Kirtland's Warbler—endangered

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Normal survival of adult birds . . . more than enough suitable habitat. Why then has the Kirtland's Warbler suffered such a drastic decline?

On May 30-31, 1931 Richard E. Olsen, A. D. Tinker and I visited, for the first time, the breeding ground of Kirtland's Warbler (*Dendroica kirtlandii*). It was in an extensive Jack Pine (*Pinus banksiana)* area, about four miles southeast of Lovells, Crawford County, Michigan. The Jack Pines, six to 15 feet tall, were densely spaced in many areas, widely scattered in others, and almost lacking in many clearings. A dirt road through the center of the tract indicated that a fire, some eight to ten years earlier, had jumped the road. We camped in one of the clearings, and during two days became well acquainted with the 25-30 singing male Kirtland's Warblers present. I found one female building a nest, well hidden by blueberries four to six inches tall, at the base of a small Jack Pine. On June 15-19 Richard and Humphrey Olsen and I again visited the region. The May 31 nest contained only one Kirtland's egg, deserted. But we did find a second nest, with five 3-4 day old nestlings.

During late May 1932 my wife and I visited this region again and explored farther, finding two large tracts near Red Oak, Oscoda County, where there were even more Kirtland's Warblers present. We returned to these latter regions in mid-June and soon I found another Kirtland's nest which held one Kirtland's egg and two Brown-headed Cowbird eggs. I removed the latter and the bird continued to incubate her lone egg. It hatched June 24. Since she was very tame, I sometimes sat on the ground beside the nest. At times she landed on my feet, hat, arms, even my hands. If I parted the low blueberry bushes above the nest, she flew to a little branch above and looked apprehensively down at the nest, then hopped onto my hand. I took several photographs of her, then caught and banded her with number F64468. She was the first Kirtland's Warbler to wear a band.

During 1933 Al Dowding and I stopped to examine a nest found earlier by others. After locating the nest, they had removed two cowbird eggs, but the Kirtland's Warbler had deserted her two eggs. Since then I have found that they seldom, if ever, desert three eggs (of any combination) and that if one or two are cowbird eggs, they can be destroyed without removal by piercing them with a fine wire. But there is another danger; there are times when the smaller warbler's eggs will not hatch because (Mayfield, 1960) the larger cowbird's eggs may prevent the setting female from providing her own eggs enough heat.

At the Red Oak colony we found another Kirtland's nest, with only one fledgling — a cowbird. Although we searched through favorable Jack Pines in both the northern Michigan peninsula and across northern Wisconsin we found no more Kirtland's Warblers.

On May 13, 1937 I found a few singing males directly west of Grayling, Crawford County, about two miles west of Lake Margrethe. On May 29-30, 1938 I located a female building a nest there. Four eggs were laid, one daily, June 5-8 and one cowbird egg on June 5. The cowbird egg was removed but only one (#1) egg hatched, June 22, 15 days after incubation began. This female was also very tame. She ate flies, moths and other insects from my hand, landed on my arm and shoulder and soon, she too, was wearing a band. After she was banded, she came right back and pecked my fingers when I touched the nest. I found two other nests. Neither was parasitized. One held five eggs, four of which hatched; the other, five half-grown nestlings. All of these nests were still intact when we left in late June except five young had already fledged. Jack Pines here were 20 feet or more in height. The ground cover over two nests was blueberry

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(*Vaccinium* sp.), over the third, Sheep Laurel (*Kalmia angustifolia*). Predators seemed at a minimum and cowbirds were scarce. While driving past this region June 23, 1940, I heard a male Kirtland's Warbler singing, stopped and soon found his nest with five nestlings (no cowbirds). As I sat banding the half-grown young, a slight noise attracted my attention. There on a branch three feet away sat a banded female Kirtland's Warbler. Both birds were captured, the male banded, her number verified. She was the bird I had banded in 1938, about 1,000 feet to the west. The male disappeared the next year and this ended this colony.

In 1941 I found a nest with 5 eggs in the old Lovells colony but apparently a house cat devoured it the night of July 4. A summer home had been built right in the heart of the colony. I worked periodically on this species in Michigan, and when Van Tyne and Mayfield were preparing their book on the bird, submitted my notes to them.

During 1951, our family aided in the count of singing males. We located a colony near East Tawas in Iosco County, where Jim Ponshair, Peter Hovingh, Jr. and I found a nest (5 young) in June 1953. A day later we found another nest north of Atlanta, Montmorency County (5 eggs) and observed another nest in southern Presque Isle County. My wife and I censused Oscoda County in May-June 1961. During this count, Fenn Holden located several singing males and a nest (4 eggs) on June 27 in a recently-burned tract of 2,307 acres 15 miles northeast of Grayling, Crawford County. The fire had started here, August 19, 1955. This was the youngest growth in which anyone had found Kirtland's Warblers nesting. Nearly half of this region was again burned about May 18, 1967. In early July 1966 William A. Dyer, William Coates, Kenneth Krum and I located three Kirtland's Warbler nests here. Two contained only cowbird eggs or young, while four additional pairs with young, had only cowbird fledglings. One nest of seven fledged two Kirtland's young.

From my records, 1931-1955, only seven of 29 Kirtland's Warblers nests were parasitized by cowbirds. Fifteen of these nests contained 5 eggs or young. Yet from 1957 through 1971 only four nests of 68 contained 5 eggs (all 5 disappeared in one nest when the cowbird laid her belated eggs) and only 17 had 4 eggs, while 47 were parasitized. It appeared that as the trees became taller, the nests were parasitized less often. See

Female Kirtland's Warbler, 15 m.n.e. Grayling, Mich., July 2, 1966. Photo/Lawrence H. Walkinshaw.

Table 1

Kirtland's Warbler Egg Success, 1931-1971

Years	Eggs laid	Eggs hatched	Young fledged	Where most Jack Pines were in height: 15 feet and under			15-16 feet and over		
				Eggs laid	Eggs hatched	Young fledged	Eggs laid	Eggs hatched	Young fledged
1931-48	65	51	41	42	33	23	23	18	18
1953	15	10	10	15	10	10	—	—	—
1954	5	5	5	5	5	5	—	—	—
1955	5	5	5	—	—	—	5	5	5
1957	39	9	9	39	9	9	—	—	—
1966-68	24	10	7	24	10	7	—	—	—
1969	24	6	6	24	6	6	—	—	—
1970	48	27	17	—	—	—	48	27	17
1971	29	16	12	—	—	—	29	16	12
Totals	254	139	114	149	73	60	105	66	54
Per cent	100	54.7	44.88	100	48.9	40.3	100	62.8	51.4

Table 1. The evidence of parasitism increasing, especially from 1957 through 1971, is shown in Tables 2 and 3, and the evidence of aid to breeding success when cowbird eggs and young were removed is shown in Table 4. Our data for some nests is incomplete, but where we removed 36 cowbird eggs or young, 15 and possibly 29, Kirtland's young fledged. Considering that the species numbers only about 400 individuals, these 15-29 birds could have been an important increment.

In other areas, both well managed, cowbird traps have been used for several years. One area has been supervised by Nicholas Cuthbert and Central Michigan University, the other by Bruce Radabaugh and the Detroit and Pontiac Audu-

Table 2

Contents of Kirtland's Warblers nests

Years	Number of Kirtland's Warbler eggs where no cowbird eggs were laid							Number of Kirtland's Warbler eggs where cowbird eggs were laid					
	0	1	2	3	4	5	6	0	1	2	3	4	5
1931-55	1	1	2	0	2	15	1	2	1	1	1	2	0
1957	1	0	0	0	0	0	0	0	0	2	3	4	2*
1966-68	0	0	1	2	2	0	0	7	1	0	0	1	0
1969	0	0	0	1	1	0	0	1	1	1	2	2	0
1970	2	0	0	3	1	1	0	0	3	1	3	4	0
1971	2	0	3	0	0	1	0	1	0	6	2	0	0
Total nests	6	1	6	6	6	17	1	11	6	11	11	13	2*
Total eggs	6	1	12	18	24	85	6	0	6	22	33	52	10*
							146						123
	37 nests with only Kirtland's Warbler eggs, averaged 3.94 eggs per set.							54 nests with both Kirtland's Warbler and cowbird eggs averaged 2.11 KW eggs per set.					

*-Two nests; 1 with 4 eggs, the other with 5 lost all KW eggs after the cowbird laid eggs in them.

7 of 29 nests, 1931-1955, or 24.13 per cent were parasitized.

20 of 25 nests 1957-1968, or 80.00 per cent were parasitized.

7 of 9 nests during 1969, or 77.7 per cent were parasitized.

11 of 16 nests during 1970, or 68.7 per cent were parasitized.

9 of 13 nests during 1971, or 69.2 per cent were parasitized.

bon Societies. By removing cowbirds they aided the warbler, but one wonders how low the population might have been if it were not for this aid. The 1951 count was 432, for 1961 it was 502, and in 1971 only 201 singing males were recorded (Mayfield, 1953, 1962, ms.).

A few Kirtland's Warblers desert nests when cowbirds lay in them; one bird built a second bottom over an egg (possibly laid before the nest was completed), but generally if a cowbird lays one or more eggs in a warbler's nest, the nesting will fail.

There were no heavy concentrations of Blue Jays in Jack Pines west of Grayling during 1938-39, nor during the 1930s and 1940s south of Lovells, but Blue Jays increased in the pines in the new areas when they grew to 12-15 feet or taller. During June, 1971, I found three Blue Jay nests on one quarter-section (160 acres).

At one 1967 nest, Steven Walkinshaw and I found two half-grown cowbirds in good condition one morning, but one-half hour later a Blue Jay was at the nest devouring them. They are not selective predators, however, and I feel certain that Kirtland's eggs and young are also taken. At another nest, a Red Squirrel (*Tamiasciurus hudsonicus*) was seen running from an empty nest which had had two nestling cowbirds in it minutes earlier. Thirteen-lined Ground Squirrels (*Citellus tridecem-lineatus*) were observed by William Freeman and Leighton Smith (*pers. comm.*) eating or carrying away nestling Kirtland's Warblers. Losses during my studies are shown in Table 5.

Why does the cowbird do so much damage to the Kirtland's Warbler? First, Kirtland's Warbler nests are host to more cowbird eggs than all other local species. For example, my records of 111 nests of other species show only six with cowbird eggs (1 in each of 6 nests) as compared to 87 cowbird eggs in 54 (of 91) Kirtland's Warbler nests. Species whose nests were found in or within 100 feet of Kirtland's Warbler colonies were: Com. Nighthawk, 14; Eastern Kingbird, 9; Eastern Wood Pewee, 1; Black-capped Chickadee, 2; Brown Thrasher, 15; Robin, 11; Hermit Thrush, 1; Eastern Bluebird, 9; Nashville Warbler, 2; Prairie Warbler, 2; Palm Warbler, 1; Brewer's Blackbird, 5; Vesper Sparrow, 25; Slate-colored Junco, 3; Clay-colored Sparrow, 2; Chipping Sparrow, 9. Parasitized nests were Nashville Warbler, 1; junco, 2; Chipping Sparrow, 3.

Cowbirds return in spring slightly earlier than Kirtland's Warbler. My earliest spring observation for a male Kirtland's Warbler is May 13, 1937. Most are back by May 20 and the females a few days later. Most males return to their past season's territory or to areas adjacent to it. Many males banded by Dr. Frank Novy, E. J. Slomkowski and me have survived until five to seven years old (some are still living). Josselyn Van Tyne had one bird survive to the age of nine. (Mayfield, 1960). Since the trees are getting much taller during these five to seven years, these males and their mates probably have better nest success than younger birds, nesting in areas of smaller jack pines.

Table 3

Nests of Kirtland's Warbler parasitized by the cowbird and unparasitized nests (arranged according to contents)

KW eggs per nest	Unparasitized Nests	Unparasitized Total KW eggs	C eggs per nest				Parasitized nests				
							Nests		Eggs		
			1	2	3	4	Total	Per cent	KW number	C number	C per nest
0	6	0	6	3	1	1	11	20.3	0	19	1.72
1	1	1	2	3	1	0	6	11.1	6	11	1.83
2	6	12	4	5	2	0	11	20.3	22	20	1.81
3	6	18	5	6	0	0	11	20.3	33	17	1.54
4	6	24	10*	2	1	0	13	24.1	52	17	1.31
5	17	85	1	1*	0	0	2	4.0	10	3	1.50
6	1	6	0	0	0	0	0	0	0	0	0.00

Six nests were never observed with either cowbird or Kirtland's Warbler eggs.

*–Two Kirtland's Warbler nests contained complements of 4 and 5 KW eggs before cowbird eggs were laid in them. In the 4-egg nest, I placed 2 infertile KW eggs from another nest after it was deserted, after the rightful 4 KW eggs had disappeared. The next day only the cowbird egg remained.

KW–Kirtland's Warbler; C–cowbird.

Table 4

Success of Kirtland's Warbler nests when cowbird eggs were removed

Year	Kirtland's Warbler			Brown-headed Cowbird			Cowbird eggs removed
	Nests	KW eggs	KW fledged	Parasitized nests	C eggs	C fledged	
1966	7	7 (28)	2	6	9	6	3
1967-68	7	17 (28)	5	3	7	0	1
1969	9	24 (36)	6	7	10	3	7
1970	16	48 (64)	17 (23)	11	16	0	14
1971	13	29 (52)	12 (15)	9	13	1	11
Total	52	125 (208)*	42 (51)*	36	55	10	36

*Numbers in parentheses — numbers possible.

When a female Kirtland's Warbler begins her first nest in late May or early June, groups of watchful cowbirds move from one to another tall stub left over after the fire has swept the area. They must first find, and then parasitize their nests. But 16-17 years after fires, few stubs remain. The taller Jack Pines are now interwoven, and the female Kirtland's can move through the branches and more easily escape detection.

Female Kirtland's Warblers lay one egg daily until the clutch (3-6) is complete. These eggs are laid late in May or early June. Cowbird eggs are laid at any time but usually during the period when the Kirtland's Warbler is laying, more rarely prior to this period. At times eggs are deposited even when the Kirtland's incubation is advanced. If a clutch or young are lost in a nest, Kirtland's Warbler will normally renest, unless it is late June or early July. Even then some birds will renest. If the Kirtland's rears a brood of one or more cowbirds it will not renest. This happens in many nests.

Table 5

Known losses of Kirtland's Warbler eggs and young

Agency	Kirtland's Warbler eggs lost or eaten	Kirtland's Warbler young lost or eaten
Predator (not cowbird)	27	21
Apparently cowbird	37	0
Infertile eggs	11	—
Unknown	1	1
Total	76	22

The Cowbird is a larger bird; its eggs averaged (16) 21.72 X 16.65 mm in measurements and weighed 2.8-3.4 grams. Kirtland's Warbler eggs (138) averaged 18.19 X 14.13 mm and weighed 1.5-2.1 grams. Cowbird incubation periods range between 11 and 13 days but normally are 12 in Kirtland's Warbler regions. I have found Kirtland's Warbler eggs require between 13 and 16 days to hatch (13 days twice; 14 days 5 times; 15 days 5 times; possibly 16 days once). The young cowbird then is two to three days old when the young warbler arrives (if it hatches at all). The young cowbird weighs over 13 grams at that time (weight equal to the average adult Kirtland's Warbler). The newly arrived warbler weighs about 1.4 grams or less. His chances for survival with one or two advanced cowbirds in the nest are slim or nil.

Four examples of nest histories were:

1970 (Nest 67). June 1, nest found with 2 KW eggs, no C eggs. June 15, 3 KW eggs (#1 egg was gone, indicating at least 4 eggs laid). June 16, 2 KW eggs (#2 egg gone), female incubating. June 17, another KW egg gone and a C egg added. Female off at 1400 hrs but back at 1800 hrs. June 18, 1 Cowbird egg only — deserted. June 22, I placed 2 infertile KW eggs from another nest in this nest. June 23, only 1 Cowbird egg in nest. This female laid her first egg in a second nest June 23, 915 feet south of the first nest.

1970 (Nest 70). June 16, female building nest. June 19, 1KW egg; June 20, 0830 hrs, 2 KW eggs, 1 C egg, 1200 hrs, #2 egg was gone; June 21, a 3rd KW egg had been laid; June 22, no evidence of a new egg; June 23, nest contained #3 and #4 KW eggs only and 1 C egg. I poked a hole in the egg with a fine wire. July 7, 1 small KW. Nest OK when last observed July 10.

1971 (Nest 86). June 20, nest found with 2 KW eggs and 1 C egg and 1 newly hatched C. Neither KW egg hatched. The young C was removed and the KW commenced renesting. Another nest with 2 C found without any KW eggs or young.

1971 (Nest 96). June 26, nest found well concealed beneath blueberry (*Vaccinium pensylvanicum*) and grass (*Andropogon*, probably *scoparius*). Contents 1 C which weighed 13.4 grams; 2 KW young which weighed 1.4 and 2.4 grams respectively.

This is not the only battle Kirtland's Warbler is losing. Hundreds of people go each year, by groups or individuals, to see this rare bird. Many wish to merely observe the bird but a fair percentage want photographs. They often search out nests, open up the cover, then leave the nests badly exposed for predators. Some even come with recorders and recordings. I found one young man with a playback system placed in the top of a small Jack Pine. He stood over his camera 15 feet away, played the recorder and was trying to get a Kirtland's Warbler photograph "Better than any ever taken." The male, with his new mate (they had not begun to nest) was so agitated he left his mate, flew back and forth repeatedly trying to locate the opponent on his territory. This species has been photographed so much, and many excellent photographs taken, that I suggest that photographers might try some species that would really give them a challenge — for example, Le Conte's Sparrow or Connecticut Warbler. But the majority of visitors are content to roam the Jack Pines watching and studying the birds without disturbing them.

The use of the region by Michigan, Indiana and Ohio National Guard units did have some bearing on the status of the species. Orders were given in 1967 to prevent the use of tanks through the region during the breeding season. Probably the fires would not have started without the artillery fire, but tanks could have and may have done considerable damage if allowed to run rampant during the nesting season through a region occupied by Kirtland's Warbler.

Land developers continue to buy up the "North Woods," offering home-sites for sale. Oil men continue to make soundings, even along the border of Kirtland's nesting range. And there is a continual increase in summer homes in the area.

On the other hand, Michigan's Department of Natural Resources and the National Forest Service aided in management practices. Some tracts were burned, and several others planted to pines in April and May 1958. Trees were planted 4 feet apart, in rows 6 feet apart, 10 rows planted and 15 rows skipped (to provide openings), and the rows were curved to utilize nearby stands. In all 267,400 Jack Pines, 2,000 Red Pines (*Pinus resinosa*) and 1,950 White Spruces (*Picea glauca*) were planted. During 1971 the Lovells region had 12-14 singing male Kirtland's Warblers.

Now that the region has been tested, improvements are planned. One improvement would be to plant an additional 5 rows of trees in the 15-row space, undulating them from one 10-row planting to the other. This would give the birds a chance to move through small trees from one tree group to the other without crossing a large clearing. It would also give nearly one-half as many more trees for future harvesting.

SURVIVAL

The serious decrease of Kirtland's Warbler — 502 singing males in 1961 to 201 in 1971 — reflects the immediate peril in which the species finds itself. Sixty-two of the 201 singing males were located on and adjacent to my study area. Mayfield (1960:205-206) estimated the annual mortality of adults at about 40 per cent, the average life span of an adult bird in June about 2 years. My studies indicate that Kirtland's War-

Table 6

Survival of Four Species of Michigan Breeding Birds

Species	Males			Females		
	Number banded as adults	Average survival after banding	Oldest survival after banding	Number banded as adults	Average survival after banding	Oldest survival after banding
Prothonotary Warbler, *Protonotaria citrea*	18	2.44	5.5 (2)	59	1.84	5.0 (1)
Kirtland's Warbler, *Dendroica kirtlandii*	30	2.77*	7.5*(2)	27	1.83*	4.5*(1)
Acadian Flycatcher, *Empidonax virescens*	21	2.98	5.5 (2)	27	2.76	6.5 (1)
Traill's Flycatcher *Empidonax traillii*	30	1.87	5.5 (1)	34	1.97	7.5 (1)

*A number of Kirtland's Warblers are still living.

bler lives as long as other small birds, possibly even longer. In the following table, many of the Kirtland's Warblers are still living. With the other species, all birds are now gone.

From this data it is suggested that once reaching adulthood, Kirtland's Warbler lives a normal small bird life span, perhaps longer than many similar birds. If this is so, we may rule out as reasons for the species' decline excessive loss of adult birds on breeding or wintering grounds, or in migration, from whatever cause. The drastic decrease in numbers apparently must be attributed to failure to produce new generations at population-maintenance levels, and the evidence seems overwhelming that the primary reason at present is loss of eggs and/or young in the nest, caused chiefly by cowbirds and predators. Since the available suitable habitat, in recent years of decline has, if anything, increased, we cannot blame habitat loss for this situation.

Jack Pine Stand, 15 mi. n.e. Grayling, Crawford County, Mich., July 2, 1966. Photo/Lawrence H. Walkinshaw.

No studies have ever been made of the total fauna on Kirtland's Warbler breeding grounds. My own observations tell me that Blue Jay, red squirrel, spermophiles, and possible snakes, have increased. The cowbird must have increased prodigiously: where only 7 nests of 29 were parasitized 1931-1955, 47 of 63 nests (74.6 per cent) were parasitized, 1957-1971.

The number of eggs per nest has decreased since 1955. From 1931 to 1955, the average number of eggs per clutch was 4.48 (1-6); between 1957 and 1971, in 16 unparasitized nests, 3.25 (2-5). In parasitized nests, all observed with either or both Kirtland's Warbler and cowbird eggs, the average number of Kirtland's eggs 1931-1955 (7 nests) was 2.0; 1957-1971, (47 nests), 2.12 eggs per set. Most of the unparasitized nests had full complements when I found them, so it could not have been my disturbance causing this change. It must be from other sources.

What should be done?

1. Surveys of all animal life should be made on certain measured tracts in the Kirtland's Warbler breeding grounds.
2. Comparisons of hatching and fledging success should be made of all species of birds on these grounds.
3. Predation should be controlled for a period of time, even if it means removal of some forms of wildlife.
4. Visitors should be discouraged, except to view the birds from a distance. Photography and the use of sound recorders, except for studies, should be eliminated.
5. Cowbird traps should be maintained on all larger warbler tracts.
6. A trailer, which could be moved from one area to another, would be useful for protectors and students of the species. (Funds needed).
7. New areas should be planted for future use by the warbler. Similarly, controlled fires might be used in managing suitable areas.
8. Banding activities should be discouraged, except for authorized studies. Controlled banding might give clues as to the species' longevity, and might detect other causes of population loss, especially on the Bahama Islands wintering grounds, where no one has found any numbers of birds in this century. Banding on the breeding grounds should involve watched mist nets, which cause the least disturbance.
9. All plans and activities for the study, protection, and increase of the species should be the responsibility of a committee, which is already in formative stages.

By these measures we may yet save, for a few generations at least, this beautiful bird whose survival is in our trust.

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