

CONSERVATION SECTION

BIRD DAMAGE TO CORN IN THE UNITED STATES IN 1970

CHARLES P. STONE, DONALD F. MOTT, JEROME F. BESSER
AND JOHN W. DE GRAZIO

Accurate assessments of agricultural losses to birds are difficult to obtain, but are fundamental in evaluating the necessity for, and effectiveness of, damage control. Some estimates of statewide losses have been made, but most extensive surveys to date have had little empirical basis, cannot be compared statistically, and were subject to many biases.

The results of the first nationwide survey of bird damage to corn are reported in this

TABLE I
DAMAGE PATTERNS IN 24 MAJOR CORN-PRODUCING STATES IN 1970

State	Corn acreage (thousands)	Counties		Fields		Corn ears	
		Number surveyed	% with damage	Number surveyed	% with damage	Number examined	% with damage
Alabama	545	36	16.67	61	9.84	1,152	1.04
Florida	322	19	0.00	79	0.00	1,365	0.00
Georgia	1,426	61	4.92	105	2.86	2,641	0.57
Illinois	10,066	78	15.38	188	7.44	6,848	0.45
Indiana	5,027	79	16.46	147	10.88	5,277	1.06
Iowa	9,990	89	1.12	197	1.02	6,897	0.03
Kansas	1,285	38	7.89	112	3.57	3,267	0.15
Kentucky	988	56	33.93	110	18.18	3,043	2.50
Maryland	484	19	57.89	92	19.57	2,538	3.55
Michigan	1,444	37	45.95	116	25.00	3,891	4.81
Minnesota	4,594	49	20.41	158	8.86	7,623	1.08
Mississippi	248	43	37.21	73	28.77	1,305	5.21
Missouri	2,837	63	6.35	150	3.33	4,100	0.27
Nebraska	4,897	60	5.00	169	1.78	5,374	0.13
New York	279	29	62.07	75	41.33	2,698	6.92
North Carolina	1,345	61	11.48	143	4.90	4,709	0.28
Ohio	3,014	60	31.67	133	19.55	4,684	2.82
Pennsylvania	943	37	64.86	121	34.71	3,844	8.32
South Carolina	402	27	40.74	95	16.84	2,262	2.17
South Dakota	2,496	39	33.33	105	18.10	2,606	1.42
Tennessee	569	38	34.21	91	19.78	2,246	1.60
Texas	531	35	8.57	128	4.69	3,070	0.68
Virginia	458	46	21.74	73	12.33	2,294	2.53
Wisconsin	1,794	46	32.61	133	15.04	4,896	2.45
Totals and means	55,984	1,145	21.92	2,854	15.60	88,630	1.82

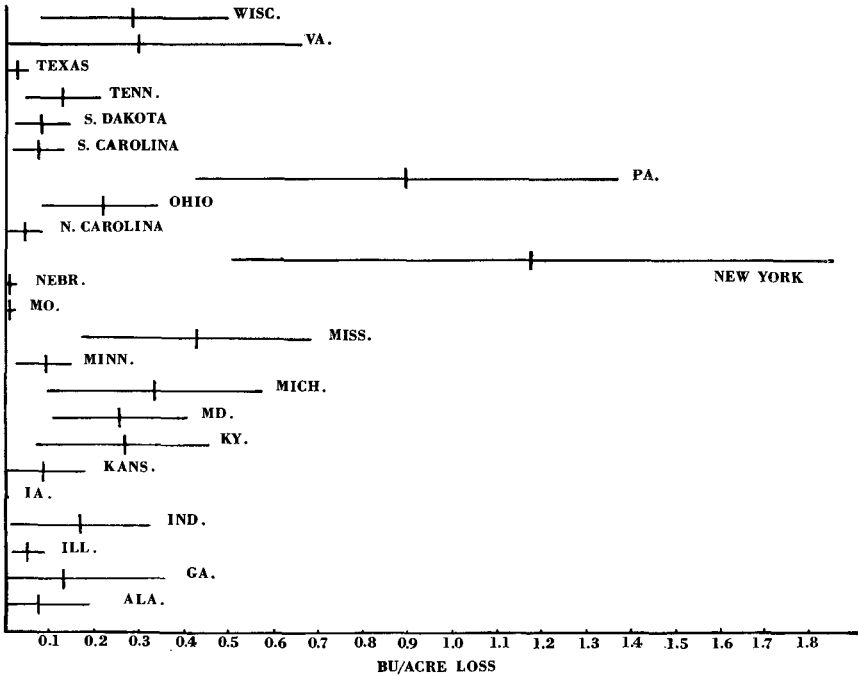


FIG. 1. State corn losses to birds in 1970 (mean bu/acre loss and 95 per cent confidence limits).

paper. The data were collected in a similar manner in each state, and a statistical approach permitted establishment of confidence limits on damage estimates. Valid comparisons of data from the various states are thus possible for the first time. The approach also permitted the mapping of damage according to presence or absence in the counties surveyed. For the states with which we are most familiar, the pattern appears realistic, and for other states it is revealing, but merits further study.

METHODS

The 1970 bird damage survey was conducted under an interagency agreement between the Bureau of Sport Fisheries and Wildlife and the Statistical Reporting Service (SRS) of the U.S. Department of Agriculture. Enumerators employed by the USDA to conduct the annual Objective Yield Survey for corn, were introduced to bird damage in different stages of corn maturity through a slide series and handouts prepared by the authors.

The sampling frame employed by the SRS during their final pre-harvest survey was used to estimate bird damage. Enumerators were asked to complete an additional form relating to bird damage for the fields normally surveyed. Fields were randomly chosen and two 15-foot units of two rows each were randomly established in each field. Enumerators recorded the number of ears of corn with kernels in the first row in each unit. They also measured the average length of damaged and undamaged kernel rows to the nearest 0.1 inch for each damaged ear in the first row of each unit. Bureau personnel

TABLE 2
ESTIMATED STATE CORN LOSS TO BIRDS IN 1970

State	Mean bu/acre loss \pm S.E. (tos)	Mean bushel loss \pm S.E. (tos)	Mean dollar loss ¹
Alabama	0.0774 \pm 0.1132	42,183 \pm 61,694	\$ 63,275
Florida	0.0000 \pm 0.0000	—	—
Georgia	0.1296 \pm 0.2351	184,810 \pm 335,253	277,215
Illinois	0.0540 \pm 0.0363	543,564 \pm 365,396	815,346
Indiana	0.1716 \pm 0.1607	862,633 \pm 807,839	1,293,950
Iowa	0.0018 \pm 0.0027	17,982 \pm 26,973	26,973
Kansas	0.0811 \pm 0.0969	104,214 \pm 124,517	156,321
Kentucky	0.2651 \pm 0.1941	261,919 \pm 191,771	392,879
Maryland	0.2542 \pm 0.1492	123,033 \pm 72,213	184,550
Michigan	0.3356 \pm 0.2400	484,606 \pm 346,560	726,909
Minnesota	0.0896 \pm 0.0678	411,622 \pm 311,473	617,433
Mississippi	0.4253 \pm 0.2584	105,474 \pm 64,083	158,211
Missouri	0.0114 \pm 0.0141	32,342 \pm 40,002	48,513
Nebraska	0.0140 \pm 0.0165	68,558 \pm 80,801	102,837
New York	1.1791 \pm 0.6761	328,969 \pm 188,632	493,454
North Carolina	0.0426 \pm 0.0386	57,297 \pm 51,917	85,946
Ohio	0.2180 \pm 0.1373	657,052 \pm 413,822	985,578
Pennsylvania	0.8957 \pm 0.4732	844,645 \pm 446,228	1,266,968
South Carolina	0.0750 \pm 0.0577	30,150 \pm 23,195	45,225
South Dakota	0.0812 \pm 0.0606	202,675 \pm 151,258	304,013
Tennessee	0.1271 \pm 0.0868	72,320 \pm 49,389	108,480
Texas	0.0257 \pm 0.0255	13,647 \pm 13,541	20,471
Virginia	0.2983 \pm 0.3559	136,621 \pm 163,002	204,932
Wisconsin	0.2861 \pm 0.2086	513,263 \pm 374,228	769,895

¹ At \$1.50/bushel.

converted the length data to weight of corn lost (in grams) through use of the mathematically generated table developed by De Grazio et al. (J. Wildl. Mgmt., 33:988-994, 1969). It is possible that the table underestimates damage somewhat, and this is being checked at present. Confidence limits were established at the 95 per cent level for bushel-per-acre losses in each state and for total bushel losses for the 24 states surveyed. The data for each state were weighted according to corn acreage grown in order to calculate the overall mean and confidence interval (Cochran, Sampling Techniques, 1953). The 24 states surveyed accounted for 98 per cent of the acreage harvested and for 97.5 per cent of the corn produced in the United States in 1970, according to the SRS.

RESULTS AND DISCUSSION

The estimated mean of the direct corn loss to birds in the 24 states was 0.1112 \pm 0.1880 bu/acre, or 6,225,421 \pm 10,524,992 bu (95 per cent confidence limits). At \$1.50/bu, the dollar loss amounted to \$9,338,132 \pm 15,787,488. Based on USDA production figures, birds accounted for 0.16 \pm 0.26 per cent of the total corn crop in the 24 states in 1970.

Corn damage according to numbers of counties and fields surveyed and ears damaged

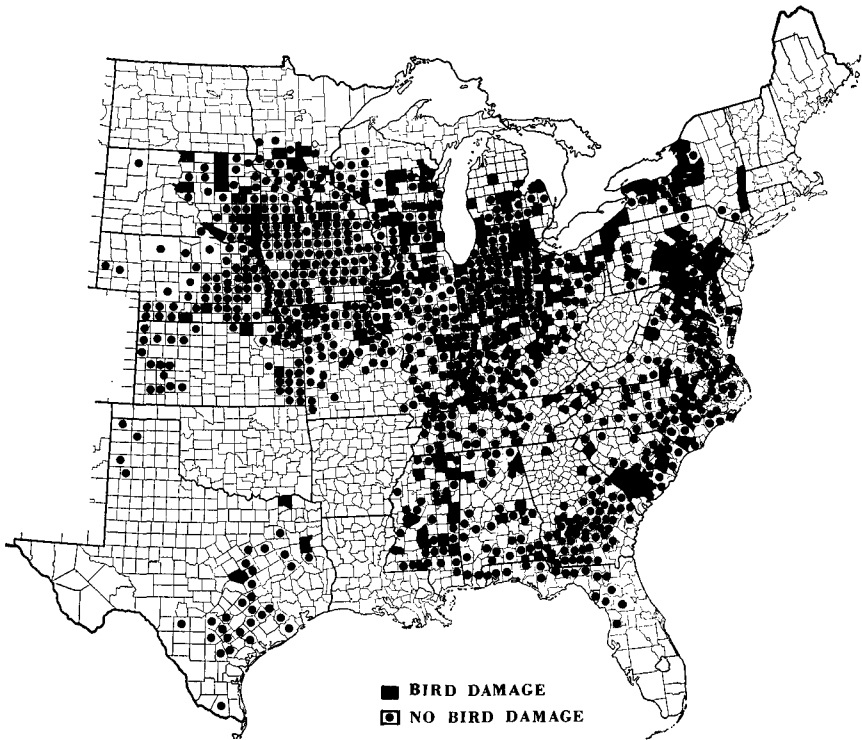


FIG. 2. Distribution of bird damage to corn in 1970 by counties.

in each state is summarized in Table 1. Kentucky, Maryland, Michigan, Mississippi, New York, Ohio, Pennsylvania, and South Carolina showed higher than average damage by all three analyses. These states also suffered relatively high bushel-per-acre losses, although the confidence intervals overlapped considerably with those of other states (Fig. 1). It is evident, however, that bushel-per-acre losses were particularly high in New York and Pennsylvania and comparatively low in Texas, North Carolina, Nebraska, Missouri, Iowa, and Illinois.

The greatest economic losses, determined by a combination of considerable acreages of corn and relatively high bushel-per-acre losses, occurred in Illinois, Indiana, Michigan, Minnesota, Ohio, Pennsylvania, and Wisconsin (Table 2). However, high bushel-per-acre losses in states with relatively low acreages of corn (such as New York) are of obvious importance to the growers involved. The low bushel-per-acre losses in Iowa and Illinois, which together accounted for 35.8 per cent of the corn acreage in the 24 states, are noteworthy.

Counties that contained at least one survey field, and those in which at least some bird damage occurred in 1970, are shown in Figure 2. Probably damage in 1970 was lessened by the rapid corn maturation and early harvest, which resulted in part from an infestation of southern leaf blight.

SUMMARY

The first nationwide survey of bird damage to corn was conducted in 1970; 24 states producing over 97 per cent of the U.S. corn crop were sampled. The total direct loss to birds was estimated to be 6,225,421 bushels \pm 10,524,992 bushels (95 per cent confidence limits). New York and Pennsylvania suffered the high losses per acre, and Indiana, Illinois, Wisconsin, Ohio, Pennsylvania, Michigan, and Minnesota showed high total losses.

ACKNOWLEDGMENTS

We wish to thank John L. Oldemeyer of this Center for statistical advice, and Ann H. Jones, also of this Center, for editorial comments.

BUREAU OF SPORT FISHERIES AND WILDLIFE, DENVER WILDLIFE RESEARCH CENTER, DENVER, COLORADO 80225, 22 OCTOBER 1971.

PUBLICATION NOTES AND NOTICES

A NATURAL HISTORY OF NEW YORK CITY. Revised and abridged edition. By John Kieran.

Published for The American Museum of Natural History by The Natural History Press, Garden City, New York, 1971: $4\frac{1}{2} \times 7\frac{1}{4}$ in., paper covered, viii + 308 pp. \$2.95.

This is a revised and updated edition of the original book published in 1959 (and favorably reviewed in *The Wilson Bulletin*, 72:298, 1960). Mr. Kieran tells not only a great deal about the natural history of his city, but also how to see often inconspicuous plants and animals. His enthusiasm for his subject should arouse many New Yorkers to seek it for themselves. They will be amazed to find how much wildlife remains in spite of environmental decay. The illustrations that graced the original edition have unfortunately been deleted from this one.—P. S.

ECOLOGY OF COLORADO MOUNTAINS TO ARIZONA DESERTS. By Helen Moenke. Museum Pictorial No. 20, Denver Museum of Natural History, Denver, Colorado, 1971: 6×9 in., paper covered, 96 pp., many col. and hl. and wh. photos. \$2.50.

This booklet is accurately self-described as "An interpretive study of the ecology of plants and animals exhibited in life zone habitat groups in the Walter C. Mead Ecological Hall of the Denver Museum of Natural History." Based on these exhibits, the text discusses ecological relationships in sequence from the alpine tops of Colorado's Rocky Mountains down through the life zones to the Sonoran deserts of Arizona. Photographs of these superlative exhibits and of plants and animals in nature are included. The booklet is edited by Alfred M. Bailey, and therefore is up to the high standards of previous Museum Pictorials. It will help travelers in Colorado to see behind the scenery.—P. S.