# RESIDENT AND MIGRANT BLACKBIRDS IN SOUTHEASTERN VIRGINIA: AGRICULTURAL DEPREDATIONS AND WINTER ROOST LOCATIONS

by

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# BLACKBIRD ECOLOGY AND THEIR RELATIONSHIP TO AGRICULTURE IN SOUTHEASTERN VIRGINIA

## INTRODUCTION

No single species of animal can be said to be completely bad or good. Under a given set of conditions, any part of the fuana may produce situations not in the best interests of man. Often a conflict with man is inevitable when a species is capable of thriving in large numbers and adapting to changing environmental conditions. Blackbirds have reached this status in many sections of the United States (Janzen, 1960). In this report, the term "blackbirds" refers to the Redwinged Blackbird (Agelaius phoeniceus, Linnaeus), the Purple Grackle (Quiscula quiscula, Linnaeus), the Brown-headed Cowbird (Molothrus ater, Boddaert), the European Starling (Sturnus vulgaris, Linnaeus), and, less common in Virginia, the Rusty Blackbird (Euphagus carolinus, Muller).

With the exception of the Starling, which was introduced from Europe, these blackbirds are thought to have been a part of the avifauna since colonial times. Early American writings indicate that blackbird depredation was known at that time; however, only recently have losses been so widespread that concern existed. Favorable conditions in southeastern Virginia encourage large numbers of blackbirds to winter in the area. Being adaptable to changing conditions, blackbirds have found corn, milo, and peanut fields an excellent source of winter food. The broadleaf thickets of the nearby Dismal Swamp offer favorable habitat for roosting and loafing. Blackbirds have taken advantage of the

surroundings which George Washington described as "a glorious paradise abounding in wild fowl and game (Brown, 1946)."

A study of the blackbirds and their relationship to agriculture in southeastern Virginia was first undertaken in 1958, after complaints of severe blackbird damage to crops of the peanut belt section were voiced by the agricultural interests of this region. As a result of the concern expressed by agricultural officials, the U. S. Fish and Wildlife Service awarded a research contract to the Virginia Agricultural Experiment Station by the Virginia Cooperative Wildlife Research Unit. The objectives of this investigation were:

1. To determine the ecological relations of blackbirds in southeastern Virginia, with particular emphasis on the collection of such data as the breeding and wintering abundance and distribution, flocking habits, feeding habits, movements by seasons, nesting habits and nesting productivity, and behavior patterns.
2. To determine the type, extent, and distribution of agricultural damage caused by blackbirds in southeastern Virginia.
3. To investigate, in the laboratory and in the field, the relative merits of various methods of reducing blackbird damage to crops, including chiefly the use of lethal agents and other measures which may appear practical.

This paper records the results of the last phase of a three year blackbird investigation in southeastern Virginia. The field work reported

herein was conducted from June, 1960, through May, 1961. Although the author assisted the previous investigator in the nesting productivity study during the summer of 1960, these results will not be reported in this paper. The results of the nesting productivity investigations are reported by Crebbs (1960) and Lefebvre (1961).

## REVIEW OF LITERATURE

This paper is concerned primarily with the study of migrant blackbirds, including the Redwinged Blackbird, the European Starling, the Brown-headed Cowbird, the Purple Grackle, and the Rusty Blackbird. Some of the more important papers reviewed for this investigation are summarized below.

Allen (1914 and 1934) and Bendire (1895) completed early life history studies of the Redwinged Blackbird. A complete life history investigation of the Cowbirds is reported by Friedmann (1929). Before his death in 1954, Arthur C. Bent made arrangements for the publication of the compilation of findings of investigations on the life history of the blackbirds (Bent, 1958). Kessel (1957) and Kalmbach (1928) discuss the life history and economic status of the European Starling in the United States.

Much has been written on the blackbird depredations to agricultural crops. Damage surveys are reported in California by Piper and Neff (1935). Later field damage studies include Neff (1949), Cardinell and Hayne (1944), and Hayne (1946). Recently, blackbird damage evaluations have been conducted by Neff and Meanley (1957), Mitchell (1953), Mitchell and Linehan (1954, 1955, and 1957), and Linehan (1957, 1957a, and 1961). Giltz and Stockdale (1960) reported on depredations to corn in Ohio. Crebbs (1960) and Lefebvre (1961) made similar studies in southeastern Virginia.

Feeding habits and foods taken by blackbirds are discussed fully by Beal (1900) and Burleigh (1938). Other such studies include those

by Hayne (1946), Kalmbach (1942), Martin, Zim, and Nelson (1951), Wright (1954), Glitz (1959 and 1960), and Stockdale (1959).

Methods of crop damage control have been published by Neff and Meanley (1952 and 1957). Bird repellent investigations have been conducted by Dambach and Leedy (1948) and Griffin (1960). A general discussion of research on control of blackbird depredations is reported by Lindzey (1960).

Anthracnose, a fungal disease causing milo damage which is often confused with blackbird damage, is authoritatively treated by LeBeau, Stokes, and Coleman (1951), Walter (1941), and LeBeau, Lohman, and Koehler (1951).

Behavior and flocking habits are mentioned in the life history studies of Allen (1934), Friedmann (1929), Kalmbach (1928), and Bent (1958). Meanley (1956 and 1961), Meanley and Webb (1958a, 1958b, 1959, and 1960), Hewitt (1961), and Glitz (1960) have contributed to this field.

A review was made of the available literature on the flora and fauna of the Dismal Swamp and surrounding habitats favorable to large numbers of blackbirds. Early writings of this area include Byrd (no date), Kearney (1910), and Eaton (1910). More recently, Stansbury (1925) and Brown (1946) have given excellent descriptions of this region.

Much of the information concerning the agricultural history and practices in the Virginia peanut belt section was obtained through personal conversation and correspondence with local agricultural experiment station and extension personnel. Arant, et. al. (1951) published a

complete report on peanut culture of this section.

For the identification of species of birds and their habits of this general section, the following sources were consulted: Peterson (1959), Murray's "Checklist of the Birds of Virginia" (1952), and Pearson, Brimley, and Brimley (1942).

For identification of plant material and scientific names Gray's Manual, Eighth Edition and Muenscher (1950) were used.

## TECHNIQUES AND PROCEDURES

### Selection and Description of Study Area

The southeastern portion of Virginia was chosen as the site for this investigation because: (1) a very large wintering blackbird population occupies the area; (2) reports from this area indicated that blackbird depredation to agricultural crops was severe; (3) a study in this section would allow maximum cooperation with the nationwide blackbird investigation which is under the direction of Patuxent Wildlife Research Center, Laurel, Maryland; and (4) a large percentage of the blackbird damage was reported to be to the peanut crop, therefore, damage control techniques developed for other crops might not be applicable to the peanut agriculture.

Crop damage appraisals were limited to Nansemond County in order to acquire more detailed information concerning type, extent, and distribution of blackbird depredations. Other aspects of the blackbird investigation included the entire Virginia peanut belt section (Fig. 24).

Much of the monetary income of this section is dependent upon the peanut industry and upon agriculture. The cash crops include peanuts, hogs, cotton, and corn. Corn, of which a large percentage is used for livestock feed, is grown in larger acreages than any other crop. Recently, there has been a substitution of milo for corn in the crop rotation programs. Some truck crops, such as watermelons and cabbage, are produced extensively in parts of the Virginia peanut belt.

The topography of the study area is from slightly rolling on the western side to flat on the eastern side. A distinct dividing line, a

geologically-recent coastline, runs north to south forming the western edge of the Dismal Swamp. West of this line elevation ranges 30 to 70 feet, and to east it varies from 15 to 30 feet.

Two physiographic areas are included in the study area. West of the previously-mentioned line is middle coastal plain terrain, while to the east lies flatwoods. The parent material for soils in both areas is sands and clays. From these sandy loams, materials are developed primarily in the Norfolk, Ruston, Moyock, and Onslow soils. These soils are best suited to the production of crops, such as peanuts and truck crops (Agronomy Department, V. P. I., 1959:130).

Mean annual precipitation is 48 inches, with the greatest amount (an average of 28 inches) falling in the warm months (April-September). The climate is mild with an average of 200 days in the growing season. Mean annual temperature is 59.5° F., with a minimum of 2° F. and a maximum of 105° F.

Over one-half of the study area is covered by forest. The middle coastal plain section supports an overstory of Loblolly Pine (Pinus taeda), with an understory of scattered holly (Ilex opaca), Red Cedar (Juniperus virginiana), Red Oak (Quercus falcata), and briers. The flatwoods contain several distinct plant communities. On fairly well-drained areas, hardwoods, such as Tulip Poplar (Liriodendron tulipifera), Sycomore (Platanus occidentalis), White Oak (Quercus alba), Black Oak Quercus velutina), and Water Oak (Quercus nigra), and Life Oak (Quercus virginiana), are found. Some swampy areas are dominated by almost pure stands of White Cedar (Chamaecyparis thyoides) and Bald Cypress

(Toxodium distichum). Hardwood stands found in wetlands are composed of a mixture of Black Gum (Nyssa sylvatica), Carolina Ash (Fraxinus caroliniana), Red Maple (Morus rubra), and Swamp Cottonwood (Populus heterophylla). Pocosin type areas, found throughout the undrained sections, are covered by broadleaf evergreen thickets.

## Appraisals of Crops Damaged by Blackbirds

A primary objective of this study was to determine type, extent, and distribution of blackbird damage to agricultural crops in southeastern Virginia. The methods employed in estimating such losses consisted of both original ideas and modifications of the techniques used on this study by the two previous investigators, Crebbs and Lefebvre, respectively. Because of shortness of the period between the time the damage occurred and removal of the crops from the fields, it was necessary that a limited number of samples be examined. In some cases, the choice of the sample taken was determined by the order in which the fields were harvested.

### Corn

A survey of Nansemond County was conducted during September, 1960, to determine damage to field corn by blackbirds. The technique used to assess blackbird damage was a slightly modified version of the method used by Crebbs and Lefebvre during similar investigations in southeastern Virginia. The survey was designed to evaluate, on a county-wide basis, the total damage caused by blackbirds. By the use of a map, the county was divided into sections of four square miles or 2,560

acres each. Field corn in southeastern Virginia averages 11,000 stalks per acre (Agronomy Department, V. P. I., 1959:7). One randomly selected 100-stalk or 1/100-acre sample was examined in each section which contained plantings of field corn. Each ear of the 1/100-acre samples was checked. The data collected (Fig. 1) in each sample area included height of stalks, degree of ear drooping, spacing between stalks, thickness of ground cover, time of maturing, distance from active roosts or nesting areas, number of ears opened, number of ears damaged, percentage of each ear destroyed and total number of ears per 100 stalks. After the data were collected, the percentage of kernels destroyed per acre was converted to bushels per acre. Because of the high yield of 1960 in Nansemond County, 70 bushels per acre was used as the average. This figure of average production was the observed opinion of County Agent, J. Freeman. The current market price per bushel was used to determine monetary loss per acre.

Peanuts

Past efforts to appraise blackbird damage to the peanut crop include the use of wire exclosures around the shocks (Crebbs, 1960). Such variables as shock size and moisture content made the technique ineffective; therefore, this test was not repeated. In its place, two different techniques were used.

The first method was employed in twenty peanut fields selected to give a well dispersed pattern over Nansemond County. After the shocks had been allowed to dry and settle for a period of two or three weeks,

Survey of Corn Damage Form

Date _____ Sample # _____ Section # _____

Height of stalk _____ Degree of ear drooping _____

Spacing in row _____ Ground cover _____

Time of maturing _____

Remarks (distance from active roosts or nesting areas):

Number of ears opened:

Number of ears damaged:

Percentage of each ear destroyed:

Total number of ears per 100 stalks _____

Fig. 1. Form used to record blackbird damage to corn in Nansemond, Virginia, in 1960.

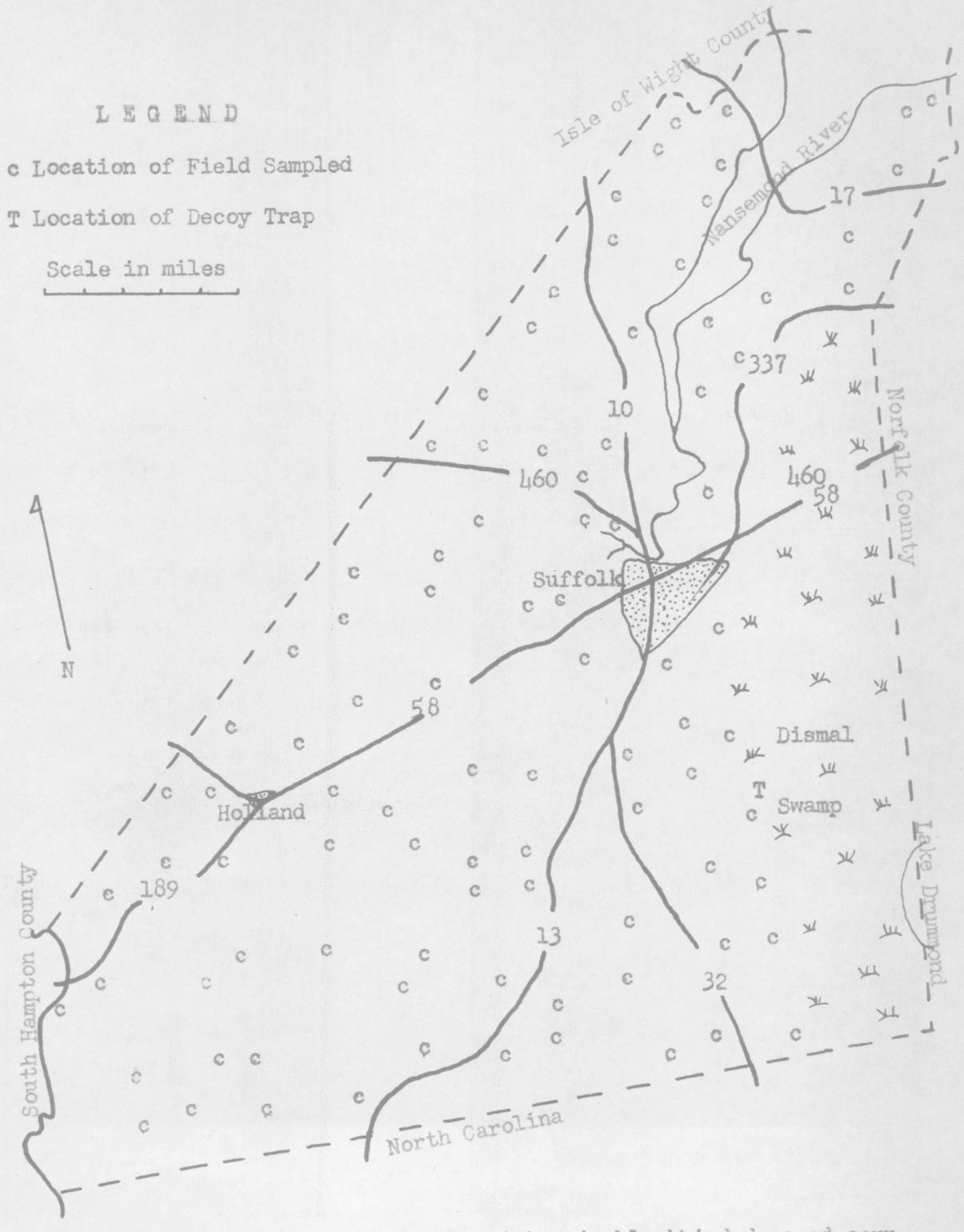


Fig. 2. Dispersal pattern of samples taken in blackbird-damaged corn survey. Note location of decoy trap at western edge of Dismal Swamp.

the test was begun. Ten shocks were chosen at random in each field (Fig. 4). Of each shock selected, a foot square section was randomly chosen along a vertical line on the north, east, south, or west side of the shock and marked so it could be relocated at a later date. All exposed peanuts within the sampled areas were counted before the birds arrived and recounted just preceding the picking operation. Peanuts missing or damaged at the recount were assumed to have been destroyed by blackbirds unless other wildlife damage signs were observed. A foot square frame, numbered garden stakes, and labeling tags were used to lay out and label sampled areas (Fig. 3).

A second technique was devised to measure peanuts damaged by blackbirds as a result of shocks being left in the field (exposed to birds) for a period of one month or longer. In Nansemond County about twenty per cent of the peanut crop remained in the field for more than a month during the 1960 season. The 200 square-feet sampled in the first test provided an average number of peanuts exposed per square foot. This average number of peanuts per square foot of exposed shock was used in sampling ten fields with shocks exposed for one month or more. Five of the ten fields sampled in this test were located at a minimum of twelve miles from the swamp edge or a minimum distance of twenty miles from the main blackbird roost of the Dismal Swamp. The other five fields tested were located less than twelve miles from the swamp edge. One randomly selected square foot was sampled (as in the previous technique) on ten shocks of each field. The same foot square frame was used to lay out the sampled areas in both tests.

These two techniques were used for the purpose of obtaining a general knowledge of the degree of damage to the peanut crop by blackbirds. Due to the limited time, different varieties of peanuts, differences in soil fertility, and time of harvesting, it may be assumed that these tests did not measure damage accurately. However, it is the writer's opinion that these tests were of value in obtaining a general picture of the degree of damage to peanuts caused by blackbirds. Such techniques might serve as a basis for further appraisals of this nature.

Milo (field sorghum)

Visual estimates of the per cent of milo which appeared to be damaged by blackbirds were made in 11 fields throughout Nansemond County (Fig. 5). The total acreage of the fields examined represented about twenty per cent of the milo grown in the county during 1960. Investigations conducted in October revealed that two different types of damaged milo heads were present. With the assistance of plant pathologists of Virginia Polytechnic Institute, it was found that a very large percentage of the "so-called" blackbird damaged milo was actually damaged by a fungal disease, anthracnose. During the milo damage appraisal, the following differences between milo damaged by anthracnose and blackbirds were noted and used as guide lines to determine the percentage of damage caused by each agent: (1) pattern of attack over the county - blackbirds seem to attack all fields somewhat equally if these fields were of equal distance from roosting marshes and swamps. The fungal disease

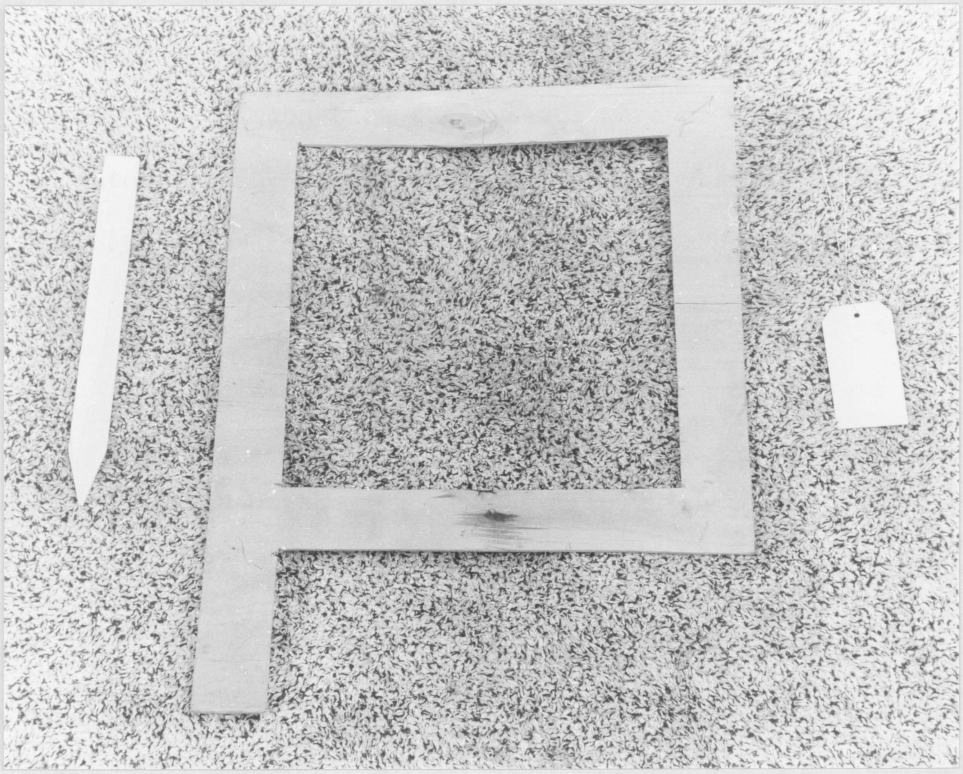

Fig. 3. Garden stake, one square foot plywood frame, and labeling tag used to sample blackbird damage to the peanut crop.

Survey of Peanut Damage Form

Date _____

Location and owner of farm _____

Date of digging _____ Expected date of picking _____

Acreage of field examined _____

Sample (shock) number: ___ ___ ___ ___ ___ ___ ___ ___ ___ ___

Location of sample on stock: ___ ___ ___ ___ ___ ___ ___ ___ ___ ___

Number of peanuts per sample (taken before blackbirds arrive): ___ ___ ___ ___ ___ ___ ___ ___ ___ ___

Number of peanuts per sample (taken after damage has occurred): ___ ___ ___ ___ ___ ___ ___ ___ ___ ___

Number of peanuts per sample damaged or missing: ___ ___ ___ ___ ___ ___ ___ ___ ___ ___

Sketch map showing locations of shocks sampled and field boundaries:

Average size of shocks sampled: _____

Total number of shocks per acre: _____

Number of whole peanuts per pound: _____

Fig. 4. Form used to record blackbird damage to peanuts in Nansemond County.

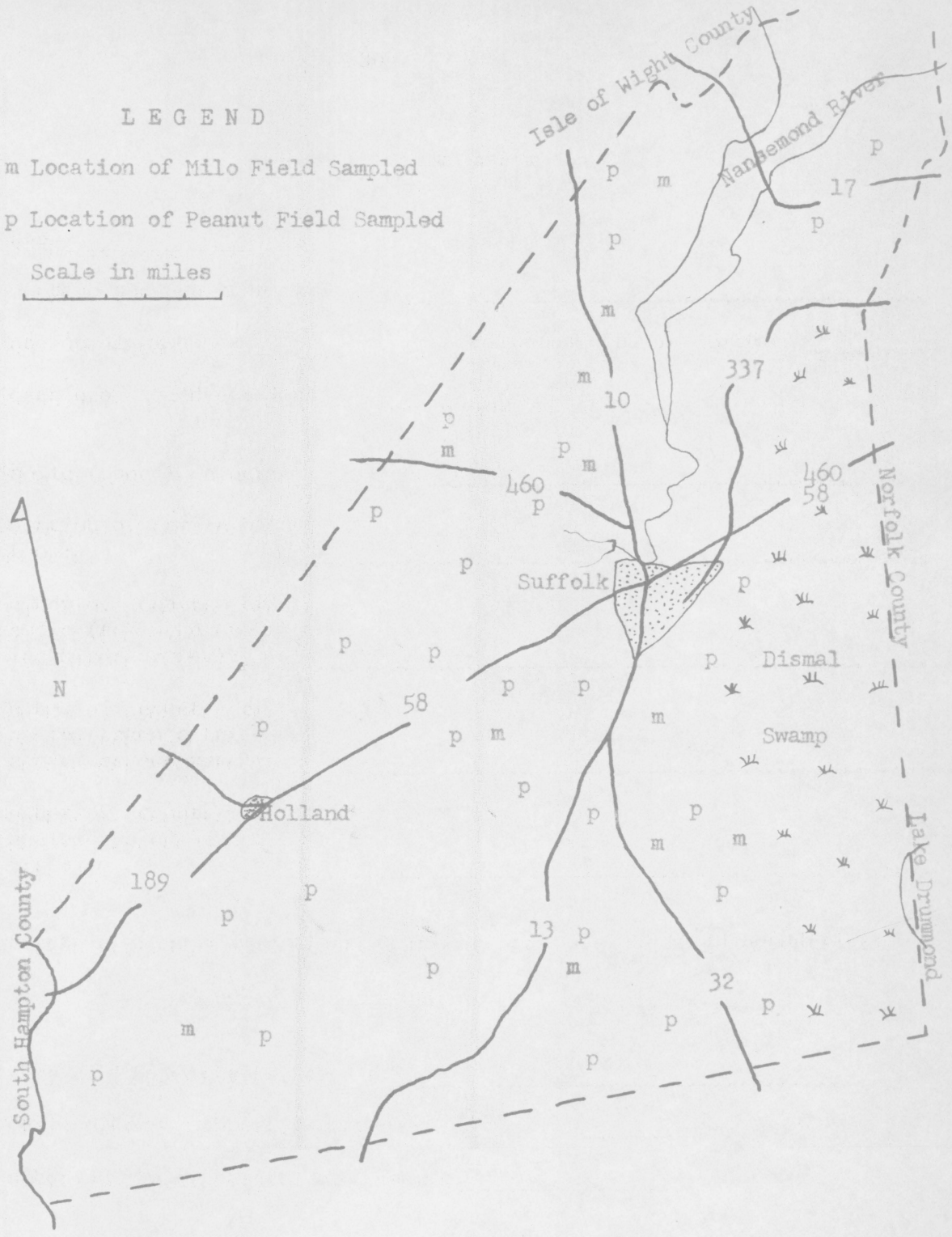


Fig. 5. Dispersal pattern of samples taken in blackbird-damaged milo and peanut surveys.

was observed to destroy completely one field, whereas, another nearby field would receive no fungal damage; (2) microscopic examinations showed that bird-damaged heads exhibited open husks with bracts that tend to curl after the grains had been removed, whereas, the disease damaged heads contained grains which appear to be undeveloped or show remnants of rotting or decaying debris (the grain has not been completely removed as it had in the case of bird damage); (3) spikes of bird-damaged heads were pulled apart giving the overall appearance of being loosely composed, whereas, spikes of heads damaged by anthracnose were clustered or compressed to the stalk more closely than normal. Careful examination of heads was necessary to determine if such head composition was a result of the variety grown or damage. This technique was concerned only with measuring type, extent, and distribution of damage to milo in Nansemond County.

## Trapping

### Decoy Trap

With the assistance of the previous investigator, who was familiar with the winter flight lanes and feeding areas used during the winter of 1959 and 1960, two locations were chosen for the erection of two decoy traps. The decoy trap site located at Hog Island Waterfowl Refuge in Surry County was chosen because of sizeable flocks of resident Redwings which occupy this area. Being on the shores of the James River and near favorable marsh habitat, this position was located on a major flyway used by migrant blackbirds. Also, the wintering population of this area had been large in the past. The trap was erected in a milo field

approximately 100 yards from an adjacent corn field. In years past, this area had been used consistantly by feeding blackbirds. Another decoy trap was constructed near the point where Washington Ditch enters the Dismal Swamp. This point appeared to be a favorable trap site due to the cover and agricultural surroundings which are preferred by feeding flocks of birds. Evening and morning flights of birds going to and from the Dismal Swamp roost were observed stopping to feed regularly in these sections of the county during the preceding winter. Each of the trap locations were chosen so as to allow convenient access by automobile; however, they were a considerable distance from heavily traveled roads.

In an effort to capture large numbers of blackbirds for banding, the decoy trap was devised and first used by members of the Patuxent staff in Maryland and New Jersey. The two traps used in this study were of the same general type as those used by Patuxent personnel. The decoy trap, referred to by some workers as an exclosure-trap, consists of a large cage 40-feet long, 20-feet wide, and 6-feet high. Entrances of different types are placed around the edge at or near ground level (Fig. 7). One-inch mesh chicken wire was used to cover the ends and sides. The top was covered with the same type of wire or, as in the case of the Dismal trap, 1/2-inch meshed twine fish net was used. If net is used, it should be treated with cresote or some other compound to prevent rotting. The net was much easier handled since large sections can be purchased to cover the entire trap without splicing sections together as was necessary when the wire was used. Also, the net was

easier fastened to the sides. On the Dismal trap, which was covered with the fish net, this was accomplished by weaving the sides and top together with twine string using an overhand stitch. The sections of wire forming the top and sides of the Hog Island trap were fastened to each other with number 2 pig rings. The funnel type entrance was constructed of 1/2-inch mesh hardware cloth. A 10-inch square section was folded into a "U" shape. One end of the funnel should be shaped to fit into an open semicircle about 6-inches across cut in the decoy trap at the ground level. The open side of the "U" is then pushed into the ground with the long axis of the funnel perpendicular to the trap side and extending into the trap from the open semicircle. The funnel was held in place by four small stakes and the opening was wired to the decoy trap (Fig. 8). Mammal predators may be discouraged from entering by pushing a 10-inch piece of number 9 wire 6-inches into the ground in the center of the front of the entrance. Also, by making the inside end of the funnel two inches wide the predator's chances of gaining access are lessened. The confusion entrance or shorebird type trap was modified and used as an entrance to the decoy trap. This small field trap, which is described in detail by Crebbs (1960), is placed with one of its two closed ends of the "U" against the decoy trap (Figs. 7 and 8). After birds have entered the confusion entrance trap, they readily locate the entrance to the decoy trap through a circular hole 6-inches in diameter cut four inches from the ground. To prevent birds from passing from the decoy trap out into the confusion entrance trap, a wire cylinder 10-inches long, with one open end of 6-inches in diameter and tapering

to 3-inches in diameter at the other open end, is attached to the 6-inch hole in the decoy trap and extends parallel to the ground into the decoy trap. A total of 12 funnel entrances were placed at equal distances around the decoy trap located at Hog Island. The Dismal trap was operated with four confusion entrance type entrances. This type of entrance seemed to be more nearly predator proof than the funnel type entrance. Two holding cages were located in one corner of the decoy trap for catching and holding birds during the banding operation. Beginning at the top of the trap these two holding cages were mounted one under the other and extending from the side of the trap outward (Fig. 6). The entire end of each holding cage could be opened or closed, thus making it possible to drive the birds into the cages and hold them while banding. A small 6-inch-square door on the side of the cage allowed the bander to reach into the cage and catch individual birds. The overall length of each holding cage was 2-feet by 3-feet by 4-feet. Hardware cloth was used to cover the body of the cage. The ends were constructed of plywood so as to permit sliding of these sections to open or close the ends.

The trap was put into operation by opening entrances and baiting. By placing a dozen live birds in the trap as decoys, feeding flocks of the area were attracted to the trap. Bait used consisted of both cracked corn and scratch grain. The scratch grain proved to be undesirable because the whole oats, wheat, and barley contained in this bait would sprout during mild weather, thus filling the entrances and blocking them off from birds which might enter. Bait should be spread

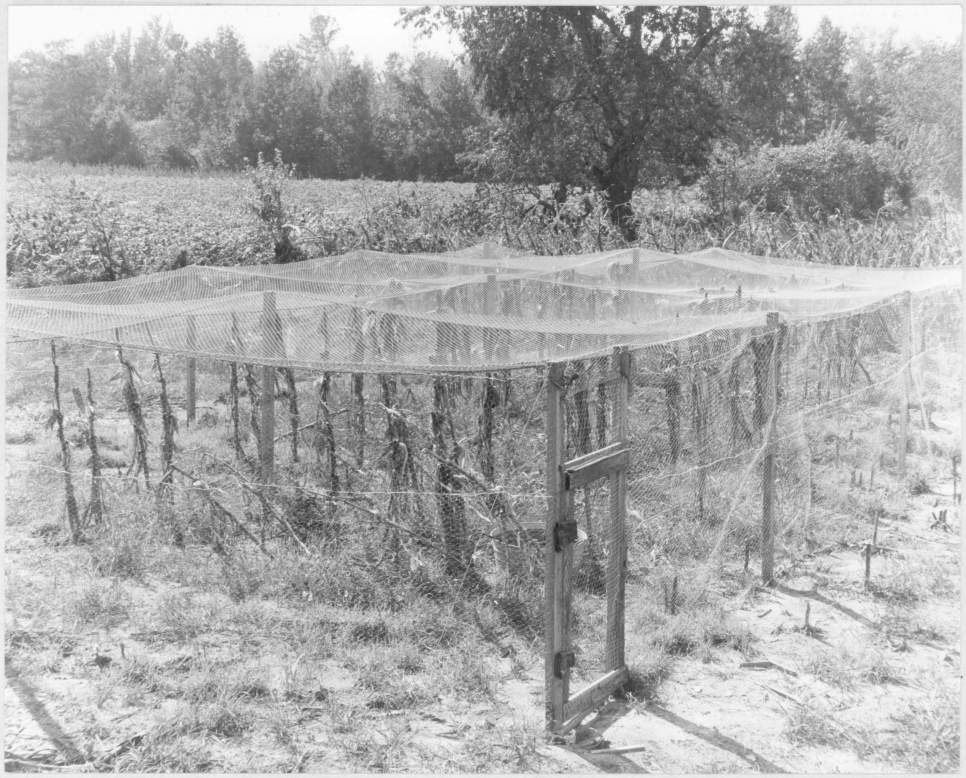

Fig. 6. Decoy trap (top). Holding cage (bottom) where birds are caught for banding.

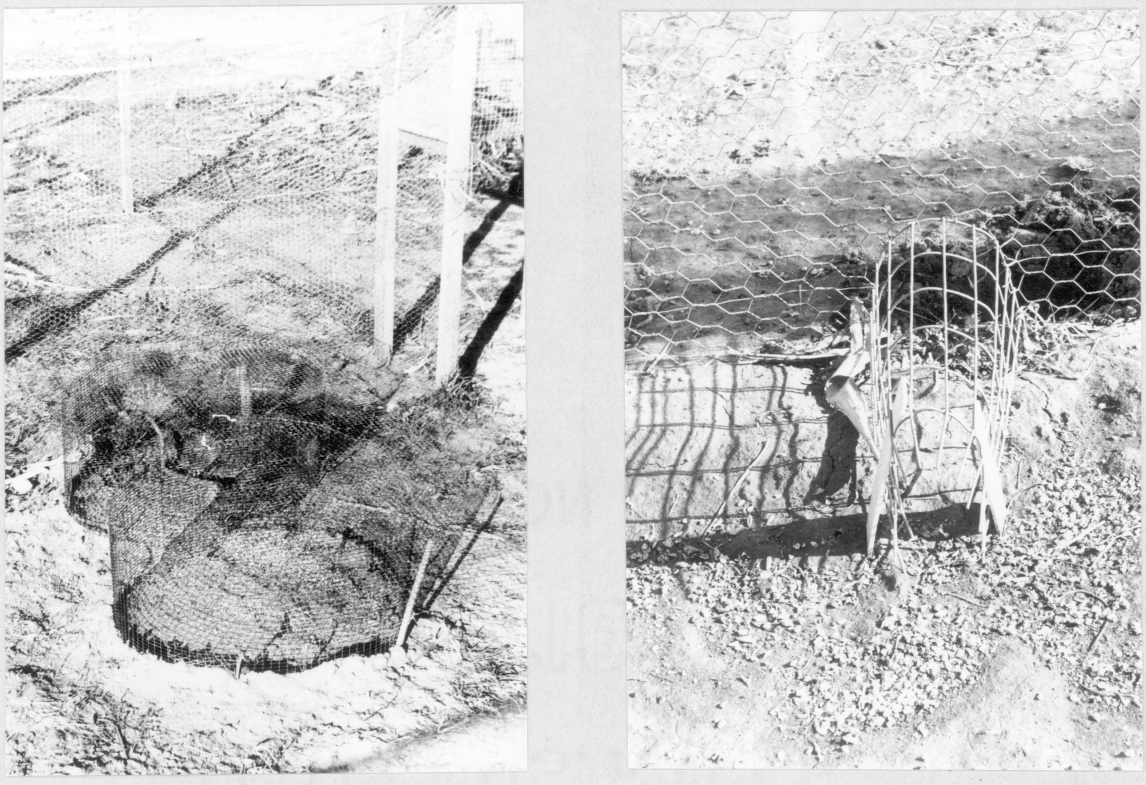

Fig. 7. Two types of entrances used with the decoy trap. At left confusion entrance trap leading into main trap. At right funnel entrance (photograph taken from inside decoy trap).

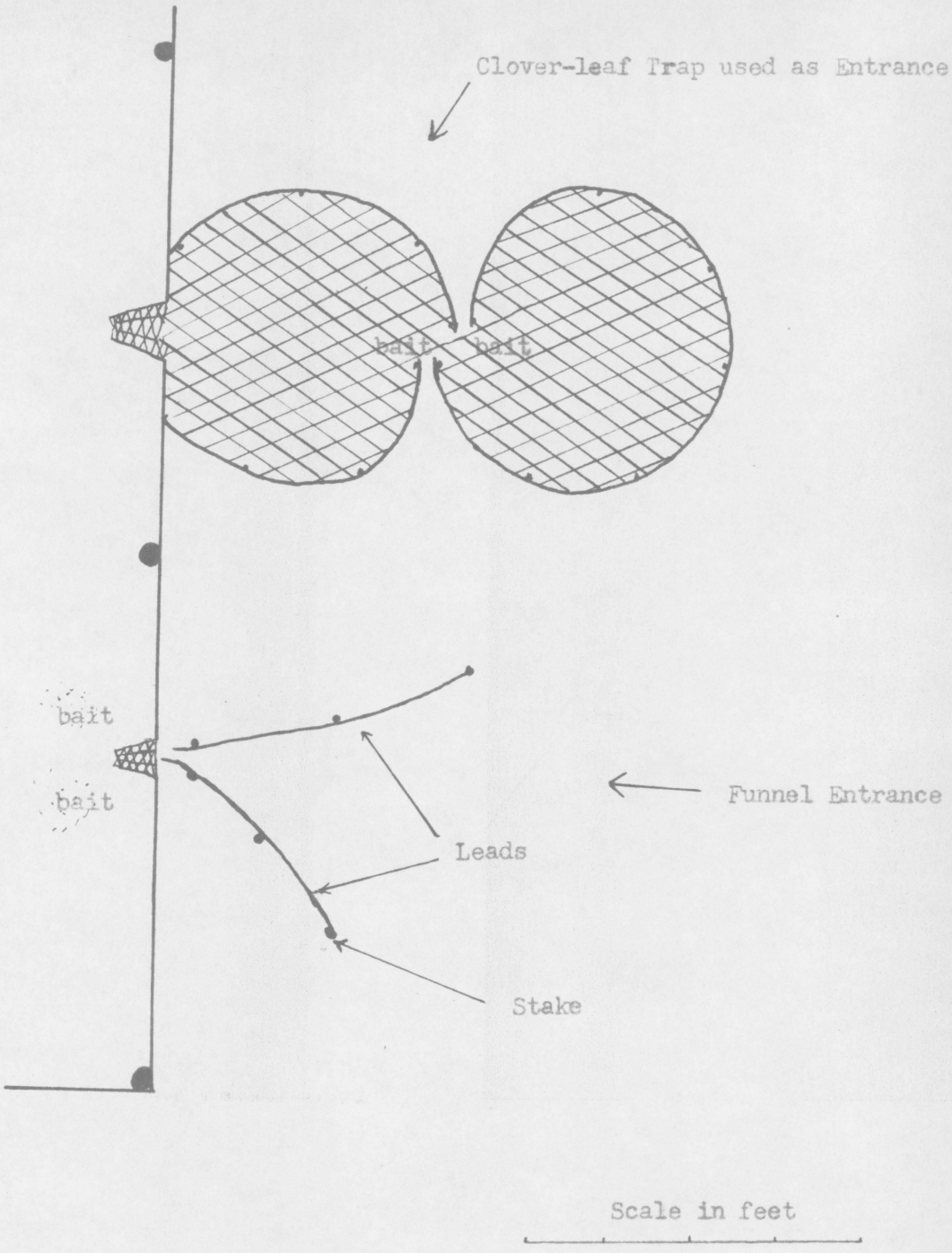


Fig. 8. Clover-leaf trap entrance and funnel entrance used with decoy trap.

heavily near the center of the trap to make it attractive to birds outside and to allow the captured birds to feed away from the entrances. Water should be placed near the center of the trap.

Confusion Entrance Trap

During the course of this study, this small field trap was used for the purpose of capturing small numbers of blackbirds to "prime" or use as decoys in the large decoy trap. Both the construction and operation of this type of trap was described in detail by Crebbs (1960).

Floodlight Trap

After the Dismal Swamp roost was located and examined in January, 1961, plans were coordinated with Patuxent personnel to operate the floodlight trap in this area. Patuxent staff personnel, under the direction of Robert T. Mitchell, are engaged in the development of this technique as a method of capturing large numbers of blackbirds in winter roosts. This brief description of the trap concerns only the one used in this study. Many variations of the floodlight trap have been employed in other sections of the country by the Fish and Wildlife Service. This information was obtained through the courtesy of the Patuxent staff.

The trap consists of a large funnel-shaped structure of commercial 2 1/4-inch stretch mesh nylon fish net and a 6- by 11-feet tent (Fig. 9) at the apex funnel. The net was treated with a weather resistant preparation. Pulleys attached about thirty feet in two pine trees 50 feet apart served to hoist each side of the open end of the funnel. This formed an

entrance of 50 by 25 feet. A "C" shaped arch 18 1/2-feet high constructed of 2-inch aluminum tubing was placed midway between the front opening and the tent. A similar arch 6-feet high was placed at the front of the tent. Both the front of the tent and the small (back) end of the net were fastened to this arch. The sides of the net and tent were fastened to the ground with stakes to prevent birds from escaping. Flaps capable of covering the front of the tent were left open until the birds entered from the funnel. The tent served both for holding captured birds and for allowing the light to be seen from only the front of the trap. Three 1,000-watt floodlight lamps with plane grass lenses were placed inside and near the back of the tent. Care was taken to direct the light through the funnel of the trap without allowing the trap itself to be aluminated. Two rows of four holding cages (of the same type used with the decoy trap and pictured in Fig. 6) were placed on the ground at the back of the tent. One flood lamp of the type previously described was placed 6 feet to the rear of the holding cages. This setup allowed birds to be attracted from the tent into the cages. The lamps are powered by a 5-kilowatt portable generator placed 100 feet from the trap. This generator should be set up directly behind the trap when possible. During the Dismal Swamp light trap operation, it was necessary to place the generator beside rather than behind the trap.

The trapping site was located within the 2,000-acre roost at a place chosen during the pre-trapping examinations for the following reasons: First, the area in front of the trap seemed to be supporting a large number of roosting birds; Second, the area was accessible by

Fig. 9. Floodlight trap on operation site in Dismal Swamp roost.

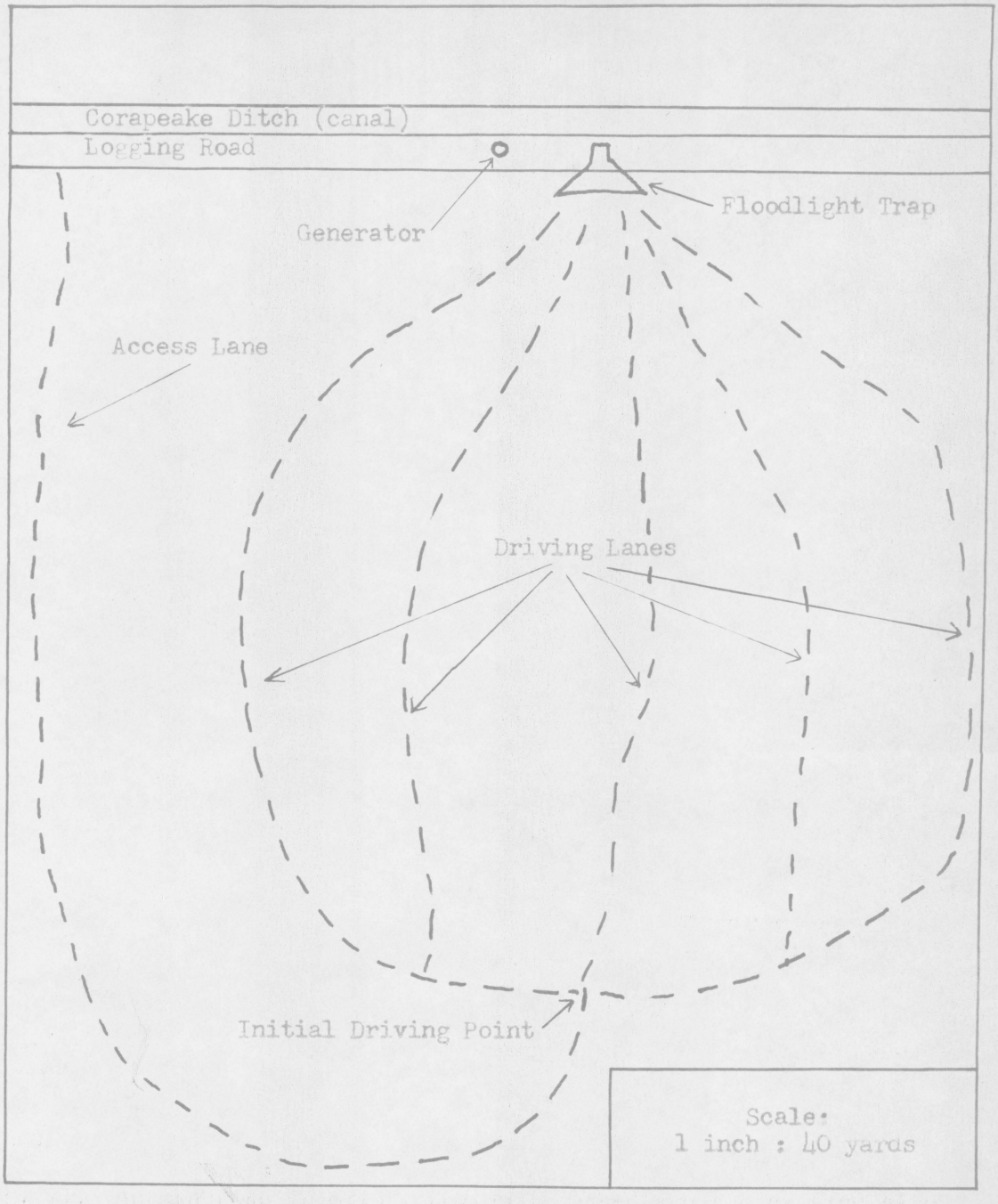


Fig. 10. A sketch map showing trap and lane locations used during floodlight trapping operations in the Dismal Swamp roost.

logging roads; and, third, the vegetation immediately in front of the trap was suitable for driving or scaring of birds. Once the site was chosen the equipment was moved in along 19 miles of logging roads. After the trap was set up, driving lanes were cut through the thickets of broadleaf evergreens. The lanes were cut only wide enough to permit drivers to find their way along them after dark. A white cotton string was tied along the path about four feet from the ground (Fig. 25) to guide the drivers. The driving lanes began along a 200-yard front about 200-yards from the trap and converged at the trap entrance. An access lane which allowed drivers to get to the driving lanes without disturbing the birds was cut around the area which was to be driven (Fig. ).

The darkest nights were chosen to operate the trap. Drivers moved quietly along the access lane to the starting point. At a pre-set time, the lights were turned on. At this moment, the drivers started making noises by clapping their hands and hollowing and moving along the lanes in a coordinated drive toward the trap. As they neared the trap entrance, the birds were frightened further into the trap and on into the tent. The captured birds were closed off in the tent and holding cages, and allowed to remain until they could be banded the following day. The trap was operated three nights in this manner. On a fourth night, a new driving technique was tried. A coast guard helicopter was used to scare birds toward the trap. Several passes were made through the roast toward the trap entrance at an altitude of 200 to 300 feet.

## Shooting

Shooting was used when specimens were desired for food habit studies.

Best results were obtained by shooting into feeding flocks as they first become airborne. The flocks seem to cluster together just after they reach a height of a few feet above the ground. For this type of collecting, #8 shot with an average load appeared to be sufficient. At a range of 35-50 yards, an average of 10-20 birds per shot may be expected, including both those crippled and killed. This technique of collecting birds has long been used by biologists (Stockdale, 1959).

## Mist Netting

The technique of mist netting is discussed by Crebbs (1960). In this investigation, a battery of three mist nets was placed parallel to a logging road and canal which passed through the Dismal Swamp roost (Fig. ). As birds settled into the roost in the late afternoon, there was much shifting about. Birds were entangled in the nets as they swooped low to cross the road and canal. By using this technique, one person might expect to capture 20-30 birds-per-hour while operating under optimum conditions. Due to the onset of darkness, the maximum time mist nets could be operated in the roost was about one hour. During these operations, it was noted that mist nets with meshes of 1 1/2-inches captured more redwings and required much less time to untangle a bird than did the larger-meshed nets.

## Banding

The blackbirds banded during this study were captured by the use of mist nets, decoy traps, confusion entrance traps, and the floodlight trap.

Fig. 11. Carbide exploder used as scare device in milo field.

The birds were banded with the standard U. S. Fish and Wildlife aluminum band and released. The information collected from each bird, when possible, included sex, age, and species. This information was forwarded along with the band number to the Bird Banding Office, Patuxent Wildlife Research Center, Laurel, Maryland.

## Methods Used to Reduce Crop Damage

### Frightening Devices

Field tests were conducted to evaluate the merit of frightening devices as crop damage reducing agents. Scare devices tested included carbide exploders, rope firecrackers, and shotgun shellcrackers. Four carbide exploders were equally distributed throughout a 50 acre milo field. Operation of the exploders began about one week before birds had attacked such fields in past years. The carbide "guns" were set to fire at 10 minute intervals during the daylight hours. Each day all "guns" were filled and put into operation just before sunrise. Twice each week the "guns" was relocated in the field. When possible, the "guns" were set on small platforms two feet above the ground. The manufacturer of the exploders recommended swinging the "gun" from a stake or post, so as to allow it to be slightly above the crop. Because of the inconvenience in changing the field position when using this method, the platform was used. Rope firecrackers were used to protect a ten acre peanut field from blackbird damage. Two firing stations were employed throughout the daylight hours. The interval between blasts was 2-4 minutes during periods of heaviest feeding (early morning and late afternoon), and 15-20 minutes

during periods of less activity. The recommendations followed during this operation are found in "The Rope Firecracker," U. S. Fish and Wildlife Service, Wildlife Leaflet 365. Periodic patrols of areas being damaged were made and shotgun shellcrackers were used to frighten birds.

## Resistant Varieties

Combine Sagrain milo, which according to previous investigators was possibly blackbird resistant, was field tested at Hog Island Waterfowl Refuge. This location was chosen for the test because of the high population of resident Redwings. A four acre planting was made with two rows containing Sagrain alternating with two rows of a Dekalb variety known to be highly susceptible to blackbird damage. Periodic checks were made throughout the summer and fall to determine the degree of damage to each variety. Previous reports stated that Sagrain was not very palatable to livestock. Because of such reports, samples of each variety were taken to Virginia Polytechnic Institute for oxalic acid tests.

## Agricultural Practices

Potentially, the best crop damage control technic for southeastern Virginia appears to be the modification of cultural practices. Through personal conservation with local agricultural experiment station and extension personnel results of this nature were obtained. The primary cultural changes include planting at an earlier date and the use of

combine and artificial driers for the peanut crop. A change in the variety of milo planted might reduce losses to this crop.

Winter and Summer Roosts

During this study, no attempt was made to acquire an accurate count or estimation of the wintering populations. For information of this nature, the Christmas Bird Census records were used. Also, Crebbs (1960) reported on this phase of the blackbird investigation. Broad estimates of the relative sizes of flocks during the winter of 1960 and 1961 were made with the help of Patuxent staff biologists.

Considerable effort was made to locate the large winter roost in the Dismal Swamp area. Maps containing information on vegetation, access roads, and canals of the Dismal Swamp were obtained from the following agencies: Virginia Division of Forestry, National Geographic Survey, Camp-Union Bag, Inc., Washington Forest, Inc., U. S. Army Engineers, and local hunt clubs. Personal contact was made with game wardens, hunters, landowners, and residents who were familiar with the swamp in order to locate the roost. Traveling along roads and canals, 30 observation points were established (Fig. 13). These points were checked periodically to observe the direction of flight lines going to and from the roost.

Once the position of the roost was pinpointed, a study of the roosting site was begun. The results of the vegetative analysis, as typed in this study, are reported in the results section. Weekly observations were made at the roosting site. Information necessary for the anticipated

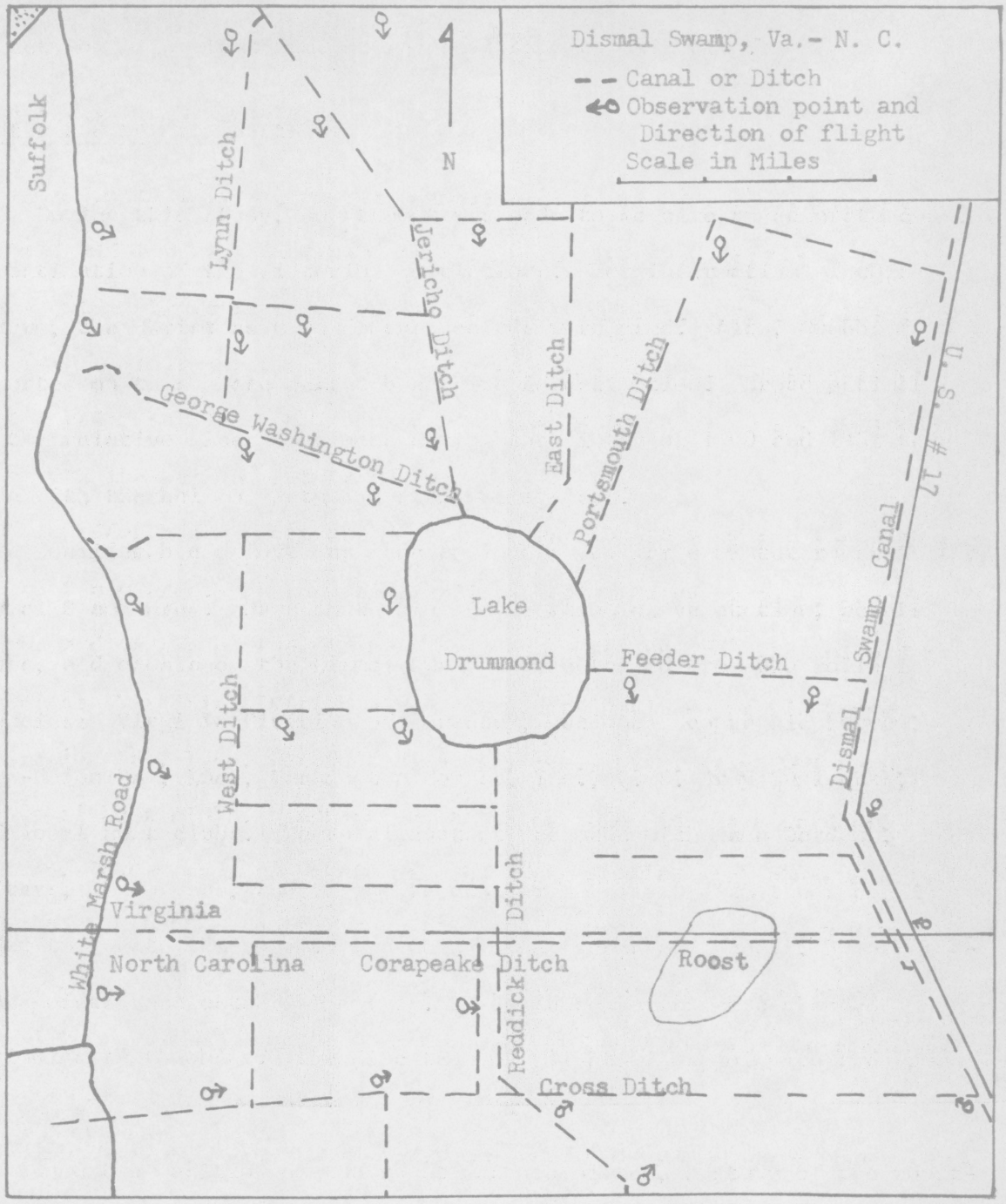


Fig. 12. Direction of flight of blackbirds and observation points used in locating the 1960-61 Dismal Swamp winter roost.

floodlight trapping operation in the roosting area was collected at these times. This included checking of population shifts, concentrations and species involved, vegetative cover density, and condition of access roads.

Beginning about mid-June, weekly checks were made on the summer roost located on the Nansemond River marsh near Suffolk. Such information as roost build-up and arrival dates of migrant flocks was recorded. Examination of the roosting area was made by boat and foot.

# RESULTS

Damage to agricultural crops by blackbirds has been recorded since colonial times; however, only in recent years has this loss been recognized by the general public as a major problem. The severity of this problem has been increased by: (1) much of the natural habitat of the species involved has been destroyed by man, and the birds have become adapted to thriving in the agricultural habitat created by man (Neff and Meanley, 1957:3); (2) the present-day farmer has a smaller margin of profit, thus the once unnoticed loss to birds becomes important; (3) larger fields are being used which allows birds to feed in areas which are set off from routine human activity; (4) a large percentage of farm labor has left the farm due to the use of modern machinery, in past generations this normal human activity served to scare birds from the fields. These agricultural practices are only partially responsible for increased losses to blackbirds. According to Glitz (1961) shifts in populations and changes in behavior patterns continuously are creating new blackbird problems.

## Appraisal of Blackbird Damage

The primary crops damaged by blackbirds in Nansemond County are corn, milo, and peanuts. Reports by farmers of damage to soybeans could not be verified by the investigator. Resident blackbirds were responsible for the damage done to corn and milo; migrant flocks did not arrive until after these two crops had been harvested. The opinions of farmers varied greatly as to crop damage by blackbirds. Some were not aware of

any damage while others were greatly concerned with flocks of blackbirds which were actually being beneficial by destroying harmful insects (Lefebvre, 1961). Such extreme differences of opinion resulted in investigations of crop damage by blackbirds. These investigations were restricted to Nansemond County in an effort to evaluate such damage.

## Damage to Corn

In Nansemond County, field corn is damaged during a three-week period from the time it comes into the "milk" stage until the kernels "harden." In two fields which were under observation, an estimated 75 per cent of the damage occurred within a four-day period. Although, corn is vulnerable for about three weeks, most of the damage occurs while the grains are soft. Slight damage may appear as the corn passes through the dough stage. After the husk has been stripped back and the ear exposed, secondary damage then occurs. In some cases losses from secondary damage such as insects, moisture, and fungus diseases, appeared to be greater than the losses caused directly by blackbirds. During growing seasons of normal rainfall secondary damage is minimized by early harvesting and proper storing.

During the month of September, 1960, a survey of Nansemond County was conducted to determine the type, extent, and distribution of blackbird damage to field corn. By examining 96 sample areas of 1/100-acre each, every section of the county was sampled. Factors which might possibly influence the degree of blackbird damage were investigated, including time of maturing; height of stalks; distance between stalks

Fig. 13. Corn damaged by blackbirds. Note that part of seed coat is left intact.

Fig. 14. Varieties having a large percentage of ears with open end and non-drooping characteristics usually are more heavily damaged if grown within active summer range of blackbirds.

Table 1. Effect of time of maturing on corn damage by blackbirds, Nansemond County, Virginia, 1960

| Time of Maturing* | Number of fields sampled | Bushels destroyed per acre | Bushels destroyed in Nansemond County | Per cent of ears opened | Per cent of ears damaged |
|---|---|---|---|---|---|
| Early | 27 | .021 | 147 | 4.0% | 1.3% |
| Average | 58 | .042 | 630 | 6.4% | 1.5% |
| Late | 11 | .063 | 189 | 9.8% | 2.0% |

* Time of maturing refers to the time of the growing season in which the kernels "hardened" and not to the variety of corn. Early - before July 15; Average - July 15 - August 15; Late - after August 15.

Table 2. Effect of degree of ear drooping on corn damage by blackbirds, Nansemond County, Virginia, 1960

| Degree of ear drooping in per cent | Number of fields sampled | Bushels destroyed per acre | Bushels destroyed in Nansemond County | Per cent of ears opened | Per cent of ears damaged |
|---|---|---|---|---|---|
| 90 - 100 | 58 | .0105 | 158 | 3.3 | .008 |
| 60 - 90 | 29 | .0560 | 422 | 7.0 | .023 |
| 0 - 60 | 9 | .1540 | 386 | 17.0 | .053 |

in the row; amount of weeds on the field; distance from major nesting and roosting areas; and degree of ear drooping. In contrast to a survey of 1958 (Crebbs, 1960:78), there was no noticeable correlation between the severity of corn damage by blackbirds and the distance between stalks or amount of weeds in the field. To a limited degree, corn was damaged more severely along the northern and eastern sides of the county than in the other sections. In general, damage was not restricted to any particular area. In several cases, adjacent fields showed considerable differences in the degree of blackbird damage, even though the previously mentioned factors varied only slightly.

The two major factors, according to this survey, which determine the degree of blackbird damage to field corn are time of maturing or "hardening" of the kernels and the degree of ear drooping or erectness of the ear (Tables 1 and 2). An estimated two per cent of the ears which "hardened" in mid-August were damaged, while only a little over one per cent of the ears "hardening" in mid-July showed any damage. Most resident blackbirds, which are responsible for all blackbird damage to corn, have completed nesting and begun to flock by the first week of August. Thus, early maturing corn is not exposed to the resident flocks of blackbirds which damage late corn. During July when early corn is maturing, the diet of the blackbird contains twice the amount of animal matter as it does one month later (Beal 1900:38).

The greater the amount of ear-drooping, the less the blackbird damage. Those fields sampled which had 90-100 per cent of the ears drooping sustained a loss of only .6 pound-per-acre. In fields which

Fig. 15. Erect ears (left) showed much higher degree of damage than those which were drooped (right).

had less than 60 per cent of the ears drooping, there was a loss of 8.6 pounds per acre. The ears start drooping during the early "milk" stage. The ears need be inclined only a few degrees from the vertical position to greatly decrease blackbird damage.

It should be noted that only 24 per cent of those ears which were opened by blackbirds actually received any direct damage. After close examination of these ears, it is the investigator's opinion that blackbirds opened the ears in search of corn earworms, not to eat kernels. Further investigation is necessary to determine the economic role of blackbirds in the control of corn earworms.

The total damage to field corn by blackbirds in Nansemond County in 1960, as estimated by this survey, amounted to nearly one thousand bushels or $1,100. This was based on a total of 25,000 acres of corn in Nansemond County, with an average yield of 70 bushels per acre.

Throughout the county the average monetary loss was slightly less than five cents per acre in the corn crop. In a few isolated situations the blackbirds present a problem to the corn grower; however, generally the loss is so small that it goes unnoticed. This loss may be greatly reduced if the farmer chooses a variety with a high degree of ear drooping and if the corn is planted as early as possible.

Damage to Peanuts

The first complaints of severe blackbird damage to crops of the Suffolk area were the results of losses in the peanut crop. Peanuts are the major money crop of this area. Blackbirds damage to the peanut crop

has been widely discussed by the local public for many years.

All the significant damage to the peanut crop is caused by migrant blackbirds which winter in the area. These birds begin to arrive the latter part of October. In 1960, damage to peanuts did not begin, to any appreciable degree, until the first week of November. Large flocks of birds were first observed feeding in peanut fields which had large numbers of peanuts on the ground surface. In four fields which were observed periodically, most of the feeding during the first week was from the ground. As feeding continued, birds began to eat peanuts directly from the shock. Flocks composed of Redwings, Grackles, Cowbirds, and Starlings seem to follow a regular pattern of visiting feeding areas. After leaving the roost, most flocks would settle in nearby fields and gradually feed in an outward direction. In several instances flocks were observed feeding immediately upon leaving the roost. Such flocks were followed to determine the rate of moving while feeding. This rate of movement varied greatly depending upon the type of crop land and terrain covered. Normally, such flocks would cover five to ten miles per hour. Other flight lines were observed leaving the roost and were followed fifteen to twenty miles before they stopped to feed.

While observing blackbird activity in four fields for a two-day period, it was noted that the birds usually approached the field in a similar manner. The largest part of the flock or flight line would settle in nearby cover. Within a few seconds both Redwings and Grackles would start darting to the ground or shocks near the field edge and fly back to cover carrying whole peanuts. Starlings and Cowbirds would, at the same time, be taking peanuts from the ground and hulling them in

place. On no occasion were the Starlings or Cowbirds observed to eat peanuts from the shock or to remove peanuts from the field. Only a few minutes of activity along the field edge seemed necessary before the flock would cover the entire field. Redwings seemed to be slightly more active in the afternoon than in the morning (Fig. 20). As activity increased, Redwings preferred to hull the peanuts still in place on the shock. Grackles would usually carry the whole peanut to cover to remove the hull.

Blackbirds seem to be attracted to fields where peanuts are exposed on the ground. The two primary reasons for having peanuts on the ground are improperly adjusted diggers and digging at the incorrect time. Peanuts left on the ground in some fields of Nansemond County amounted to an estimated loss of 50 to 100 pounds per acre (Fig. 16). The practice of "hogging off," turning hogs into the field to get peanuts which remain after picking, is not as commonly used at the present as it has been in the past. Those farmers who still use this practice often state that the blackbirds take the peanuts that could be utilized by the hogs. This is a true statement since the birds do remove most of the peanuts left on the ground. However, there is sufficient reason to believe that the practice of "hogging off" is not profitable regardless of whether or not blackbirds are present. According to the two previous investigators, Crebbs 1960 and Lefebvre 1961, the peanut exclosure technique was not successful in estimating blackbird damage to the peanut crop. In search of a means to evaluate such damage, two methods were employed (techniques section).

Fig. 16. Peanuts left on the ground by the digging operation. Such waste in this field was estimated at a loss of $8.00 to $10.00 per acre.

One method was concerned with counting the exposed peanuts within a randomly chosen section on a shock before the birds arrived, and recounting those which remained after the shocks had been exposed to depredation by migrant blackbirds. Only three of the twenty fields used in this test were allowed to remain unpicked until the migrant birds arrived. Of these three fields, an average of three peanuts per square foot sampled was removed or destroyed. With an average of 70 shocks per acre and 60 square feet exposed per shock, there were normally about 4,200 square feet of exposed area per acre. This may vary from year to year and from variety to variety depending upon the rankness of vines. Assuming that an average of three peanuts were taken, or damaged, per square foot, then an estimated 12,600 peanuts (50 pounds) were destroyed per acre. This would amount to about $5 per acre. Each of the three fields investigation were exposed to blackbirds for a period of two weeks. An estimated 50 per cent of the peanuts in Nansemond County were picked before the birds arrived in late October. Another 30 per cent of the crop was harvested by the middle of November; this part of the crop sustained not more than $5 loss per acre, as shown by the previously-mentioned investigation. Weather conditions favorable for drying the crop would have permitted all the peanuts to be harvested by mid-November if the farmer had chosen to do so. However, about twenty per cent of the peanut crop was left in the field until the latter part of November or later.

A second technique was devised to measure losses to blackbirds when the peanut shocks were left in the field until late-November. This

portion of the peanut crop, an estimated twenty per cent, was the most heavily damaged. The blackbirds did not feed from the shocks as readily after November as they had earlier. This is thought to be true only under weather conditions which are favorable to drying. Reliable observers are of the opinion that such damage was much more widespread and severe during the winter of 1957-1958 when unfavorable weather forced many farmers to delay harvesting until January or February. Of the ten fields sampled in fall of 1960, the five located along the Dismal Swamp edge and Nansemond River sustained a loss of 60 to 90 per cent of the exposed peanuts on the areas sampled. An average of 70 per cent of the peanuts on the surface of the peanut shocks had been either removed or destroyed in place. The loss in these five fields amounted to about 23 pounds or $20 to $25 per acre. Of the five fields sampled in the western part of Nansemond County, an average of 20 per cent of the exposed peanuts had been destroyed. Some fields showed no damage. It was stated previously that flocks were followed twenty miles before settling to feed. It was noted that in such cases the flocks or flight lines passed over wooded areas such as the Dismal Swamp. Most flocks which were observed did not travel this far once favorable feeding areas were reached. This is a possible reason for the lesser degree of damage in the western part of the county.

It should be noted that damage amounting to $25 per acre to peanuts is not normal. Such losses result when: (a) shocks are left exposed to birds for long periods and, (b) the peanut fields are located near roosting sites.

Fig. 17. A comparison between (top) squirrel and (bottom) blackbird damage to peanuts as seen in the field. Note that squirrels pull peanuts from vines and open them at the bottom of the stack.

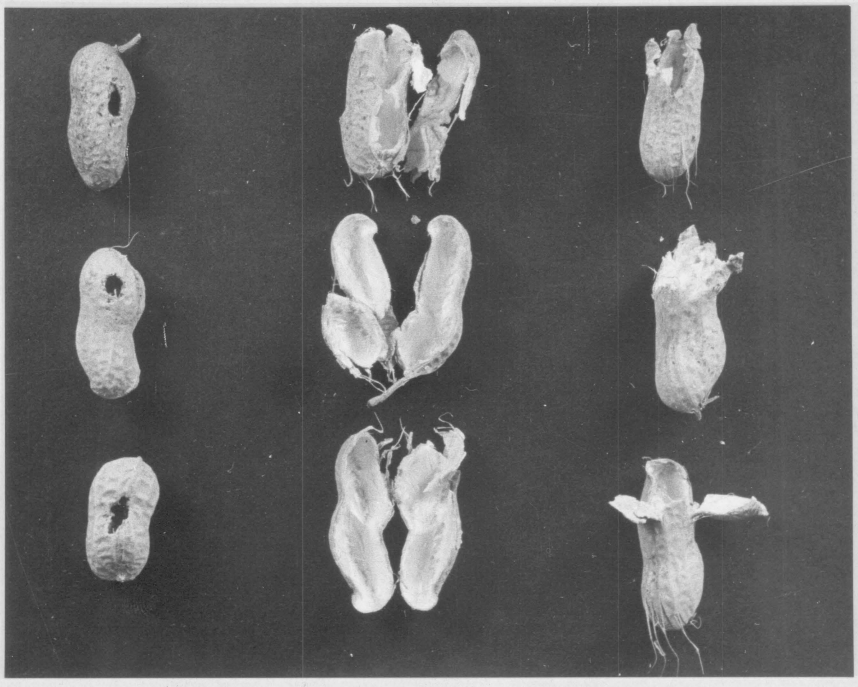

Fig. 18. Three types of wildlife damage to peanuts: sapsucker damage on left, squirrel damage center, blackbird damage on right. Note that each type is easily distinguished.

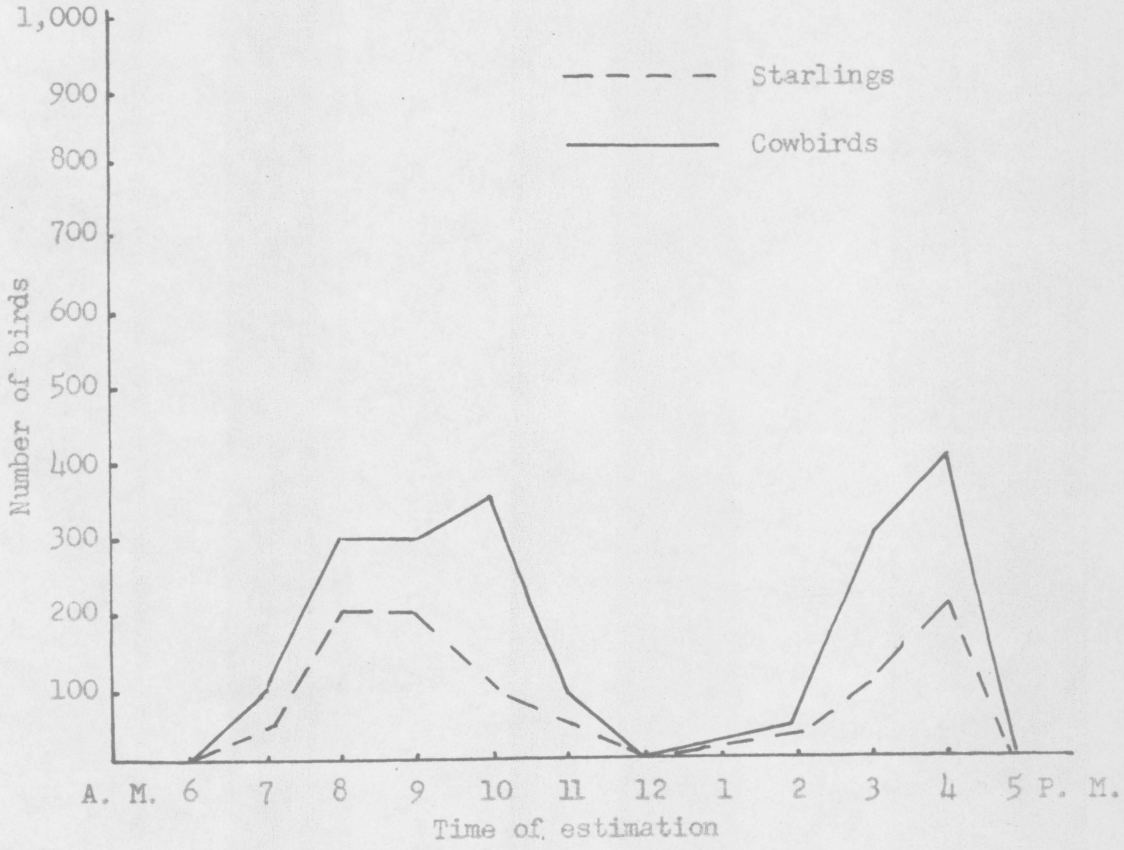


Fig. 19. Mean number of Starlings and Cowbirds feeding at 60 minute intervals in four fields during a four day period.

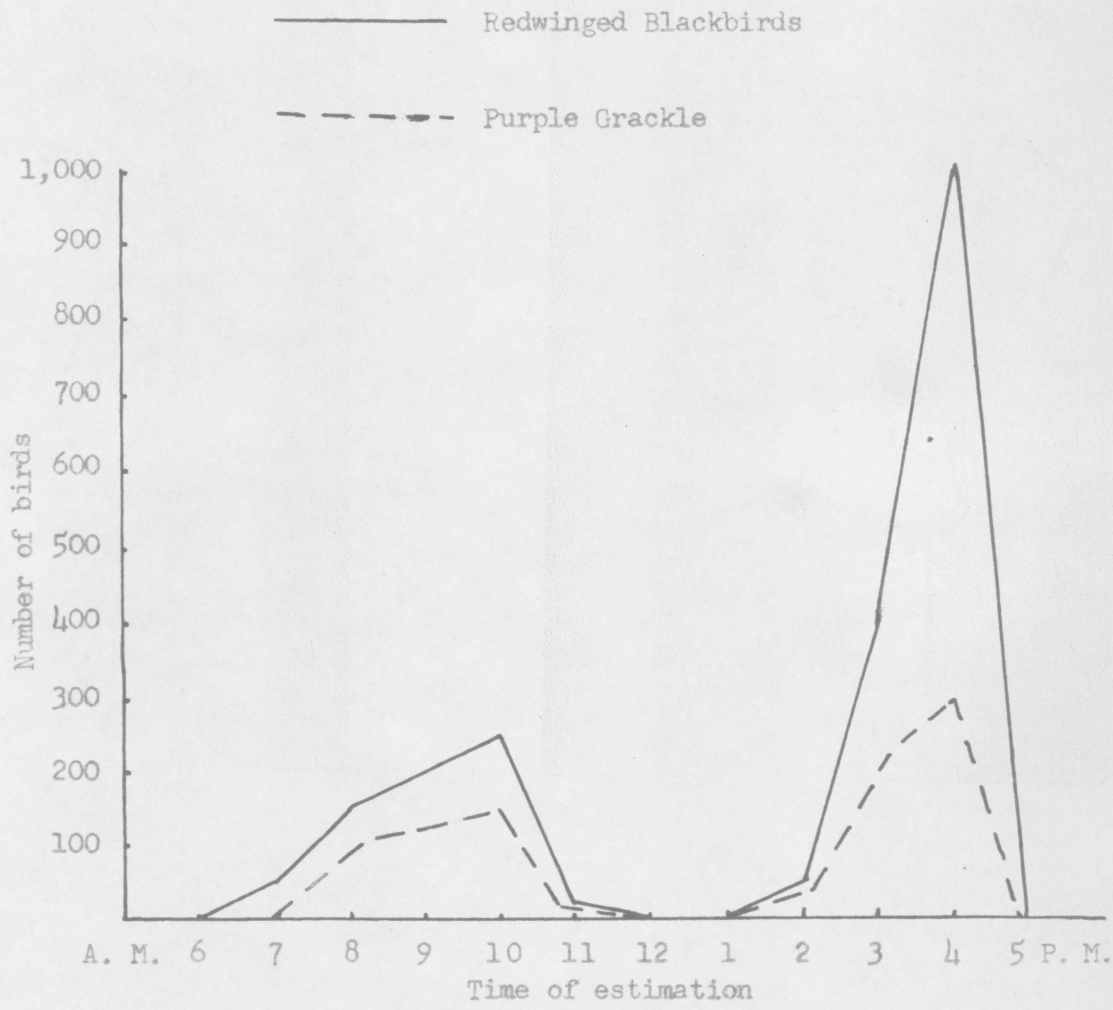


Fig. 20. Mean number of Redwinged Blackbirds and Purple Grackles feed- at 60 minute intervals in four peanut fields during a four day period.

Based on these data, it is the writer's opinion that the peanut crop is subjected to greater damage by blackbirds than any other agricultural crop in this area. Under normal weather conditions, losses of shocked peanuts can be reduced to a minimum by picking before the migrant blackbirds arrive or combining and drying artificially.

Modifications of cultural practices can eliminate most of the blackbird damage to the peanut crop. Artificial drying is increasing rapidly in southeastern Virginia (Va. Agr. Exp. Sta. Bul. 439), and it is the opinion of agricultural extension personnel that within the next five-year period 85 per cent of the Nansemond County peanut crop will be combined rather than dried on stackpoles in the Field, (Freeman, pers. comm.). This operation, discussed fully by Crebbs (1960), would allow the crop to be dug and dried artificially during the first part of October, thus removing any blackbird threat. It was noted by Mr. Freeman that only a few of the farmers grew large enough acreages of peanuts to justify the initial cost of the necessary equipment for the combining and drying operation. However, it is likely that custom drying will be a regular practice in the immediate future. The fifteen per cent of the crop which is not harvested using the artificial drying method will still use the stackpole method. As previously indicated, these farmers should dig and pick at an early date in order to save the crop from any major blackbird damage.

Damage to Milo (field sorghum)

Eleven fields throughout the county were examined in the milo

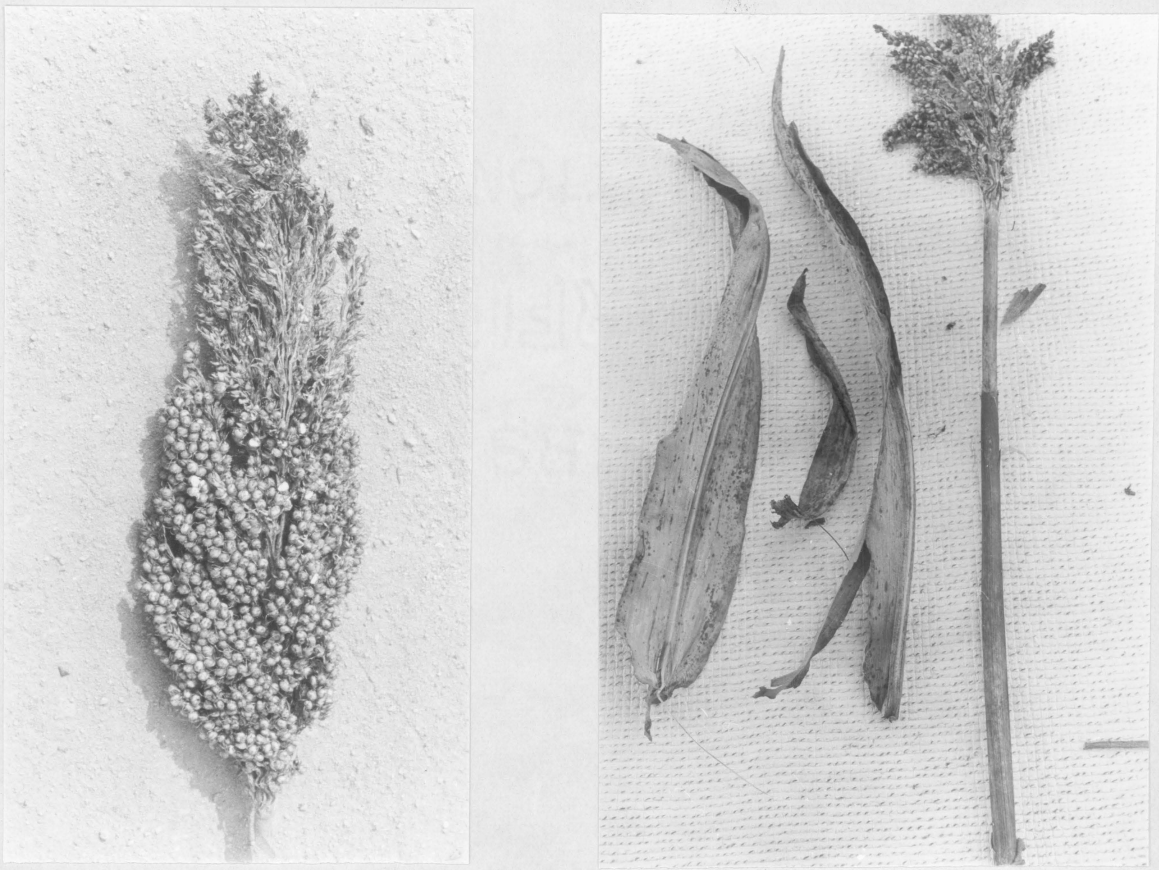

Fig. 21. Anthracnose in milo (previously mis-diagnosed as blackbird damage in Nansemond County). Note blasting on upper half of head (left). Dark brown spots on leaves and stalk (right) are symptoms of infested plants.

Fig. 22. Combine Sagrain, blackbird resistant variety, on left. DeKalb E56A on right was completely destroyed by birds.

Fig. 23. Milo on ground was knocked out of head by feeding birds.

damage survey. Of the 11 fields checked, representing about twenty per cent of the total acreage in Nansemond County, an estimated fifteen per cent had been destroyed. Blackbird damage accounted for only two per cent of the total amount while anthracnose and insect damage were responsible for the remaining 13 per cent. In the countywide appraisal, insect damage which was very minor was grouped with the anthracnose damage.

During the appraisal of blackbird damaged to milo in October, three different types of damage to this grain were observed; insect damage, fungal damage, and blackbird damage.

Early in the investigation it was suspected that much of the so-called blackbird "damage" was being caused by a sorghum midge (Doering and Randolph 1960:48-49). Doctor Greenwood, entomologist of the Norfolk Truck Experiment Station, was contacted concerning the characteristics of midge damage. With his assistance, field and laboratory examinations were made of damaged milo fields. As a result of these examinations, criteria were established to differentiate between blackbird and non-blackbird damaged milo. When examined under the binocular, it was found that less than ten per cent of the damaged kernels were a result of insect attacks. Insect-damaged kernels showed only a partial grain development. Dipterous puparia found inside the husk in such grains numbered from one to several. The puparia were usually found pressed against the undeveloped kernel (Lange, 1961:7). Emergence holes in the grains suggested some feeding prior to the cessation of growth. After examining insect damaged kernels, it became apparent that when the

pistilate remnants protruded from the husk, the likelihood of dipterous puparia being present would be rather great. Only rarely was an insect, other than the midge (Anonymous, 1960), found. A study of the biology and control of the sorghum midge was published by Walter (1941). In a few cases, parts of mature grains had been eaten by coleopterous insects.

Through the assistance of plant pathologists of Virginia Polytechnic Institute, it was found that a large majority of the so-called blackbird "damage" to milo was caused by anthracnose. Anthracnose and red rot, caused by Colletotrichum graminicolum (Ces.) G. W. Wils., are two phases of a major disease of sorghum in the humid sections of the South (LeBeau, et al., 1951:11). This fungal disease was first described in the U. S. from Texas in 1911. Anthracnose has been recorded in Burma, Java, China, Australia and several other countries having comparable climatic conditions. It has often been described as two different diseases; however, LeBeau treats it as one disease having two distinct phases. Infection first appears as small tan to reddish spots on leaves (Fig. 21). The spores may spread by rain and wind to infect the entire field. If the plants are infected during the blooming period, then the kernels do not develop completely. Several fields through Nansemond County were affected in this manner during the 1960 growing season. Some were so heavily damaged by fungal infection that harvesting of the crop was not profitable.

Previous investigators have reported that, due to blackbird damages to milo in southeastern Virginia, the acreage in milo has been greatly curtailed in recent years. As a result of this investigation, it is the

writer's opinion that a very large percentage of the so-called blackbird "damage" to milo during 1960 was caused by anthracnose. Most of the local farmers insisted that this type of damage was caused by birds. During the damage appraisal, it was noted that no definite pattern of damage over the county was apparent. As opposed to this, blackbirds have a definite pattern of attack (Crebbs, 1960:83) when feeding on milo.

Losses Mistaken for Blackbird Damage

To anyone who has a preconceived idea that blackbirds are "bad," it is almost impossible to distinguish between damage caused by blackbirds and that resulting from other wildlife species. Just as anthracnose was confused with bird damage; squirrel, raccoon, crow, bobolink, sapsucker, flicker, and other wildlife species cause damage which may be undistinguishable to the inexperienced observer (Fig. 18). It is the writer's belief that often farmers erroneously blame the blackbirds for crop losses because they are not aware of the real causing agent. After watching birds numbering in the tens of thousands settle into peanut fields, there is no doubt that a farmer could have a good alibi if his yield was low even though the birds might have caused very little damage.

The peanut is a preferred food of many forms of wildlife (Martin, Zim, and Nelson, 1951:471). From observations during this investigation, peanuts seemed to be more heavily damaged by squirrels than any other wildlife species other than blackbirds. Squirrel damage is usually easily detected since the hull is pulled from the vine and left on the ground at the bottom of the shock (Fig. 17). Also, the hull is torn open along

the long axis as compared to the blackbird-damaged hull which is usually opened only at one end (Fig. 18). Normally, squirrel damage was not found to extend more than 50 to 100 feet from the field edges.

Blackbirds forage through the field, whereas, squirrel and raccoon damage is found only around field borders.

On several occasions, crows and flickers were observed eating peanuts from the shocks. The Yellow-bellied Sapsucker was seen puncturing the peanut hulls and damaging the enclosed nuts (Fig. 18). Milo was damaged by English Sparrows near barns and other dwellings. Migrating Bobolinks numbering in the thousands were observed feeding in milo fields for a period of about three weeks during September. An estimated 5,000 would return nightly to the Nansemond River marsh blackbird roost near Suffolk during the three-week period.

## Trapping Results

Due to the concentrated nature of birds while in the winter roosts, reduction of numbers by lethal means probably could best be conducted in roosting sites. Birds that winter in southeastern Virginia may cause depredations on their more northern nesting grounds. By banding birds in large numbers, it was hoped that a given roost may be identified with one or more summering areas. Once this was accomplished, a section which receives heavy depredations during the summer might be relieved by reducing the population while it is on the wintering grounds. Blackbird investigations have shown that the Dismal Swamp harbors the largest number of birds of any winter roost in the eastern United States. Because

of the importance of this roost to the nationwide blackbird project, attempts were made to band large numbers of migrant birds from this area. The techniques used to capture birds during this investigation included the newly developed floodlight trap and decoy trap described in the techniques section.

Two decoy traps were operated throughout the winter. Both traps operated with a satisfactory degree of success during the first two weeks of November. However, captures during the remainder of the winter were low. After November birds did not feed in the areas near the traps with any regularity. When flocks did settle nearby, the bait was not readily taken. The type of bait and baiting procedures used were those recommended by experienced blackbird investigators. Waste peanuts and corn furnish ample food to blackbirds throughout the winter in southeastern Virginia. The writer is of the opinion that for this reason, the bait around the decoy trap was not sufficiently attractive. Predators caused considerable losses to this trapping operation. The major losses were from birds escaping after dogs and raccoons had dug an opening under the side of the trap. The predator usually dug under at funnel entrances. For this reason, one trap was reconstructed using only confusion entrance type entrances (Fig. 7). This appeared to reduce such losses. It is believed that hawks reduced the catch by lingering near the trap and scaring away passing flocks of birds.

Approximately 250 blackbirds were banded as a result of operating the decoy traps. Of this number 70 per cent were Cowbirds, 25 per cent Redwings, 3 per cent Starlings, and 2 per cent Grackles. Other

investigations, also, found that the Cowbird was the species most frequently taken in the decoy trap (Lefebvre, 1961).

The floodlight trap was operated intermittently during the first two weeks of February. The original quota of 10,000 captured birds was not met due to conditions of the roost; however, much needed information was obtained concerning operation techniques in this type of roost. The trap was set up along a logging road which intersected the roost along the northern edge (Fig. 9). The dense broadleaf evergreen thickets in which the birds roost could be penetrated best by cutting a narrow trail with a machete or brushhook. These trails or driving lanes allowed birds to be scared toward the trap from a two or three acre section of the roost (Fig. 25). Using this driving technique, the trap was operated for three nights with no success. In search of a different driving method, a U. S. Coast Guard Helicopter was acquired for a one night operation. Flying just above treetop level several passes were made over the roost toward the trap. Less than 50 birds were caught during this operation. After accompaning the pilot on this flight, the investigator believes that with modifications this driving technique offers possibilities. Because of the dark night and low altitude during this flight, the ground lights of the plane were used. The noise and downdraft of the aircraft flushed thousands of birds as it crossed the roost. The ground lights made them easily visible as they flushed and milled about in confusion. Being attracted to the plane's ground lights, many birds flew directly toward the plane. According to the pilot strikes (birds hitting plane) were not usually damaging to this type of

aircraft. After being flushed, birds seemed to move a few hundred feet ahead of the plane and settle into the thick cover. It seems that such a flight as this might offer a relatively easy way of pinpointing roosts in such cover as is found in the Dismal Swamp. During this flight the size, major concentrations, and geographical shape of this roost were obtained.

The lack of success of the floodlight trap in this roost is thought to have been due to three primary factors. First, the large size (approximately 2,000 acres) and homogeneous type of adjacent cover allows birds to shift their roosting from one night to another. Second, the cover is too thick to permit well coordinated drives on foot. Third, although an estimated 15 to 20 million birds occupy the roost, the concentration per acre is low when compared to other winter roosts. This type of trap, developed by Patuxent biologists, has met with excellent success when operated under ideal conditions. According to trap personnel during two nights of operating in Arkansas in January, 1961, over 200,000 birds were captured.

Information on birds banded during the floodlight trap operations in the Dismal Swamp roost was compiled and forwarded to the Bird Banding Office by Patuxent personnel.

## Evaluation of Damage Control Techniques

Many control techniques aimed at reducing the severity of blackbird damage to agricultural crops have been field tested (Dustman, 1959). The techniques tested in this study were chosen with respect to types of

crops damaged in this section. They included: (1) resistant varieties, (2) modifications of agricultural practices, and (3) frightening devices. No direct lethal control tests were made; however, much of the information on the Dismal Swamp roost was collected with the thought that this area might offer excellent opportunities for field testing of lethal control techniques if conditions warrant drastic control methods in the future.

Resistant Varieties

Studies of a milo variety which appeared resistant to blackbird damage were conducted at Hog Island Waterfowl Refuge. Field experience has shown that DeKalb E56A, a milo variety commonly planted in southeastern Virginia, is susceptible to blackbird damage, whereas, Sagrain is resistant to blackbird attacks. These were the two varieties of milo tested. Although the two varieties were planted at the same time Sagrain, the resistant variety, matured two weeks earlier than DeKalb E56A, the susceptible variety. The maturation date apparently had no adverse effect on the test since the birds began feeding on the DeKalb variety in late August and continued throughout the fall. The Sargrain variety suffered no, or very minor, damage while the DeKalb variety was completely destroyed (Fig. 22). Much of the milo loss resulted from uneaten grains being knocked to the ground during feeding (Fig. 23). Once all the DeKalb variety was destroyed in the planting, birds did not feed in the area with any regularity. According to local reports the Sagrain variety is not taken as readily by livestock as are other varieties. Tests showed

that the Sagrain variety has an appreciable quantity of oxalic acid; this may influence its palatability. The oxalic acid content of Sargrain and several other varieties of milo is being determined at V. P. I. During the course of these observations at Hog Island, it was noted that deer completely stripped the planting of the Sagrain variety during the month of January. Of course, since the birds had taken the DeKalb variety, none of this variety was left exposed to deer. Sagrain appeared to be as resistant to bobolink and English Sparrow damage as to blackbirds.

## Modification of Agricultural Practices

Modifications of agricultural practices as a technique to reduce blackbird losses to crops potentially offer the quickest and best solution to the problem in this section of the country. Suggested modifications are contained in this paper in the discussion of each crop involved (see results section, appraisal of blackbird damage). Crebbs (1960:86-89) reported in detail on this topic.

## Frightening Devices

One of the oldest and most used of all bird damage reduction techniques are the several types of frightening devices. These frightening devices include scarecrows, rifle and shotgun firing, carbide exploders, rope firecrackers, rotating electric beacons, amplified recordings of distress notes of birds, and a host of other moving objects and noise makers (Dustman, 1959; Hockenyos, 1960:11). Frightening

devices which were field tested during this study included the carbide exploder, shotgun shellcrackers, and rope firecrackers.

The four carbide exploders which were used in a 50-acre milo field seemed to keep away the majority of the feeding flocks of blackbirds. An estimate of the milo saved as a result of operating these exploders was not made. It was noted that other fields nearby which did not use any frightening devices received very little blackbird damage. It is the investigator's opinion that this technique can be used with a reasonable degree of success when properly applied (Neff and Meanley, 1957:72). The volume of sound produced is greater than that of a 12 gauge shotgun blast. The initial cost ranges between $50 and $75 each. The daily cost of operation is low ($.50 each) and labor required is about 10 minutes per day for each exploder.

One local farmer used the rope firecracker with a fair degree of success in a 10-acre peanut field. This technique was preferred because it allowed the operator a chance to vary intervals between blasts. The blasts were preset to occur at a more rapid rate during hours when feeding activity was the greatest. The operating cost of this technique is greater than that of the carbide exploder, although the initial cost is much less.

The shotgun shellcracker is effective in scaring birds from fields, although the cost of maintaining a shooter on constant duty would be expensive.

As suggested by Neff and Meanley (1957:75) a combination of two of these techniques might yield satisfactory results. It is believed that

during this study the cost of operating the frightening devices was as great or greater than the value of the crops saved.

## Distribution and Abundance of both Resident and Migrant Blackbirds

Much emphasis was placed on the locating and studying of roosts during this investigation. Should large scale reduction by lethal means prove feasible, a roosting site would be the most likely place of application of the agent. Because of the gregarious nature of blackbirds, winter roosts containing large populations are scattered all along the Atlantic Coast (Fig. 24).

### Summer Roosts

The summer roost in the marsh on the Nansemond River a few hundred yards north of the Suffolk Corporate Limits was kept under observation throughout the study period. During the first part of July, Starlings and a few male Redwings began occupying this roost. The numbers gradually increased until mid-September when approximately 15,000 blackbirds used the roost. Migrating Bobolinks numbering about 8,000 occupied the roost jointly with the blackbirds for the first three weeks of September. As the Bobolinks began to leave the area, the blackbird roost was moved two hundred yards across the river and south of the previously occupied site. The roosting area contained 10 to 15 acres of river marsh with a dominating stand of marsh grass, Spartina cynosuroides. The roosting population reached its peak in early November. It was assumed that part of this population began roosting in the Dismal Swamp

at this time since there was a gradual decrease at the marsh roost. A large majority of the birds which remained throughout the winter in the Nansemond River roost were Redwings.

Winter Roosts

Blackbirds began to arrive in sizable numbers in late October. Cowbirds came about one to two weeks before the Redwings and three to four weeks before the Grackles. The first indications of roosting activity in the Dismal Swamp was noted November 3. At this time, a few scattered flocks of 20 to 30 birds each entered the swamp from the west. The first big buildup of the Dismal roost came suddenly during the second week of November. From this time until mid-March, continuous flight lines numbering in the tens of thousands were observed entering and leaving the swamp from all sides.

Searches for the Dismal Swamp winter roost were begun in November. Due to the vastness of the area and the thickness of the vegetation of the swamp, traveling was by boat whenever possible. Moving along logging roads (hunter access roads) and canals, the directions of flight-lines entering the swamp were plotted from thirty different locations (Fig. 12). It was found that birds did not fly straight to the roost, especially while flying over cleared land. But once they were airborne over the swamp, their flight-lines would be headed in the general direction of the roost. In one case, birds entering the swamp three miles south of Suffolk flew about two miles into the swamp in a westerly direction before bearing south toward the roost. Also, most

Table 3. Locations of major winter roosts east of the Appalachians (Meanley and Webb, 1960). Roosts are plotted on map in Figure 24

| Specific Area | | County | State |
|---|---|---|---|
| 1. | Raritan River estuary | Middlesex | New Jersey |
| 2. | Dallastown | York | Pennsylvania |
| 3. | Hanover | York | Pennsylvania |
| 4. | Artificial Island | Salem | New Jersey |
| 5. | Patapsco River | Anne Arundel | Maryland |
| 6. | Choptank River | Talbot | Maryland |
| 7. | Fishing Bay | Dorchester | Maryland |
| 8. | Crisfield | Somerset | Maryland |
| 9. | Whiton | Worcester | Maryland |
| 10. | Bullbeggar Creek | Accomac | Virginia |
| 11. | Tappahannock | Essex | Virginia |
| 12. | Hopewell | Prince George | Virginia |
| 13. | Dismal Swamp* | Norfolk | Virginia |
| | | Camden | North Carolina |
| 14. | Greensboro | Guilford | North Carolina |
| 15. | Columbia | Tyrrell | North Carolina |
| 16. | Tarboro | Edgecombe | North Carolina |
| 17. | Pinetown | Beaufort | North Carolina |
| 18. | Engelhard | Hyde | North Carolina |
| 19. | Trenton | Jones | North Carolina |
| 20. | Clemson | Pickens | South Carolina |
| 21. | Bolivia | Brunswick | North Carolina |
| 22. | Atlanta | Fulton | Georgia |
| 23. | Back River | Berkeley | South Carolina |
| 24. | Santee River estuary | Charleston | South Carolina |
| 25. | Montgomery | Montgomery | Alabama |
| 26. | Savannah River estuary | Jasper | South Carolina |
| 27. | Moody Air Force Base | Lowndes | Georgia |
| 28. | Appalachicola River swamp | Calhoun | Florida |

* Located and studied in detail during this phase of the blackbird investigation.

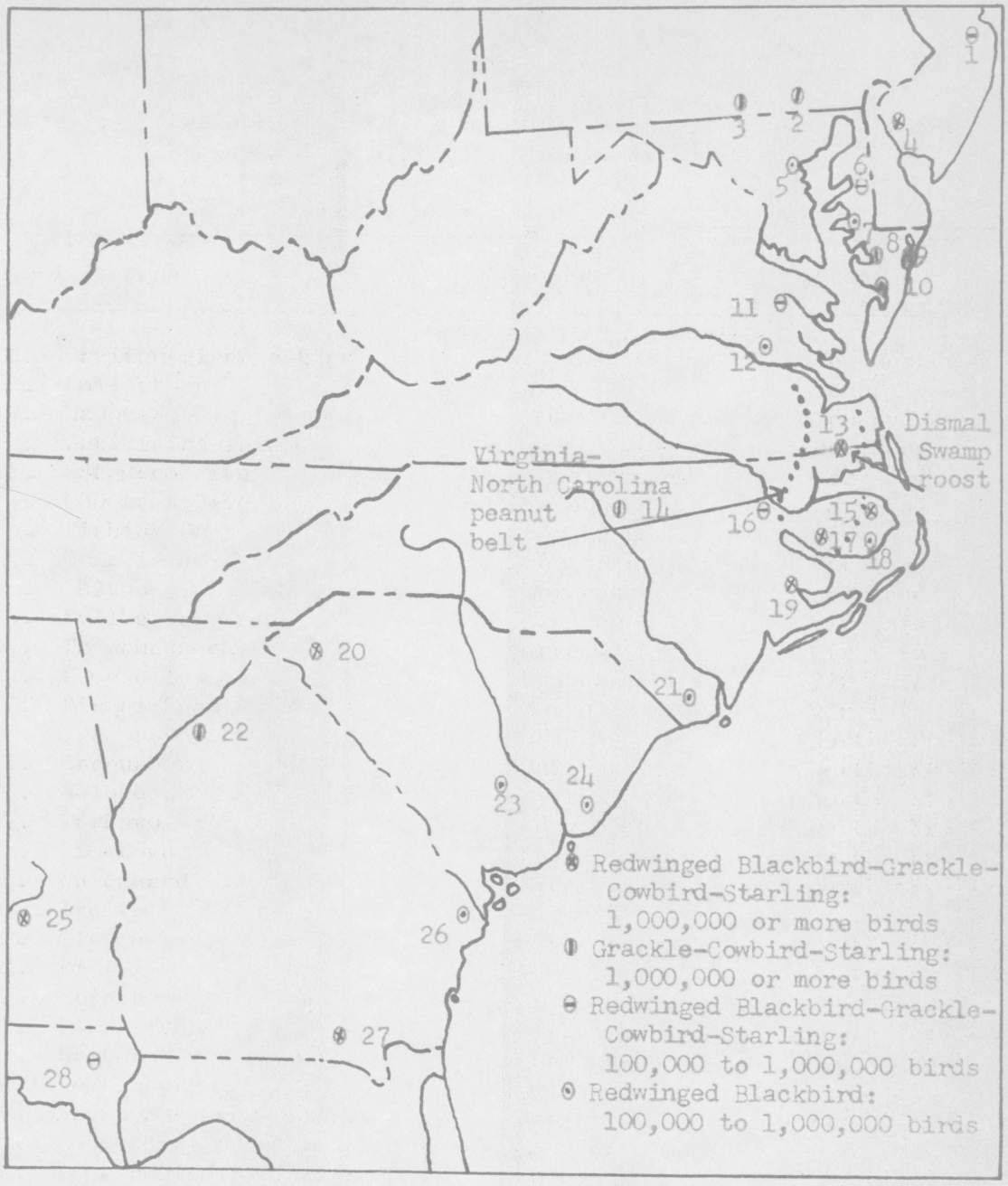


Fig. 24. Distribution of winter blackbird roosts east of the Appalachians. Dismal Swamp roost was studied in detail during this investigation. Note Virginia-North Carolina peanut belt. Roost locations are given in Table 3.

Table 4. Principal plants of the Dismal Swamp blackbird winter roost

| Species | Common Name | Occurrence |
|---|---|---|
| *Ilex glabra* | Gallberry | dominant |
| *Lyonia lucida* | Tetter-Bush | very often |
| *Smilax laurifolia* | Greenbrier | very often |
| *Persia barbonia* | Red Bay | often |
| *Myrica cerifera* | Waxmyrtle | often |
| *Cyrilla racemiflora* | He-Huckleberry | scattered |
| *Kalmia angustifolia* | Sheep Laurel | scattered |
| *Pinus serotina** | Pond Pine | often |
| *Pinus taeda* | Loblolly Pine | scattered |

* Composed the limited overstory.

Table 5. Principal plants of the summer roost on the Nansemond River in a tidal marsh

| Species | Common Name | Occurrence |
|---|---|---|
| Spartina cynosuroides | Marsh Grass | dominant |
| Baccharis halimifolia | Sea-Myrtle | scattered |
| Iva frutescens | High-Tide Bush | scattered |
| Typha spp. | Cattail | scattered |
| Hibiscus patustris | Marsh Mallow | scattered |
| Carex spp. | Sedges | scattered |
| Scirpus spp. | Bull-Rush | scattered |

Fig. 25. Broadleaf evergreens three to ten feet in height were the dominant vegetative species of the Dismal Swamp roost. Note white string left foreground and center used to mark driving lanes.

of the birds observed entering from the west would fly around the south edge of Lake Drummond rather than across the lake which in some cases would have been the shortest route to the roost. Both Fish Crows and Common Crows flew along the same routes into the swamp as were taken by the blackbirds. Often due to the size of the crows, blackbird flight-lines can be followed or seen at a much greater distance.

During the latter part of December, the large winter roost was pinpointed in the Dismal Swamp after much effort. Its location is approximately two miles west of Highway #17 along the Virginia-North Carolina state line. Measuring from the east to the west side of the roost, its width is about one mile. The largest portion is believed to be in North Carolina (Fig. 12). Crows numbering in the thousands occupied the southern-most part of the roost. A very large percentage of the blackbirds of southeastern Virginia appeared to be using the winter roost in the Dismal Swamp. A few thousand birds continued to use small summer roosting areas on the Nansemond and Pagan Rivers, but no other roosts were located. After observing evening and morning flights along an estimated 100 miles of logging roads, canals, and ditches in the Dismal Swamp, it is the investigator's opinion that most of the black-birds roost in the main Dismal roost. It is possible that roosting sites are changed from one year to another. According to previous investigators, the main roost of the Dismal area is thought to have been located in sections different from its winter, 1960-61, location. The roost covers an estimated 2,000 acres of pocosin-type plant community. The cover consists primarily of thickets of broadleaf evergreens

Fig. 26. Blackbirds settling down in the Dismal Swamp winter roost.

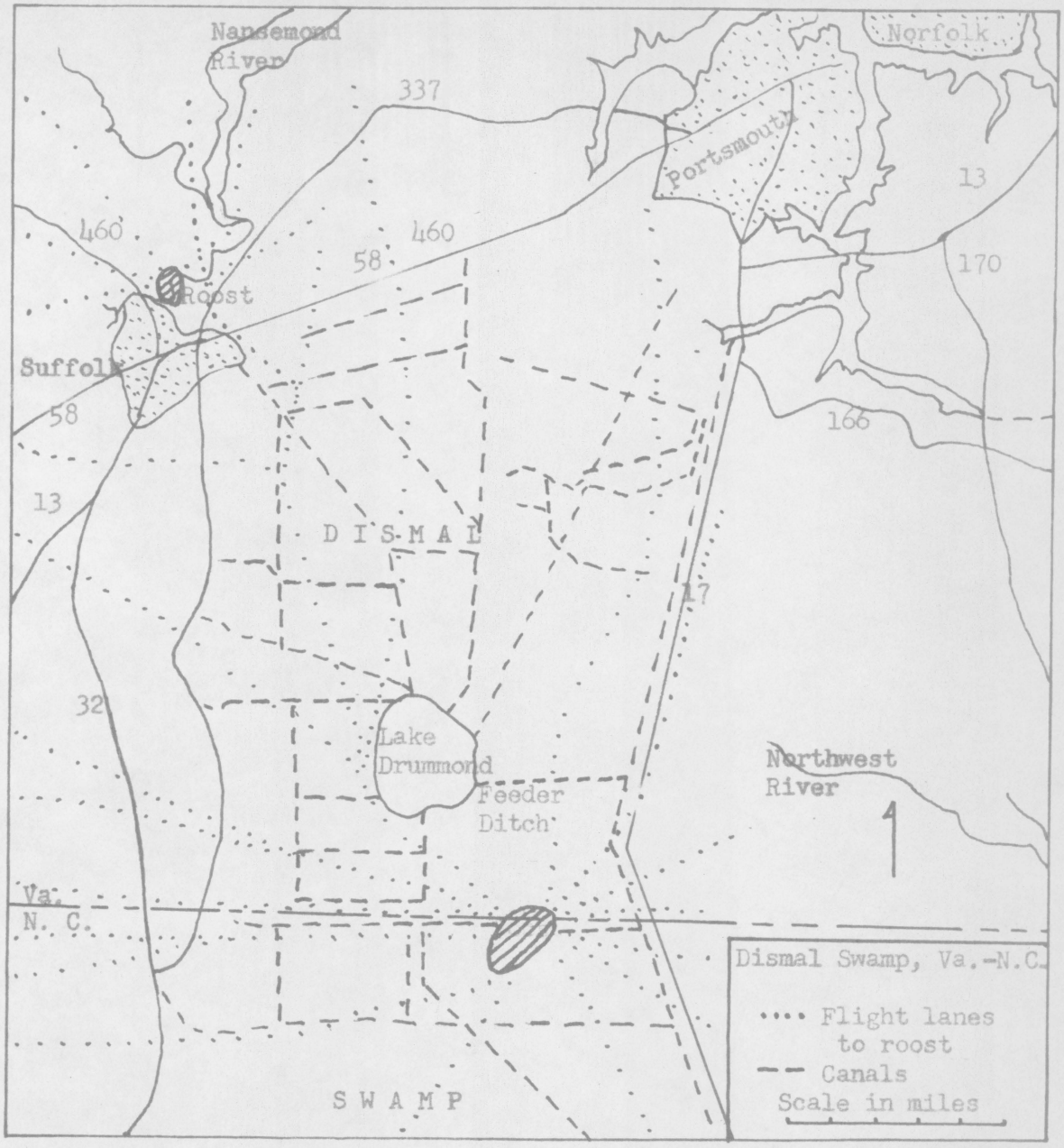


Fig. 27. Flight lanes to and from Dismal Swamp winter and Nansemond River summer roost during 1960-61.

3 to 10 feet high with a scattered overstory of pocosin pine, Pinus serotina (Fig. 25 and Table 4). According to early records, the vegetation of this section of the swamp is much the same now as it was when William Byrd and a surveying party pushed the Virginia-North Carolina line through "that green sea." The thickness of the cover is best described by notes from Byrd's journal: "Skirts of Dismal Swamp on the east is reeds 10 to 12 feet high entangled everywhere with strong bamboo-bryers in which mens feet were perpetually entangled. ... never was rum, that cordial of life, found more necessary than in this dirty place."

## Flocking and Feeding Behavior

### Habits of Migrant Flocks

As birds flew to and from the roost, they were often observed settling to perch as if resting in tall trees. After checking out several reports from local persons of small scattered roosts in different parts of the swamp, it appears that such pre-roost resting points are often mistaken for nightly roosts. The resting stops may be observed anywhere along the flight lanes to the main roost. In no case was the same point used with any regularity, but different ones seemed to be established and vacated each night. It was noted that such perching points were always in tall trees (over 20 feet high), and not in the low type of vegetation in which the birds roost. As a flight-line crossed the swamp, for no apparent reason a few hundred birds would settle and mill about in two or three usually hardwood trees while the majority of

the flock continued flying toward the roost. After perching for 10 to 20 minutes, they would take flight in the direction of the roost. Birds began to first fill into the roost about 15 minutes before sundown (Fig. 26). For about 30 minutes before dark, there is a tremendous chorus and chattering of birds milling about between the scattered pine trees and tall shrubs. As dark approaches, the noise subsides and the birds settle into the low entagled mass of broadleaf evergreens for the night. At the breaking of dawn, the chatter again is heard as the flocks fill the sky in flight to feeding grounds.

Species seem to segregate within the roost. In the northeastern part of the roost in which the light trap was operated, Redwings and Grackles seem to be the predominate species. Past Christmas Census records show that more Grackles and Cowbirds entered the swamp from the west while most of the Redwings entered from the east. Relatively smaller numbers of all species seem to forage north and south of the swamp. This is thought to be due to the much better feeding grounds found to the east and west. Shifts of species and varied sizes of feeding flocks were noted during the wintering period. The flight lane which entered from the swamp from the west along the Virginia-North Carolina line supported the heaviest bird "traffic" throughout the winter. About mid-January, a shift occurred which brought tremendous flocks of Redwings over the northwestern edge of the swamp daily. Some Starlings were observed using the Dismal roost; however, the numbers involved were much lower than are reported in other comparable roosts.

## Habits of Resident Birds

Most of this study involved migrant birds because resident birds are relatively few in number and do only a limited amount of crop depredating. However, during midsummer and early fall pertinent information concerning residents was recorded. As previously noted, flocks began to build up in early July. These were composed primarily of Starlings and separate flocks of male Redwings.

Both residents and migrants displayed a peck-order while feeding. After one bird had eaten for a short time and left the top of a peanut shock or milo head, another which had been feeding on the ground or a nearby perch would occupy the vacated feeding position.

Territorial or singing perches which had been occupied the previous nesting season were taken up by male Redwings on warm spring-like days in early February. It is not known whether these were migrant or resident birds.

## SUMMARY AND CONCLUSIONS

In an effort to determine type, extent, and distribution of agricultural damage by blackbirds, county-wide damage appraisals were conducted in the fall of 1960. Crops checked included corn, peanuts, and milo. Based on the 96 fields examined throughout Nansemond County, the average monetary loss to the corn crop was slightly less than $.05 per acre. This loss can be reduced by planting a variety with a high degree of ear drooping and planting as early as possible. The peanuts appeared to be the crop most heavily damaged. An estimated 50 per cent of the crop was picked before blackbirds arrived. Of the part of the crop left exposed after the arrival of the blackbirds, only a small portion sustained damages amounting to above $5 per acre. By harvesting peanuts at an early date, losses to blackbirds can virtually be eliminated. The 1960 milo crop was not damaged by birds nearly so severely as previous crops were reported to have been. Anthracnose, a fungal disease, accounted for about 86 per cent of the damage previously called "bird damage." An estimated 15 per cent of this crop was destroyed by anthracnose, insects, and birds. In the case of all three crops, it was noted that the first and most severe damage was to those fields nearest nesting and roosting habitat.

Large scale trapping operations were conducted using the newly developed floodlight and decoy traps. In terms of numbers captured, the floodlight trap was not too successful; however, much was learned with respect to operation techniques in the "pocosin" type roost. A new

driving technique, the use of a helicopter, was tried. The writer is of the opinion that with modifications this technique can offer valuable assistance. The two decoy traps which were operated throughout the winter captured approximately 250 blackbirds.

Damage control techniques evaluated during this investigation include resistant varieties, modifications of agricultural practices, and frightening devices. Test plantings of milo at Hog Island Waterfowl Refuge indicated that Combine Sagrain is highly resistant to blackbird damage. Modifications of peanut culture practices probably would eliminate blackbird damage to this crop. According to agricultural extension personnel, the technique of combining and artificial drying is fast becoming the common practice. Harvesting in this manner removes peanuts from the field before any migrant blackbirds arrive. Scare devices field tested include the carbide exploder, rope firecracker, and shotgun shellcrackers. These techniques appear to be helpful <u>if</u> used properly in cases where severe damage is expected.

The largest winter roost in the eastern United States was pinpointed during this phase of the blackbird investigation in southeastern Virginia. The winter, 1960-61, roost of 15 to 20 million blackbirds was located in an approximate 2,000 acre growth of broadleaf evergreen shrubs of the Dismal Swamp. Due to the remoteness of its location, this roost might present an excellent chance for future field testing of lethal controls should such become feasible.

Pre-roost stops, believed to have been mistaken for roosts by some observers, were noted along flight lanes to main roost. These

consisted of tall trees where birds stopped and milled about while on the way to the roost. It was noted that not until birds became airborne over extensive woodlands did they fly in a straight line to the roost.

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ABSTRACT

of

# RESIDENT AND MIGRANT BLACKBIRDS IN SOUTHEASTERN VIRGINIA: AGRICULTURAL DEPREDATIONS AND WINTER ROOST LOCATIONS

by

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This study was initiated as a result of reports of blackbird damage to agricultural crops of southeastern Virginia. To become familiar with the "nuisance" problem, it was necessary to investigate the biology and ecology of the species involved. Phases of this study included appraisals of crop damage, productivity, distribution and abundance, control techniques, and behavior habits of both resident and migrant blackbirds. The purposes of this study were to determine: (1) ecological relations of blackbirds in southeastern Virginia; (2) type, extent, and distribution of blackbird damage to agricultural crops; (3) ways of reducing blackbird damage to these crops.

According to crop appraisals in Nansemond County during the fall of 1960, the peanut crop sustained the greatest damage. Fifty per cent of this crop was harvested before blackbirds arrived on the wintering grounds. Of the part of the crop left exposed after the arrival of the migrant flocks, less than one half sustained damages amounting to $5 per acre. There was much less damage by blackbirds to milo than had been previously reported. During the appraisals, it was found that about 86 per cent of the damage previously called "bird damage" was caused by a fungal disease, anthracnose. On a county-wide basis, an estimated 15 per cent of the milo crop was destroyed by anthracnose, insects, and birds. Throughout Nansemond County, the average monetary loss to the corn crop was slightly less than $.05 per acre. In a few isolated cases, the loss was more apparent. Blackbird damage to these crops was greatest near nesting and roosting sites.

One large winter roost was found in the Dismal Swamp which was occupied by 15-20 million migrant blackbirds. The location of the roost was in low broadleaf evergreen vegetation about one to two miles west

of the Intracoastal Waterway near the Virginia-North Carolina state line.

Large scale trapping operations were conducted using the newly developed floodlight and decoy traps. It was learned that present operational techniques of the floodlight trap are not productive when employed in roosts of pocosin type vegetation. Two large decoy traps were operated during the winter months. The total of 250 blackbirds were captured, banded, and released, in hopes of learning more about the flyways and nesting areas of those birds which winter in southeastern Virginia.

Blackbird damage to crops of southeastern Virginia does not appear to be as great as in some sections of the United States. The existing losses in this section may be minimized by modification of agricultural practices.