sub-area to another. Fig. 19 illustrates that the number of nests per five acres of intensive study area vary from one place to another and that such variations are strikingly similar in 1957 and 1958.

If one compares the nest density of the sub-areas with the bird-count data of the same sub-areas, one realizes that there is a lack of correlation between the two series of data. It seems that the most conspicuous discrepancy between the nest-count and bird-count data is with respect to that from the Bells Corners Station sub-area.

The factors that might explain such a discrepancy may be considered from several angles.

1) As far as the bird-counts are concerned, the distribution of cover being different at Bells Corners from the other sub-areas, redwings have less chances to hide at Bells Corners Station sub-area and thus the chances to count the same bird more than once are minimized. This may be responsible for the comparatively low bird-count in that sub-area.

2) One may believe that the nest-count data are most readily acceptable for the following reasons:

a) Nests of redwings are stationary structures that may be counted, checked and rechecked several times.

b) Chances to count one nest twice are very low if the method of transect survey is carried on with care.

c) For the same reason, nests are seldom overlooked. If some of them are overlooked during the first transect survey, the chances are that they will be counted during a further count.

d) Contrary to bird-counts, nest-counts may be carried on whatever the weather conditions might be and this without any risk that such conditions influence the results. On the other hand, polygamy in redwings has been reported by several people such as: Allen (2), Roberts (24), Linsdale (16), Mayr (18) and Nero (22). Assuming that many redwings are polygamous, the number of females per male may vary, that is, from one to three, very seldom more than three. Consequently, the number of nests in an area may not reflect accurately the population of redwinged blackbirds in the area.

However, the intensive study area at Bells Corners Station may not be typically representative for that sub-area and such a situation may have exaggerated the actual number of nests in that sub-area. As a matter of fact this seems to be the most acceptable explanation to account for the discrepancy between the nest and bird-counts at Bells Corners Station sub-area. This means that, in this particular sub-area, the bird-count data would be more reliable than the nest-count data and, later on, this will be taken into consideration when discussing the factors that might bring some light on the heterogeneous distribution of redwinged blackbirds in the Ottawa area.

Table II: Bird-Count Summary for March, April, May and June, 1957 and 1958

	Year	Hours	♂	♀	Birds in Flocks	Birds in Pairs	Bird-Count March	Bird-Count April	Bird-Count May	Bird-Count June	Total # Birds	Birds per 100 hours per 5 acres
Bells Corners Station	1957	79.25	535	173	436	106	127	414	403	306	1250	10.0
	1958	74.75	414	137	253	234	94	486	293	165	1038	8.8
C.B.O. Marsh	1957	48.50	265	109	88	74		62	261	213	536	18.4
	1958	88.00	379	213	281	94	36	396	391	144	967	18.3
Deschesnes-Aylmer	1957	76.50	695	179	146	156	3	498	314	361	1176	11.6
	1958	51.25	341	112	154	82	44	195	246	204	689	10.2

Table III: Nest Density vs Bird Density

1957	Nests per Five Acres	Birds per Five Acres per 100 Hours of Observation
Bells Corners Station	31.0	10.0
C.B.O.	20.0	18.4
Deschesnes-Aylmer	13.5	11.6
1958		
Bells Corners Station	26.5	8.8
C.B.O.	17.0	18.3
Deschesnes-Aylmer	13.5	10.2
Average for 1957 and 1958		
Bells Corners Station	28.8	9.40
C.B.O.	18.5	18.35
Deschesnes-Aylmer	13.5	10.90

Table IV: Statistical Analysis for Bird-Counts

Analysis of Variance. Snedecor (27).

Source	Degree of Freedom	Σ sq.	M. sq.	
Total	5	93.57	-	F = 83.6
Groups	2	91.91	45.96	P < 0.005
Individual in Groups	3	1.66	0.55	

Shortest Significant Ranges. Duncan (8).

a)

p	(2)	(3)
Rp	2.72	2.87

b) Results

Areas	Bells Corners Station	Deschesnes-Aylmer	C.B.O.
Means	9.40	10.90	18.35

Any two means not underscored by the same line are significantly different.

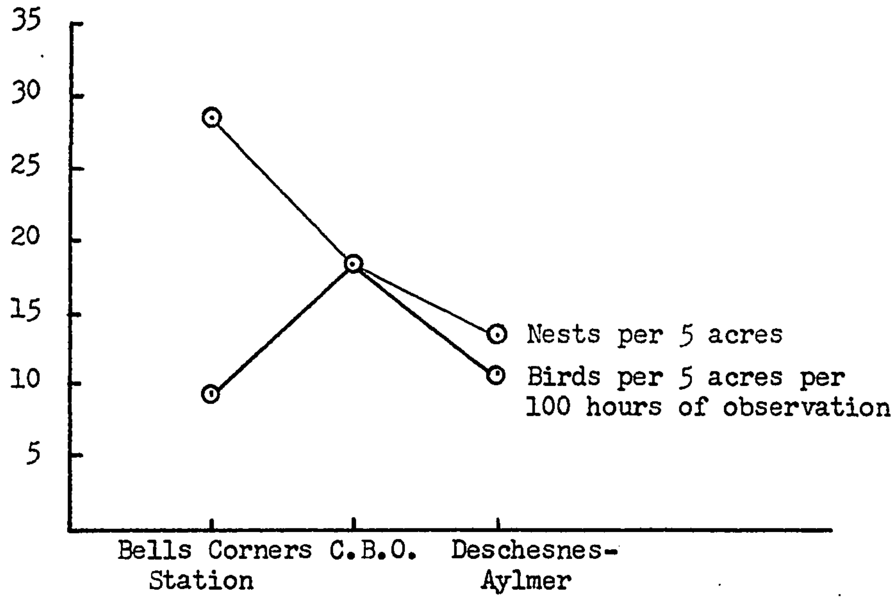


Fig. 19. Nest density vs bird density.

Clutch Size and Hatching Success

One hundred and four nests contained a total of 393 eggs for an average of 3.9 eggs per nest. The averages for each extensive study area showed little variation (Table V).

Table V: Clutch Size

	Number of Nests	Number of Eggs	Average Number of Eggs per Nest
Bells Corners			
1957	21	83	4.0
1958	18	68	3.8
C.B.O. Marsh			
1957	20	74	3.7
1958	17	61	3.6
Deschesnes-Aylmer			
1957	15	59	3.9
1958	13	48	3.7

We did not find any evidence of redwings' nests destroyed by terrestrial predators. We may suspect that there is some antagonism between grackles (Quiscalus quiscula versicolor) and redwings. This antagonism may arise from competition for available food or the predation of grackles on redwings' eggs. We observed grackles approaching redwings' nests, perhaps with the intention of robbing them but, as soon as they approached a redwing territory, they would be chased by the territory owner (male or female) and other redwings from adjacent territories would join the chase. The grackle must retreat without any chance to get close to the nest. Such chases were observed very frequently. Gowanlock (10), Townsend (29), Wheaton (31) and Christofferson (7) described the pernicious habit of the bronzed grackle in destroying the eggs and young of other birds and its practice of killing small adult birds.

Only one nest was deserted. Although it is difficult to explain exactly what happened, it seems that cattle walking through the marsh had shaken and partly damaged the nest. One egg had fallen into the shallow water; the three remaining eggs were in the nest, which was found hanging 30° off the horizontal plane.

No data on hatching success were obtained for the Deschesnes-Aylmer sub-area. Observations for C.B.O. and Bells Corners were made only in 1958.

At C.B.O. Marsh, for a total of ten nests, containing a total of 41 eggs, only four eggs did not hatch (9.7%). At Bells Corners Station, out of seven nests, containing a total of 26 eggs, only two eggs did not hatch (7.6%).

Behaviour of Flocks in Late Summer and Autumn

In the fall, redwing populations cannot be as accurately determined as in the spring for the following reasons: 1) the large number of birds in each flock makes it impossible to estimate their size with accuracy; 2) the numerous and unpredictable movements of each flock from one field to another in the same district and 3) the occasional fusion of certain flocks feeding in the same district.

While carrying on our observations on redwinged blackbirds in the fall, we noticed* that birds feeding in a certain district have a tendency to get together about an hour before sunset and to reach the same roosting site every night. The different flocks seem habitually to follow directions leading to such roosting site. For instance, redwings feeding in the general area of Merivale and Merivale Station fly towards Hogsback where they stop over 5 to 15 minutes. Then they fly to the small islands west of Billings bridge where they spend the night (Fig. 20). This is repeated night after night until they undergo their winter migration.

Similar observations were made on the eastern outskirts of the Ottawa city. Birds gathering in Cyrville and Blackburn districts get together before sunset, fly over Beechwood cemetery towards Rockcliffe park; They stop over for about 5 to 15 minutes in the bushes on the south side of the Ottawa river and then cross the river to their roosting site at the mouth of the Gatineau river (Fig. 21).

Redwings gathering around South March Station fly every night over Connaught Rifle Range towards Shirleys Bay where they roost (Fig. 22).

Such daily movements of redwings, in the fall, may be interpreted as being a premonitory sign of the approaching seasonal migration.

Stomach Analysis

During April, May and June of 1957 and 1958, 110 redwinged blackbirds were collected. Twenty-nine of them were

* See "addenda" page 68.

Fig. 20. Daily movements of redwings flocks, in the fall, at Merivale, Hogsback and Billings bridge areas.

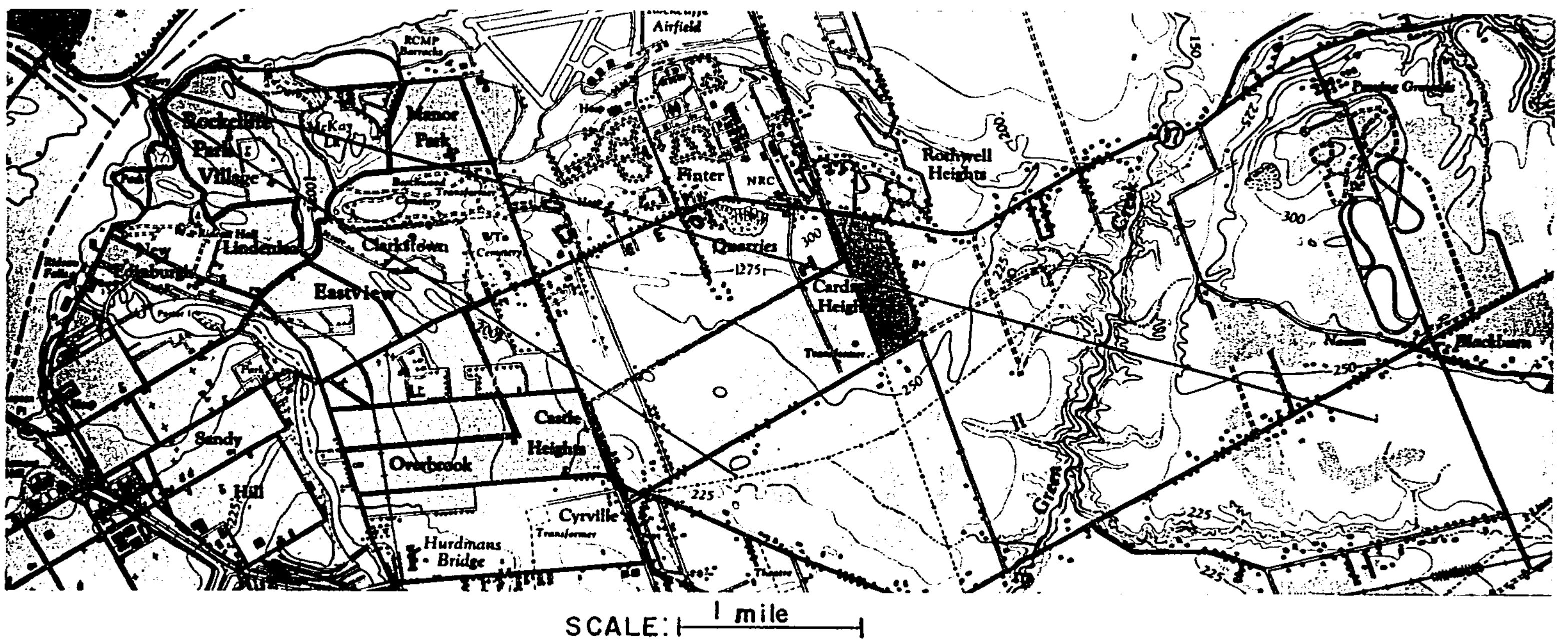


Fig. 21. Daily movements of redwings flocks, in the fall, at Cyrville, Blackburn and Rockcliffe areas.

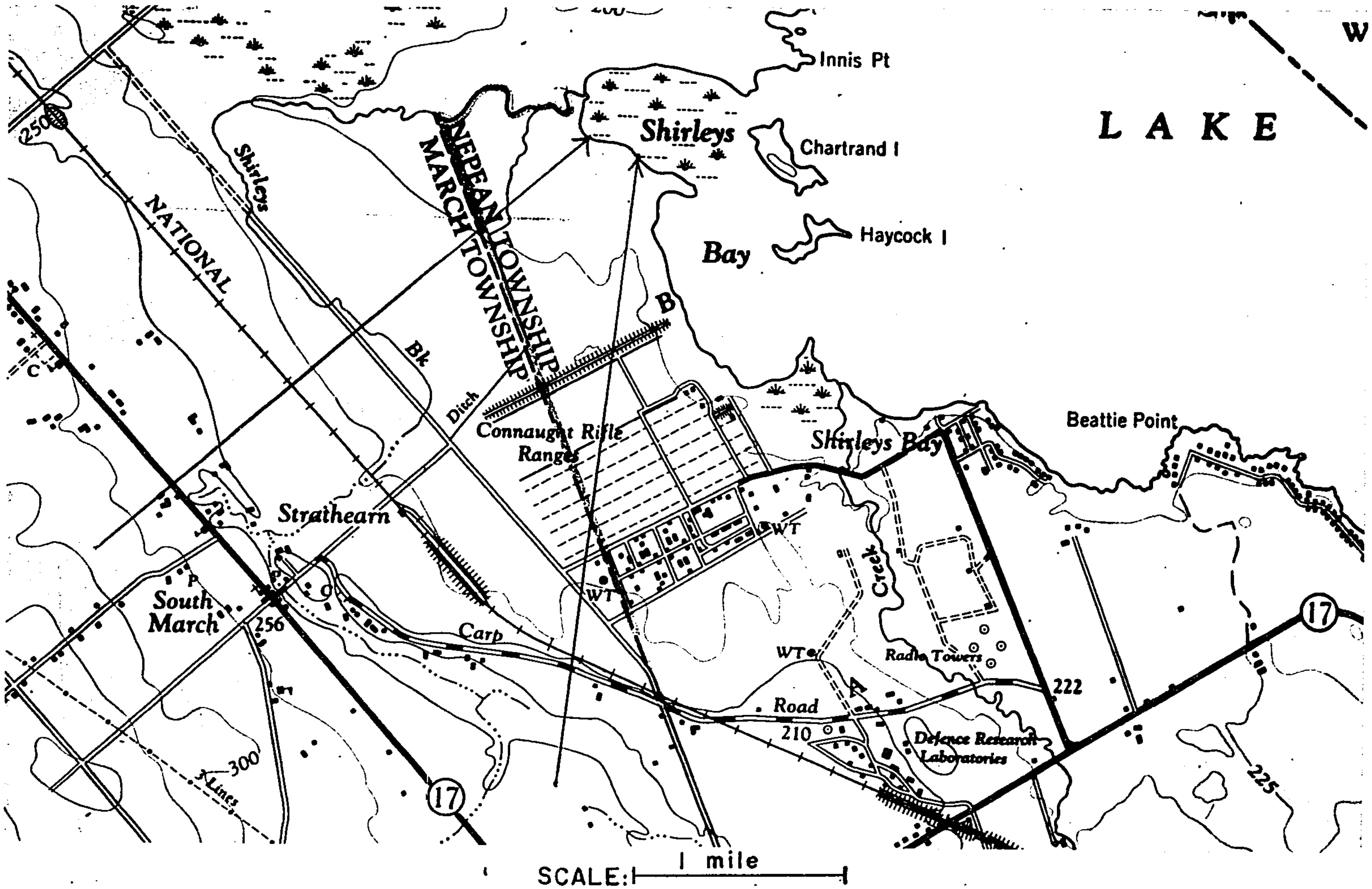


Fig. 22. Daily movements of redwings flocks, in the fall, at South March Station and Shirleys Bay.

killed at C.B.O, Marsh sub-area, 45 at Bells Corners Station and 36 within the Deschesnes-Aylmer sub-area. Specific analysis was carried out on 86 of these stomachs or whenever some parts of the stomach contents could be identified.

As mentioned previously, any amount of material found in the stomach was measured by the volume (see under "methods"). From April to June, the insect consumption increased considerably according to stomach contents of birds collected within the three sub-areas (Tables VI and X and Figs. 23, 24, 25 and 27). On the other hand, seed consumption increased from April to May and decreased from May to June for birds killed at C.B.O. and Bells Corners Station. At Deschesnes-Aylmer, however, seed consumption remained almost constant during April, May and June (Table VI and Figs. 23, 24 and 25).

Table VI: Stomach Contents

	Seeds	Insects	Grit	Unidentified
Bells Corners Station				
April	7.8%	8.3%	18.8%	65.3%
May	27.4	26.5	8.7	37.5
June	10.5	44.7	8.7	36.5
C.B.O.				
April	15.1%	20.2%	5.9%	58.2%
May	26.8	24.0	0.0	49.5
June	12.7	60.3	0.0	27.0
Deschesnes-Aylmer				
April	21.2%	19.3%	9.5%	50.2%
May	16.2	26.9	12.0	44.7
June	18.5	30.0	5.0	47.0

Table VII: Comparison of the Sub-Areas in Connection with the Seed Consumption

Analysis of Variance. Snedecor (27).

Source	Degree of Freedom	Σ sq.	M. sq.	
Total	85	2340.45	-	F = 2.30
Groups	2	123.03	61.52	P > 0.05
Individual in Groups	83	2217.41	26.72	No significant difference

Table VIII: Comparison of the Sub-Areas in Connection with the Insect Consumption

Analysis of Variance. Snedecor (27).

Source	Degree of Freedom	Σ sq.	M. sq.	
Total	85	58540.97	-	F = 1.28
Groups	2	1750.26	875.13	P > 0.05
Individual in Groups	83	56790.71	684.22	No significant difference

Table IX: Comparison of the Sub-Areas in Connection with the Grit Consumption

Analysis of Variance. Snedecor (27).

Source	Degree of Freedom	$\sum$ sq.	M. sq.	
Total	85	7878.33	-	F = 4.66
Groups	2	795.47	397.74	$0.01 < P < 0.05$
Individual in Groups	83	7082.86	85.34	Significant difference at 5% level

Shortest Significant Ranges. Duncan test (8), Kramer modification (15).

a)

p	(2)	(3)
Rp (Duncan)	18.38	19.36
Rp (Kramer)	25.6	26.7

b) Results

Areas	Bells Corners Station	Deschesnes-Aylmer	C.B.O.
Means	9.82	10.03	2.95

(9.82 and 10.03 are underscored by the same line.)

Any two means not underscored by the same line are signficantly different.

Table X: Stomach Contents

Average for April, May and June, 1957 and 1958

	Seeds	Insects	Grit	Unidentified
April	17.5%	18.2%	9.4%	54.7%
May	23.9	26.8	8.7	41.1
June	12.1	48.7	5.2	31.7

Table XI: Stomach Contents

Average for Bells Corners Station, C.B.O. Marsh
and Deschesnes-Aylmer Sub-Areas, 1957 and 1958

	Seeds	Insects	Grit	Unidentified
Bells Corners Station	19.6%	30.2%	9.8%	40.4%
C.B.O. Marsh	16.5	33.4	3.0	46.7
Deschesnes-Aylmer	19.4	22.5	10.0	47.8

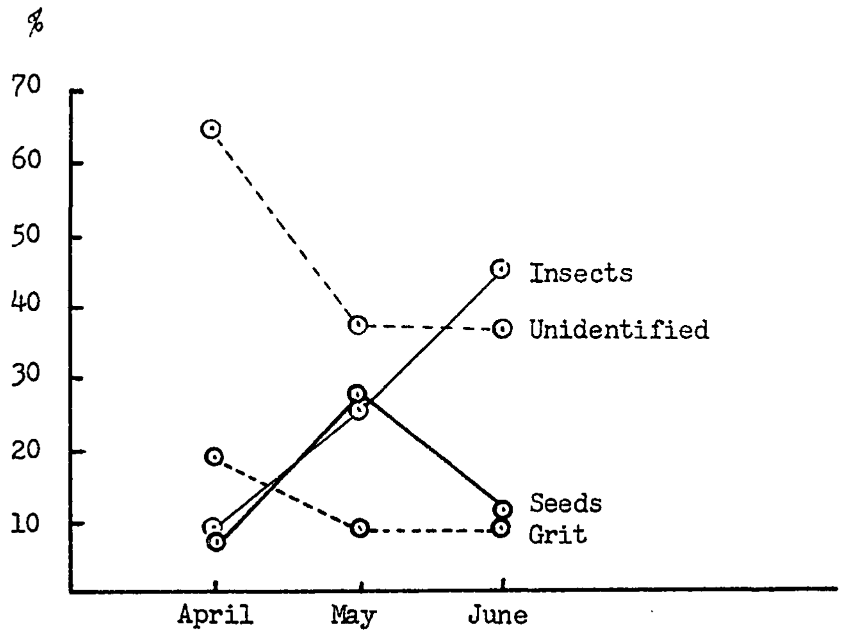


Fig. 23. Bells Corners Station; stomach contents. Average for 1957 and 1958.

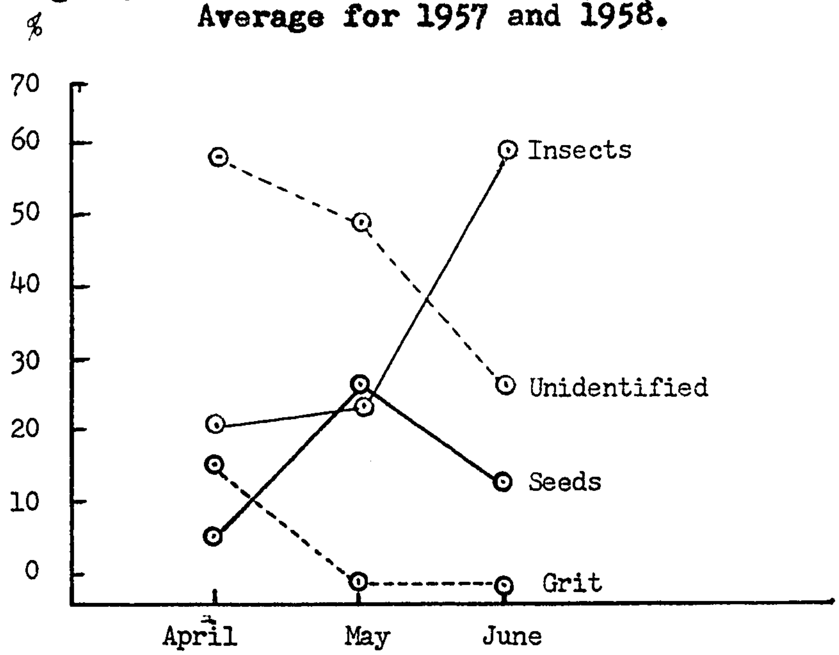


Fig. 24. C.B.O.; stomach contents. Average for 1957 and 1958.

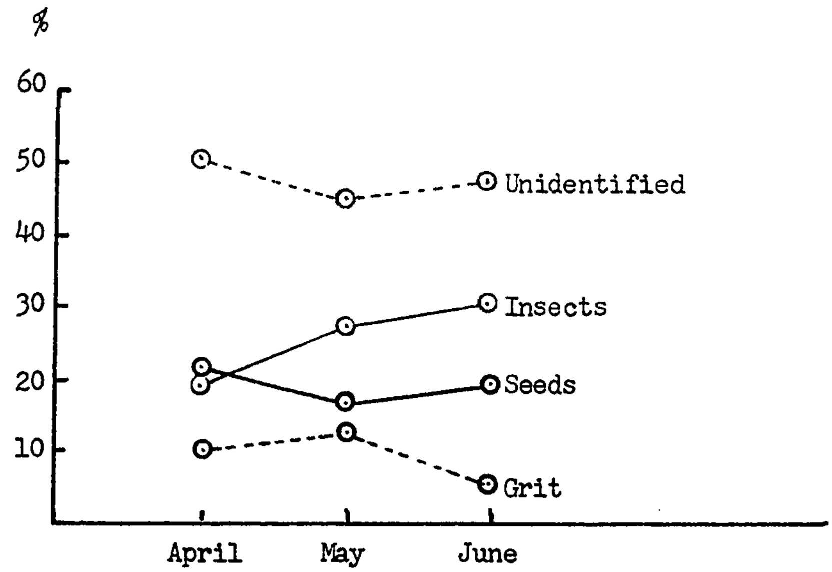


Fig. 25. **Deschesnes-Aylmer; stomach contents. Average for 1957 and 1958.**

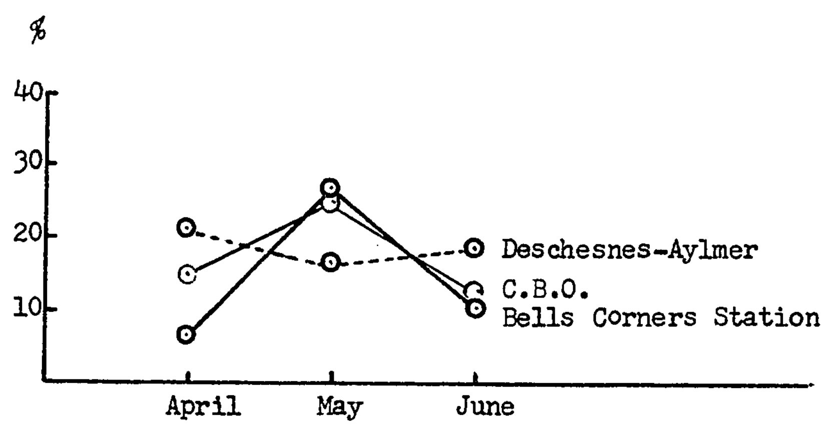


Fig. 26. **Stomach contents; seed consumption. Average for Bells Corners Station, C.B.O. and Deschesnes-Aylmer for 1957 and 1958.**

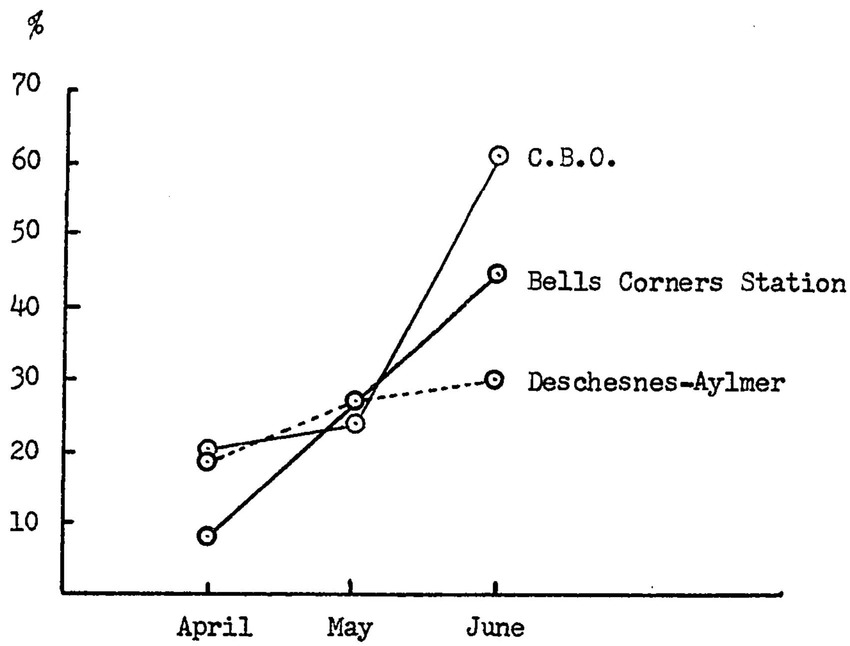


Fig. 27. Stomach contents; insect consumption. Average for Bells Corners Station, C.B.O. and Deschesnes-Aylmer for 1957 and 1958.

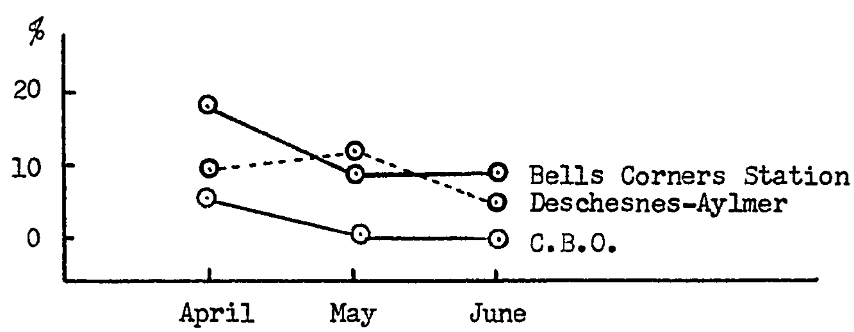


Fig. 28. Stomach contents; grit consumption. Average for Bells Corners Station, C.B.O. and Deschesnes-Aylmer for 1957 and 1958.

The percentage of grit in the redwings' stomach seems to be inversely proportional to the volume of insects taken by the birds (Table XI and Figs. 23, 24 and 25).

Spiders were found in the stomach of three redwings. Coleoptera were their main item as insect food, that is, Coleoptera were found in 89.3% of the birds; average for the three sub-areas for 1957 and 1958.

Table XII: Frequency of Insects and Arachnids in Redwinged Blackbirds' Stomach

	Bells Corners Station	C.B.O. Marsh	Deschesnes-Aylmer	Average for the Sub-Areas
Class Arachnida	1.6%	3.3%	3.2%	2.7%
Order Collembola	1.6	-	-	0.5
Order Coleoptera	84.4	90.0	93.5	89.3
Family Geometridae (larva)	3.1	3.3	3.2	3.2
Other Lepidoptera (larva)	9.4	-	-	3.1
Order Ephemerida	-	3.3	-	1.1

Table XIII shows that, in general, preference for Coleoptera goes to genus Apion and genus Prasocuris followed far behind by genus Aphodius and genus Magdalis.

It is quite probable that preference for certain category of organisms is on par with the availability of such organism.

Table XIXI: Frequency of Different Genera of Coleoptera in Stomach Contents of Redwinged Blackbirds.

Family	Genus	Bells Corners Station	C.B.O. marsh	Deschênes-Aylmer
Carabidae	Nebria	—	3.7	—
Carabidae	Agonum	1.9	—	—
Elateridae	Athous	1.9	3.7	—
Scarabaeidae	Aphodius	11.1	7.4	13.8
Cerambicidae	Unidentified	—	7.4	—
Chrysomelidae	Prasocuris	31.8	29.6	37.9
Chrysomelidae	Lina	5.6	3.7	—
Chrysomelidae	Pachybrachis	—	3.7	—
Curculionidae	Magdalis	9.3	3.7	13.8
Curculionidae	Orchestes	1.9	—	—
Curculionidae	Apion	37.0	37.0	34.0

The vegetable food of the redwings in the Ottawa area during April, May and June consists mainly of seeds. Seeds were found in 25 stomachs cut of 34 from birds collected at Bells

Corners Station (74%), 20 out of 22 from birds collected at C.B.O. Marsh (91%) and 25 out of 30 from birds collected in the Deschesnes-Aylmer sub-area (83%).

In the spring, redwings of the Ottawa area have a marked preference for oats. Early in spring during the sowing period, redwings were observed feeding on freshly sowed lands. This is perhaps because the sub-areas concerned with this study are intensively cultivated and because the breeding grounds are in the immediate vicinity of cultivated areas.

Table XIV: Occurrence of Different Categories of Seeds in Stomach Contents

	Number of Stomachs	Stomachs w̄ Seeds		Stomachs w̄ Oats		Stomachs w̄ Wheat		Stomachs w̄ Weed Seeds	
		#	%	#	%	#	%	#	%
Bells Corners Station	34	25	73.5	21	61.7	5	14.4	14	41.1
C.B.O. Marsh	22	20	90.9	15	44.1	4	18.1	8	36.4
Deschesnes-Aylmer	30	25	83.3	24	70.5	4	13.3	14	46.6

Redwings have a marked preference for oats as vegetable food in the Ottawa area (Fig. 29). Weed seeds come second in frequency. One may object here that dry oats remain in the crop of birds longer than corn or wheat. This was stated by Heuser (14) and it might explain the predominance of oats over wheat and weed seeds in the stomach at time of killing. In term of volume, weed seeds are almost insignificant being much smaller than the wheat or oats grains.

Redwings do not necessarily feed close to their breeding territories. This is the only way to explain why redwings collected at C.B.O. and Deschesnes-Aylmer have wheat in their stomachs (Table XIV) although there is no wheat cultivated in those sub-areas (Figs. 6 and 11 and Table XV). This explanation applies also to oats found in birds from C.B.O. although this crop is not present in the said sub-area (Fig. 11 and Table XV).

As mentioned above, our observations make us believe that redwings get most of the wheat or oats grains either from freshly sowed lands or pick up the grains lost occasionally during the preceding harvesting season.

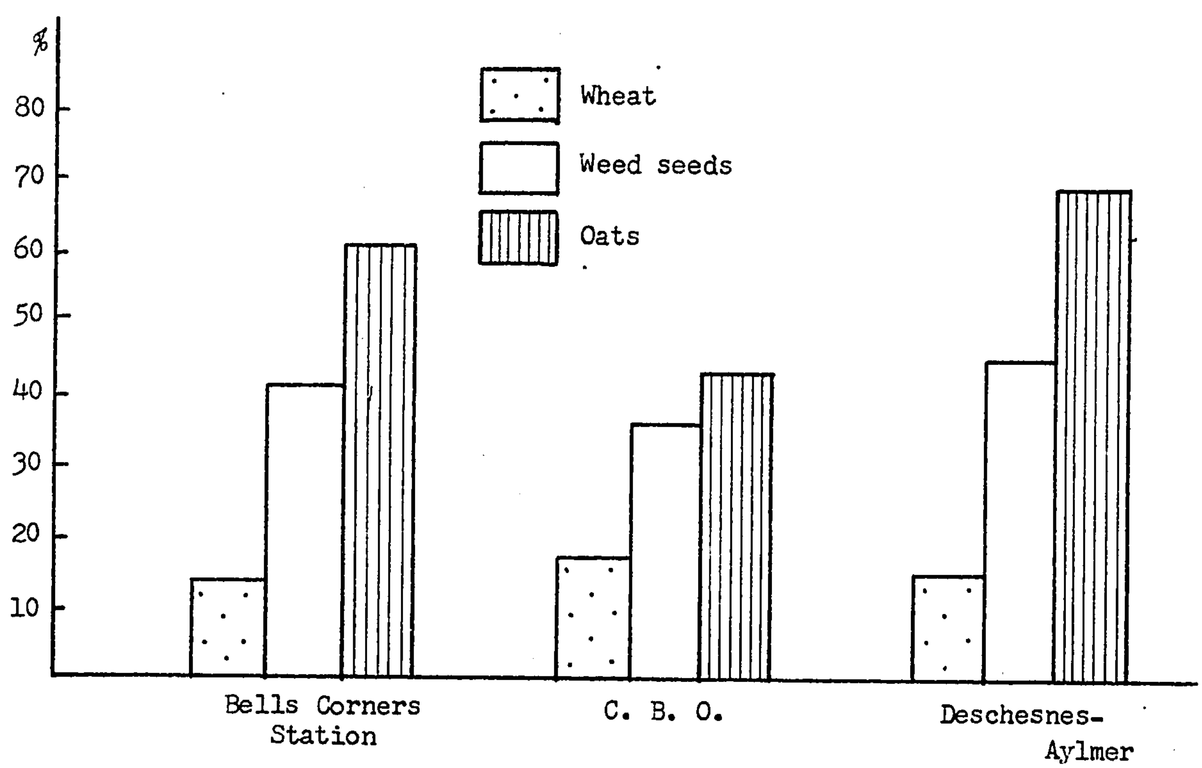


Fig. 29. Occurrence of wheat, oats and weed seeds in redwinged blackbirds' stomach.

Consumption of Food by Captives

In 1957, fifteen redwings were captured. Thirteen of them died after a period of 8 to 257 days of captivity (average life span in captivity: 67 days). The two other birds escaped after nine months of captivity as the result of vandalism.

In 1958, 22 birds were captured and 21 of them lived from 15 to 337 days (average life span in captivity: 115 days). The other bird was still alive in February 1960.

Birds were kept in a large cage about 8' x 5' x 6.5' (Fig. 30). A shelter with two entrances was provided and attached to the side of the cage. Redwings very seldom used the shelter but preferred instead the upper corners of the cage, right under the roof, where they spent the night and where they were apparently well protected against bad weather.

We were happily surprised to find out that redwings adapted themselves so quickly to captivity and that they started to feed as soon as they were placed in the cage. After such an easy adaptation to captivity it seems paradoxical to say that the rate of mortality was quite high in 1957. We believe that the birds were disturbed and teased by passers-by, especially at night when the cage was left without protection of any kind. Many dead birds were found mostly in the morning with their necks broken or their beaks or wings badly damaged, apparently as a result of flying against the wire.

Redwings in captivity were offered different types of food including cracked corn, wheat, oats, chicken feed

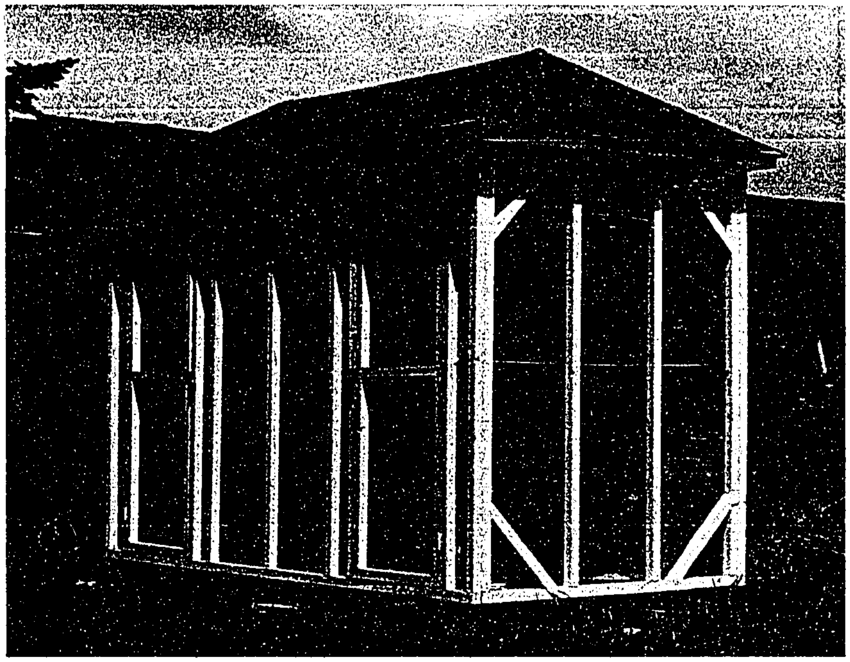


Fig. 30. Cage used for experiment with captives

(a mixture of the three) and growing mash (a mixture of ground corn, wheat, barley and buckwheat). Occasionally, in the fall, they were given whole corn ears. In 1957, the food supplied to the birds and that left after feeding was weighed daily. It was found that the average daily consumption of chicken feed per bird from May to the middle of August varied from 4.3 to 91.8 grams. These two figures are, quite probably, far from the exact daily food consumption for each bird; 4.3 grams of chicken feed is a rather small quantity of food for a bird the size of a redwing and 91.8 grams seems to be a rather large quantity of food to be taken in one day by a redwing.

There are several reasons for a high percentage of error in measurement of food consumption:

1) Birds cause a great deal of spillage when they eat. They also carry their food all over the cage making measurement of remaining food extremely difficult. In order to obtain adequate drainage of the cage, the floor was built with two-inch boards half an inch apart. Through these spaces an appreciable loss of food occurred.

2) Atmospheric humidity readily absorbed by the food left in the cage for twenty-four hours was one of the main factors responsible for the unreliable data obtained from weighing food.

3) The grit added to the food in some cases made accurate measurement of remaining food almost impracticable.

4) Bird feces quite often found with the food were also responsible to a certain extent for inaccurate measurement of remaining food.

Close examinations of the remaining chicken feed showed that the cracked corn portion of the mixture was always used in preference to oats and wheat. To check this point more thoroughly we offered the captive redwings three different trays each containing the same volume of oats, corn or wheat, A fourth tray contained grit. This type of feeding was carried on for a period of 18 days. We noticed that the captive birds showed a marked preference for corn since after 24 hours the corn container was empty or almost empty. Moreover, just after feeding time an observer could see all captive redwings rushing to the corn container and paying no attention to oats or wheat.

We noticed also that captive redwings prefer wheat to oats, this being in contradiction to our findings about the food consumption of redwings while in their natural habitat. We came to this deduction when we decided to feed the redwings with oats and wheat only. These were offered in two separate trays. At feeding time, redwings rushed to the trays showing at the time no preference for either wheat or oat. After a couple of minutes, most of them turned towards the wheat tray to complete their meal. On the other hand, when they were offered either oats or wheat alone, they did not seem to mind the restriction and they fed on what was available. We tried oats exclusively for two weeks and repeated the same treatment with wheat. The birds did not seem to be disturbed at all by such diet.

The growing mash (ground corn, wheat, barley and buckwheat) did not seem to be very appealing to redwings. Such mixture offered to redwings while chicken feed was also available to them remained untouched. For six days we offered growing mash exclusively. Birds did not care much for the mixture. At feeding time they rushed to the tray, had a few pecks at the mixture that they did not seem to appreciate and they returned to their perches seconds later. Their behaviour was quite different when they were fed with corn or chicken feed.

Because of the risk of mortality and because of the difficulty of capturing redwings in mid-summer we discontinued the growing mash diet after six days.

DISCUSSION

The most important part of the work described in this thesis was to establish whether or not the redwing population in the Ottawa area was heterogeneous. The bird-count method shows that the redwing population, based on the number of birds per five acres per 100 hours of observation, is significantly higher in the C.B.O. sub-area but not significantly different at Bells Corners Station and Deschesnes-Aylmer. On the other hand, the nest-count data indicate that the nest density is not significantly different in the three sub-areas.

Such results seem to be paradoxical since bird-counts and nest-counts in the same sub-area should follow substantially the same pattern and this is not what happened at Bells Corners. For the reason given previously (p. 33) we believe that at Bells Corners the number of birds per five acres per 100 hours of observation is more acceptable than the nest-count data and consequently we assume that the redwing population is significantly higher in the C.B.O. sub-area than at Bells Corners and Deschesnes-Aylmer.

Habitat Preference

Considering the vegetation in the C.B.O. sub-area, we notice that the cattail association is dominant, in fact 44% of the sub-area and its immediate environment is occupied by such association. At Bells Corners Station and Deschesnes-Aylmer, only a negligible portion of the sub-areas, less than 1%, belongs to that sort of association.

Table XV: Distribution of Vegetation in the Sub-Areas

	Bells Corners Station	C.B.O.	Deschesnes-Aylmer
Pasture	72%	32%	45%
Oats	2	-	4
Hay	8	-	4
Alder-willow association	2	7	5
Deciduous	8	-	2
Bog	-	4	2
Deciduous-coniferous	2	3	38
Cattail-alder willow association	-	44	-
Seasonally inundated land	-	10	-
Wheat	6	-	-

At C.B.O., 32% of the sub-area is used as pasture land while Deschesnes-Aylmer and Bells Corners Station sub-areas have respectively 45 and 72% of pasture.

Considering these facts we may assume the following reasoning:

1) The cattail association which is, without any doubt, the preferred nesting ground of redwings, constitutes the major type of vegetation for the C.B.O. sub-area. Consequently, it is normal to find a higher concentration of redwings in such environment.

2) According to our observations, pasture lands do not constitute a particularly good source of food for redwings. On the other hand, pasture areas are comparatively smaller at C.B.O. than at Bells Corners Station and Deschesnes-Aylmer and, consequently, this allows more space for more appropriate thus preferred feeding grounds such as the cattail-alder-willow association which may be responsible to a certain degree for the higher concentration of redwings at C.B.O.

3) In addition to this, the association alder-willow is slightly more important quantitatively at C.B.O. and this might also have some influence on the concentration of redwings in the sub-area. Redwings very often build their nests among such type of vegetation.

We do not believe that the redwinged blackbirds need a considerable amount of water in their habitat. In fact, in the Deschesnes-Aylmer sub-area, there is no permanent water body such as the small creek and the swampy nesting grounds at Bells Corners or the cattail marsh at C.B.O. Moreover, at Deschesnes-Aylmer, two intensive study areas (sections) out of three were dried out during the nesting season with the exception of a few small patches of standing water (about 10 to 15 square feet) promoting the growth of cattails.

The presence of a comparatively large water body at C.B.O. during the nesting season may influence the redwing population to a certain extent. Although their nests are often found on dry uplands sometimes at a considerable distance from any water, it is well known that redwings prefer the vicinity of water {Bent (4)}.

Food Habits

Food consumption in redwings varies from time to time and place to place. In the three sub-areas involved in this work the consumption of plant and animal food follows approximately the same pattern from April to June inclusively (Figs. 23, 24 and 25).

In April the insect and seed consumptions are, in volume, of equal importance. At that time, the soil is still frozen and under such conditions looking for food is a strenuous necessity for redwings. The rather large proportion of unidentified food in the stomachs reinforces this statement. Redwings have more difficulties than usual to find their food thus their stomachs may stay a long time without fresh supplies.

When collected under such conditions the stomachal remains could hardly be identified for the food has reached a too advanced stage of transformation.

In May, as far as the identified food is concerned, there was an increase of seed and insect consumption by redwings at C.B.O. and Bells Corners. At Deschênes-Aylmer, the insect consumption increases slightly while the seed consumption decreases a little. On the other hand the unidentified parts of the stomach contents drops considerably at C.B.O. and Bells Corners while there is practically no change for Deschênes-Aylmer. If further identification of stomach con tents would have been possible in specimens collected at Deschênes-Aylmer, we believe there would not be any noticeable difference between Bells Corners Station and C.B.O.

In June the insect consumption increases considerably at Bells Corners Station and C.B.O. while seed consumption decreases. At Deschênes-Aylmer the results show that the insect and seed consumption remain practically as they were in May but the explanation given in the preceding paragraph may apply as well in the present case.

Such increase of insect consumption may be accounted for as follows:

1) In the Ottawa area, June is usually the first month of the year during which a warm temperature is maintained. Such warmth favours emergence of insects, making them readily available to the redwings.

With such an abundance of insects it seems that the need to look around for seeds is lessened considerably.

2) In May and June redwings feed their young with insects exclusively. Such instinctive behaviour influences the adults to feed also on insects.

It seems that the frequency of a certain type of food in redwings' stomachs collected in a certain area reflects the availability of such food. Taking this statement in consideration, one might say that Fig. 26 shows that on an average basis, the availability of seeds in the C.B.O. sub-area is fairly good. Fig. 27 shows that insects on which redwings feed are perhaps more numerous or easier to find at C.B.O. Such availability of food in that sub-area, together with the other factors previously mentioned, may be partly responsible for the higher population of redwings at C.B.O.

There is no doubt that redwings show preferences for certain types of food, but our observations of captive redwings indicate also that they would feed on one sort of food (not necessarily the preferred type) if it is the only sort offered to them.

This theory of feeding on available food applies not only to seeds but also to food of animal origin. According to Table XII, the nature of animal food found in stomachs of redwings is essentially the same at Bells Corners Station, C.B.O. and Deschênes-Aylmer and there is no doubt that in April, May and June the small <u>Coleoptera</u> named in

Table XIII are numerous and constitute the major source of insect food taken by redwings, that is, nearly 90%.

Redwings are not fast flyers as, for instance, the barn swallow. Consequently, the redwing is not too good in chasing flying insects. Thus, they feed on insects such as beetles, that are usually found on the ground or on the vegetation.

In April, May and June, seeds were found in many stomachs (Table XIV). Oats were the most frequently found. Weed seeds were found quite often but their volume was negligible. Very few of them could be identified such as the seeds of Panicgrass (<u>Panicum</u>) and Smartweed (<u>Polygonum</u>). It is interesting to note that wheat and oats were readily available within Bells Corners Station sub-area. On the other hand, oats and wheat were not cultivated in the proximity of C.B.O. and wheat was not cultivated close to Deschesnes-Aylmer sub-area. This calls for the following explanation:

1) Redwings may not hesitate to fly over a long distance to get some food when necessary.

2) They may feed in the proximity of farms, barns and stables where a few handfuls of grain will constitute an excellent supply of food.

It might also be good to bring here an observation made by Heuser (14) to the effect that dry oats remain in the crop of birds longer than corn or wheat. Heuser made that observation when studying the rate of passage of feed from the crop of the hen. This may bring some light on the fact that more oats than wheat was found in redwings' stomach.

Many biologists believe that grit or stone particles are necessary to help food crushing in the stomach of granivorous birds. Sturkie (28) referring to previous work by Groebels (11) says that: "grinding of the gizzard in the bird can be heard with a stethoscope particularly when coarse or hard food and grit are present." Wallace (30) says that the muscular walls of the gizzard, often with the aid of grit in the form of sand grains or small pebbles abrade and crush hard material.

Meinertzhagen (20) reported a seasonal variation in grit eaten by Bramble Finch. The same author claims that quartz is most often ingested as grit but when it is not available birds eat small rounded stones and often "stones" of fruit also serve the same purpose.

Portman (23) states that grit is a constant accessory for the work of the stomach of granivorous birds. Redwings are not exclusively granivorous birds and may not need grit even if occasionally feeding on grains or seeds.

In our case we know that the types of food used by redwings at C.B.O., Bells Corners Station and Deschesnes-Aylmer are of the same nature while the volume of grit taken in by redwings at C.B.O. is significantly different at 5% level. At C.B.O., 4 out of 22 stomachs did contain grit while the proportion was 10 out of 34 at Bells Corners Station and 10 out of 30 at Deschesnes-Aylmer. Moreover, one bird in captivity for more than 14 months never received any grit or hard particles in addition to his regular diet of chicken feed. This bird is still alive and is apparently as healthy as he was when captured. Such data and observation tend to make us believe that grit is not a necessity for red-winged blackbirds but is rather obtained fortuitously.

Sturkie (28) mentions in his textbook on Avian Physiology that apparently grit remains in the gizzard for a considerable time and it is not ordinarily passed out with the feed, particularly when small amounts are present. Browne (5) fed, to a fowl that had been denied access to grit, four small pebbles and three of these were found in the gizzard three weeks later.

SUMMARY

1. The distribution of redwinged blackbirds is not homogeneous all through the Ottawa area.
2. According to the bird-count data the population is significantly higher at C.B.O. at the 5% level.
3. The predominance of cattails, alders and willows in the C.B.O. area may be a more attractive association for redwings.
4. Pastures do not seem to constitute a favourite source of food for redwings.
5. Large water bodies at C.B.O. during nesting season are attractive to redwinged blackbirds although water is not a must to them.
6. There is no tangible difference between the type of food used by redwings in the three sub-areas involved.
7. It is quite probable that redwings feed fairly far from their nesting ground.
8. The insect consumption increases gradually from April to June inclusively while seed consumption decreases.
9. Grit is not a necessity for redwings but is taken fortuitously.
10. The percentage of grit taken by redwings is inversely proportional to the volume of insects taken.

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ADDENDA

In order to determine where the birds were flying to, their compass bearings were determined. These bearings were checked several times a week and were recorded on a map of the area.