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## DECLINE OF A BLACKBIRD POPULATION DURING SEVEN YEARS OF BAITING WITH A CHEMICAL FRIGHTENING AGENT

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In the early 1960's, Sand Lake National Wildlife Refuge, Brown County, South Dakota, served as an assembling area for the largest late summer blackbird congregation known to us in the Northern Great Plains or the western portion of the Cornbelt. Approximately 4,000 acres of cattail (*Typha*) and reed (*Phragmites*) at the Refuge served as ideal roosting habitat for blackbirds. In August and September each year, postbreeding flocks of blackbirds from northern South Dakota, North Dakota, and Canada assembled to molt in these marshes and to feed on the abundant blackbird foods in the surrounding agricultural lands before migrating to wintering areas in the southern United States and Mexico.

Most of these foods were provided by large acreages of ripening corn, oat stubblefields, and cut-over haylands, all of which also contained a variety of weed seeds, especially pigeon grass (*setaria*), a preferred Redwing food (Mott *et al.*, 1972). Ripening cornfields adjacent to the Refuge marshes frequently lost from 5 to 25 bushels per acre to blackbirds in the early 1960's. During that period, we began intensive studies in the area, testing most of the methods already in use for protecting cornfields from blackbirds, along with many other methods that had indicated potential when used for other problems (De Grazio, 1964). However, we achieved substantial protection on only a few fields until we began using a chemical frightening agent, 4-aminopyridine (4AP), on large acreages in 1964. Beginning at that time, both the Sand Lake blackbird population and the damage they caused to ripening corn began to decline. In this paper, we discuss this decline and its probable cause.

### *Study Methods*

**Blackbird population.** The population that roosted in Sand Lake marshes usually peaked during the last week of August and the first week of September. From 1962 through 1971, the number of birds in this peak population was determined between August 25 and September 10 by counting birds on all flightlines emanating from the Refuge marshes. There were as many as 41 of these flightlines in a single year. Counts were started before sunrise as birds began departing from the roost and continued until all birds had left.

**Damage appraisal.** Blackbird damage was determined each year from 1962 through 1971 in a 94-section study area encompassing all cornfields within 2 miles of the Refuge marshes. Damage was measured by the method developed by De Grazio *et al.* (1969b) after corn had reached the hard-dent stage. Usually about 15 percent of about 325 cornfields were sampled each year, and an effort was made to sample fields in the same quarter section each year.

4-Aminopyridine Treatments. In 1964, the first treatment with 4AP was tried on an 8-section block of the most heavily damaged cornfields. Partially husked ears (five ears per 2 acres) were sprayed with 4AP that year (De Grazio *et al.*, 1971). In 1965, the same 8-section block was treated by broadcasting cracked corn baits containing 4AP (De Grazio *et al.*, 1972). In 1966, cracked corn baits treated with 4AP were made available to farmers for application in all cornfields within 10 miles of the Refuge, a 508-square-mile area in which about 58,000 acres of corn were grown. From 1966 through 1971, farmers in this area baited as many of these fields, and as often, as they believed economically profitable.

#### *Effects on the Blackbird Population*

During the 7 years that 4AP was used in cornfields near the Sand Lake marshes, the blackbird population roosting at the Refuge in late August and early September declined by more than 80 percent (Table 1). Damage to the cornfields decreased by more than 90 percent during the same period (Table 1). In response to the decreasing damage, the total acreage the farmers baited and the amount of bait they used also declined steadily after 1966, the first year that bait was available to protect all cornfields within 10 miles of the roosts (Table 1).

The two most likely reasons for the decline in the Sand Lake blackbird population and the subsequent decrease in corn damage are: (1) a decrease in production of blackbirds, and (2) a change in established migration patterns, either naturally occurring or caused by the 4AP treatment.

The evidence is against a decrease in production of blackbirds during the years that the decline took place, especially for Red-winged Blackbirds (*Agelaius phoeniceus*), which caused most of the damage to corn at Sand Lake (De Grazio *et al.*, 1969a). Four censuses of territorial male Red-wings conducted in a 30,000-square-mile area of North Dakota and northern South Dakota showed that the number of breeding males varied only between 1.6 and 1.7 million between 1966 and 1971. From banding recoveries, we know that this area was the origin of most of the Redwings involved in the Sand Lake problem.

This leaves a change in migration patterns as the probable reason for the decline. We believe that many of the blackbirds that had traditionally roosted in the Sand Lake marshes and fed in nearby cornfields shifted their routes and roosted and fed elsewhere. Through banding and color marking during the years of our studies, we found that many of the adult male Redwings that molted in the Sand Lake marshes and fed in adjacent cornfields returned in successive years, following an annual pattern similar to their return to breeding territories each year. In fact, some male Redwings were recaptured on the same flightlines where they had been originally marked. Most of this recurring population, however, apparently learned to avoid the area in 1966-1971. Furthermore, there was no great change in blackbird habitat at Sand Lake between 1962-65 (when the population was relatively stable) and 1966-71 (when it was steadily declining) (Table 1). For these reasons, we believe that the change in migratory routes did not occur naturally but was caused by the use of the chemical frightening agent.

If baiting over a large area with a chemical frightening agent for several years is capable of causing a shift in a migratory pattern of a blackbird

population, we suggest that a coordinated baiting program by crop growers in similar areas can provide additional (and perhaps substantial) protection to crops grown in subsequent years, even after control efforts are relaxed.

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Table 1. Relationships of blackbird numbers, corn loss, and 4-aminopyridine treatments at Sand Lake Refuge, South Dakota, 1962-71.

Year	Blackbird numbers <sup>1</sup>	Corn loss <sup>2</sup> (bu/acre)	4-Aminopyridine treatments	
			Acres treated	Bait used (lb)
1962	1,345,000	2.38 ( $\pm 1.37$ ) <sup>3</sup>	0	0
1963	1,434,000	2.48 ( $\pm 1.31$ )	0	0
1964	1,797,000	1.80 ( $\pm 1.13$ )	1,013	Ears sprayed
1965	1,421,000	2.24 ( $\pm 1.66$ )	1,129	3,400
1966	900,000	1.30 ( $\pm 0.53$ )	5,000	11,000
1967	858,000	0.71 ( $\pm 0.33$ )	4,000	9,000
1968	718,000	0.80 ( $\pm 0.34$ )	4,500	9,600
1969	689,000 <sup>4</sup>	1.37 ( $\pm 0.34$ )	3,300	7,400
1970	130,000	0.22 (NC)	2,700	3,800
1971	250,000	0.17 (NC)	2,350	4,900

<sup>1</sup>between August 25 and September 10.

<sup>2</sup>Loss in cornfields within 2 miles of roosting marshes.

<sup>3</sup>95% confidence limits (NC = not calculated).

<sup>4</sup>Numbers peaked about September 15.