

Swallows. Although Burt (Anim. Behav. 25:231-239, 1977) has shown that Barn Swallows do not start to recognize their young until the time of fledging, Grzybowski (Condor 81:236-246, 1979) demonstrated that parents can discriminate between their own young and experimentally presented young of a different developmental stage. The intruder's success in acquiring food on two feeding visits from adults in 30 min was probably a function of the severe time constraints on parents with broods of this age and size. The parents averaged 20-30 feeding visits per hour which left little time to remove the intruder from the nest and increased the probability of making a mistake since many of the visits were brief. Similar feeding errors in Bank Swallows (*Riparia riparia*) have been reported (Hoogland and Sherman, Ecol. Monogr. 46:33-58, 1976; Beecher et al., Anim. Behav. 29:86-94, 1981). But in this species, as in Barn Swallows, the parents are usually able to chase off or evict alien fledglings.

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Cowbird control and its effect on Kirtland's Warbler reproductive success.—Kirtland's Warbler (*Dendroica kirtlandii*) is the subject of international interest and was officially listed in the U.S. as an endangered species in 1967 because of its precarious status. Reasons for the decline of the Kirtland's Warbler population are complex and not fully understood. Parasitism of warbler nests by Brown-headed Cowbirds (*Molothrus ater*) has been suggested as one cause. Kirtland's Warbler is particularly vulnerable to nest parasitism (Mayfield, *The Kirtland's Warbler*. Cranbrook Inst. Sci., Bloomfield Hills, Michigan, 1960).

Since 1972 the U.S. Fish and Wildlife Service has conducted an intensive program of cowbird removal in the Kirtland's Warbler nesting areas in the northern lower peninsula of Michigan. Shake and Mattsson (Jack-Pine Warbler 53:48-53, 1975) reported on cowbird control efforts from 1972-1974. The present report summarizes the Fish and Wildlife Service's cowbird control program and its effect on warbler nesting and fledging success from 1975-1981.

Cowbird decoy traps were erected on nesting areas located in Crawford, Kalkaska, Ogemaw, Oscoda, Iosco, and Roscommon counties in Michigan. The number of traps in operation varied from 28-40 during 1975-1981. Traps were placed at approximately square mile (1.6 km²) intervals within nesting areas. A more detailed description of decoy traps and trapping methods is given by Shake and Mattsson (1975). The nesting data for 1972-1981 were collected by Nicholas Cuthbert and Lawrence Walkinshaw under contract with the U.S. Fish and Wildlife Service.

During 1975-1981, 24,158 cowbirds were removed from the Kirtland's Warbler nesting areas, an average of 3451 birds per year. When combined with data from 1972-1974 the total number of cowbirds removed by trapping is 33,536 (Table 1).

Concomitant with the cowbird control program there was a substantial decrease in cowbird parasitism on Kirtland's Warbler nests. Walkinshaw (Am. Birds 26:3-9, 1972) reported that from 1931-1971, 59% (54 of 91) of Kirtland's Warbler nests examined were parasitized. In 1972, the parasitism rate dropped to 6% (2 of 31) of the nests examined (Fig. 1). Cowbird parasitism of Kirtland's Warbler nests has ranged from 0-9%, and averaged 3.4% over the 10 years of the cowbird control program.

TABLE 1
BROWN-HEADED COWBIRDS REMOVED FROM KIRTLAND'S WARBLER NESTING AREAS IN MICHIGAN, 1972-1981

Year	Males	Females	Juveniles	Totals
1972-1974 ^a	5659	3421	298	9378
1975	2026	1463	161	3650
1976	2223	1964	112	4299
1977	1845	1405	34	3284
1978	1754	1639	18	3411
1979	1959	1722	10	3691
1980	1538	1429	0	2967
1981	1770	1085	1	2856
Totals	18,774	14,128	634	33,536

^a Shake and Mattsson (1975).

In conjunction with the reduction in the parasitism rate, there was a substantial increase in the number of young warblers fledged per nest examined. Walkinshaw (1972) reported that warbler nests averaged fewer than one young fledged per nest during the period 1931-1971. In 1972, the number of young fledged per nest (mean clutch-size = 4.22) averaged 2.84



FIG. 1. Kirtland's Warbler fledging success in relation to cowbird parasitism on nesting areas in Michigan.

(Shake and Mattsson 1975) and during the subsequent 9 years of the cowbird control program the average number of young fledged per nest per year has varied from 2.1–3.2 with an average of 2.76 young fledged over the 10 years of cowbird removal (Fig. 1).

The principal objective of the U.S. Fish and Wildlife Service's cowbird control program is to reduce cowbird parasitism of warbler nests and consequently increase the total Kirtland's Warbler population. In spite of the cowbird control program, the Kirtland's Warbler population has not increased substantially. In 1971 the census of Kirtland's Warblers revealed the presence of 201 singing males (Mayfield, *Auk* 82:263–268, 1972). The annual survey of singing male Kirtland's Warblers during the 10 years of cowbird control has varied from 167–243 birds and averaged 207 (Ryel, *Jack-Pine Warbler* 59:93–95, 1981).

The adverse effects of cowbird parasitism have long been recognized; however, other factors influencing Kirtland's Warbler population levels are not well defined. The Kirtland's Warbler has very specific nesting habitat requirements, needing young jack pine (*Pinus banksiana*) stands of fire origin. Studies are being conducted to determine the critical vegetation requirements of their breeding habitat (Buech, *Jack-Pine Warbler* 58:59–72, 1980).

The lack of increase in Kirtland's Warbler numbers also emphasizes the need for information on the warbler after fledging, during migration, and on the wintering grounds in the Bahama Islands. Researchers have speculated that wintering conditions may be more severely limiting than the breeding habitat (Mayfield, *Jack-Pine Warbler* 53:39–47, 1975; Ryel, *Jack-Pine Warbler* 59:76–91, 1981).

Considering the data indicating greatly reduced nest parasitism and increased nesting success, it is evident the cowbird control program on the Kirtland's Warbler nesting areas has been successful. The cowbird control program appears to have been essential to the survival of this endangered species. However, additional research is needed to identify and evaluate factors which continue to limit Kirtland's Warbler population levels.

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Unusual nest sanitation by a Broad-winged Hawk.—The following observations were made from a tree blind placed 7.5 m horizontally from and 1 m above a Broad-winged Hawk (*Buteo platypterus*) nest 3.9 m up in a trembling aspen (*Populus tremuloides*) in Lincoln County, Wisconsin. Three times on 21 June 1980, one of us observed the same tending adult fly less than 1 m down from a perch in the nest tree to the nest and nibble at the recently excreted feces from a brood of two (4 and 5 days old). The feces had not cleared the nest and one of two nest-supporting tree trunks. We believe the hawk consumed the feces because much of the excreta had disappeared and at no time did it shake its head to rid the beak of the material. We obtained two photographs of this hawk with stains of feces on its beak and observed this behavior by this adult on six other occasions. The behavior sequence was usually as follows: the perched adult would watch as a nestling showed intention movements (rump elevation and backing toward nest rim) preparatory to defecation; when the ejected feces did not clear the nest and/or support trunk, the adult would instantly jump to the nest and nibble at the debris clinging to the nest or tree. The adult always consumed feces which were deposited on the nest or its supports during the 84 h and 39 min of observation from