1961 DECENNIAL CENSUS OF THE KIRTLAND'S WARBLER

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IN 1951, one hundred years after the discovery of the Kirtland's Warbler, *Dendroica kirtlandii,* 32 people participated with me in a count of singing males of the species throughout its nesting range (Mayfield, 1953). This was perhaps the first attempt of any group to census an entire species of songbird.

In 1961 we repeated the count in exactly the same way, with 48 participants. The number of male Kirtland's Warblers in 1961 was 502, as compared with 432 in 1951. This is a 16 per cent increase but leaves the total population of adult warblers still in the vicinity of 1,000 birds of both sexes —a perilously low number for a species of small migratory birds.

METHOD

This census was feasible because of the well-known habits of the bird. It nests on the ground among small pines (Christmas-tree size) growing in nearly homogeneous stands of considerable extent, usually more than 32 hectares (80 acres). The only pines producing the necessary conditions in natural growth are jack pines, *Pinus banksiana*; but where plantings of red pines, *Pinus resinosa*, duplicate the conditions, the birds have sometimes accepted these also.

The loud and distinctive song of the Kirtland's Warbler carries on a quiet day as much as two-fifths km (one-fourth mile). In good weather on June mornings, a male on territory sings persistently; the probability of song from a male on territory in a five-minute period is 85 per cent, according to data on eight males I have timed in various stages of the nesting process (Mayfield, 1960: 134). Since individuals tend to cluster in chosen areas, isolated males rarely occur, and a "colony" is seldom without song. The terrain is mostly level or gently rolling, with fire lanes or roads on most section boundaries and with sand trails suitable for cars leading into many of the sections. And, most important of all, many competent observers in Michigan know the bird well and are willing to put great effort into a census of this kind.

Because of this knowledge it was possible to limit the area of search to reasonable proportions. The investigation covered the pinelands in and adjacent to the 12 counties in northern Lower Michigan (Mayfield, 1960: 10) where Kirtland's Warblers have been found nesting since the discovery of the breeding ground in 1903. Here we focused our attention on lands where (1) Kirtland's Warblers have been seen within the last 20 years, (2) pines have been planted within the last 20 years, or (3) forest

fires of more than 20 hectares (50 acres) have occurred in the last 20 years.

I gathered information on fires and plantings within the Huron National Forest by visiting the U.S. Forest Service office in Cadillac, Michigan; on plantings in state forest lands by visiting the Michigan Department of Conservation office in Lansing, Michigan; and on fires in state forest lands by correspondence with the district offices of the Michigan Department of Conservation at Gaylord, Traverse City, and Mio.

By these means I identified about 500 sections (square miles) for special attention. In addition I urged the cooperators to explore and inquire of local residents to discover other tracts, if any, meeting the habitat description. I divided the cooperators into 17 small groups, and assigned each group to a part of the range. Usually the leader of the group had a thorough knowledge of his region, and several of them had covered the same region in the previous census. I supplied each group leader with county maps, after marking with colored pencil those sections where there had been warbler sightings, pine plantings, or forest fire.

All groups made their counts in June at various dates convenient to them. The first warblers arrived on the nesting ground in 1961 before 13 May. Some of the cooperators began their reconnaissance in late May, but made no counts before 1 June lest some males had not yet established territories firmly, nor after 30 June although males continue to sing vigorously well into July, because of possible shifts in location by unmated birds and by males feeding young outside their normal territories.

The evidence from the previous census, which was conducted in the same way, had reassured us as to the validity of these methods. In the years immediately after 1951, warblers were found outside the sections reported in the census only in three small colonies. One was a short-lived colony of three pairs found in 1952 by Douglas Middleton on an isolated area of the smallest size on record (13 hectares, or 32 acres). The other two, one of them containing about a dozen pairs and the second containing fewer, were discovered by Fenn Holden.

Of the 12 counties that the warblers have occupied in this century, only Clare and Alpena failed to produce warblers in either census. Since they have nested recently within four-fifths km (one-half mile) of Cheboygan and Missaukee counties, it is probable that the warblers will be found in two more counties in due time. I have not included Wexford County, listed by Van Tyne (1953: 428) and by the A.O.U. *Check-list* (1957: 502), because I believe the single sight record there was probably that of an unmated male, similar to another that remained on the Bruce Peninsula of Ontario through most of June 1958.

SUMMARY OF THE TWO CENSUSES

	1951			*1961*		
County	*Males*	*Townships*	*Sections*	*Males*	*Townships*	*Sections*
Alcona	4	1	1	0	0	0
Crawford	142	7	19	52	6	19
Iosco	74	8	20	30	2	6
Kalkaska	28	1	6	32	2	4
Montmorency	43	2	11	61	2	15
Ogemaw	0	0	0	114	1	5
Oscoda	103	6	19	152	5	22
Otsego	0	0	0	14	1	4
Presque Isle	34	2	13	34	2	9
Roscommon	4	1	2	13	1	2
Totals	432	28	91	502	22	86

The townships in this report are surveyor's units six miles (9.7 km) square (36 square miles, or 94 km^2), and the sections are surveyor's units one mile (1.61 km) square.

The distance between the limits in the 1961 population was about 160 km (100 miles) east to west and about 97 km (60 miles) north to south. These dimensions would seem to encompass the entire modern breeding range of the bird, for no nesting records have occurred outside it except one instance in 1920 in northwestern Clare County about 40 km (25 miles) farther south.

Usually a nesting area remains suitable for only about 10 years while the trees are exactly the right size. Consequently, the nesting localities are constantly shifting within the breeding range. For example, among 91 sections with warblers in 1951, only 41 of these held warblers in 1961, and even here the portions occupied were often different in the second census.

POPULATION TREND

The 1961 count was encouraging, but it does not prove conclusively that there is a real upward trend. Two "snapshots" 10 years apart give only a partial view of what is happening in a population that may be fluctuating considerably from year to year.

Although the Kirtland's Warblers appear to be maintaining their numbers at present, a population of 1,000 songbirds is still in a precarious position. A poor nesting season or a storm in migration might reduce these numbers severely. The birds winter in the Bahama Islands and make overwater flights at the height of the hurricane season. Unlike the large birds that have attracted the attention of conservationists because of their rarity, the Kirtland's Warbler and other small songbirds have short lives in the wild. In this species the average life expectancy of adults in June

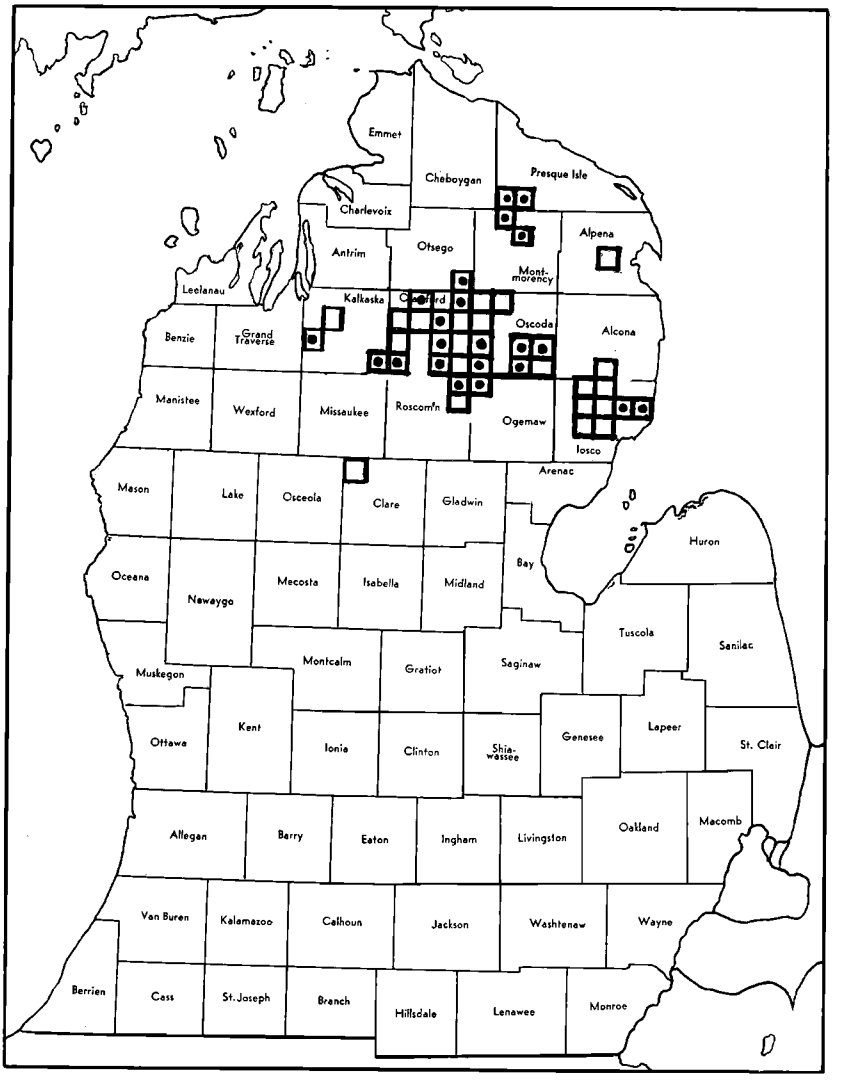

Figure 1. Michigan townships (9.7-km or six-mile squares) where Kirtland's Warbler has been known to nest: 1903–1961, small squares; where found in the 1961 census, dots.

is about two years (Mayfield, 1960: 206). Consequently, two or three bad years could be disastrous.

Efficient distribution of males and females on the breeding ground may be becoming more difficult because the special habitat required by the bird occurs increasingly in pockets isolated from one another by miles of

forest of a different kind. Better control of forest fires may reduce these areas still further. Serious efforts to control forest fires began in Michigan in 1927, and, whereas the average fire in the state burned more than 125 hectares (300 acres) in the first quarter of the century, the average fire burned less than six hectares (15 acres) in the 1940's (Mitchell and Robson, 1950: 20, 28).

In my recent study of the Kirtland's Warbler (1960: 207) my calculations showed such a low reproductive yield that I expressed doubt that the species was holding its own. The 1961 census did not show the predicted decline. Several plausible hypotheses might account for the discrepancy between the success of the entire population and the success of the sample in my study. I will mention three.

1. Nests untouched by human beings may succeed better than those visited repeatedly for study.

2. The present count may have caught a sudden and brief upsurge from one or two favorable nesting seasons.

3. There was an unfavorable ecological factor in my sample, namely, the location of an undue number of the nests in forestry plantings rather than in natural growths of jack pines.

Since a population is affected by such a complex interplay of natural forces, I am not proposing to explain by a single cause the fact that this species exceeded my predictions. But I believe the third hypothesis is worthy of special consideration. Indeed, reexamination of the data shows that nests found in the years 1951–1955 weighed heavily in my analysis of reproductive success. In those years nearly all of the nests studied were in plantations because of a scarcity of natural habitat at that time. In the 1951 census, for example, most of the birds counted were in plantations (Mayfield, 1953: 20), whereas in 1961 most of the birds were once more in natural growths of pines. Up to 1946 we doubted if Kirtland's Warblers would accept the neat rows of a successful planting, for all such examined up to that time were empty, while nearby stands of natural growth had active colonies. Then we revised our view as we began to find colonies in plantations.

We have never doubted, however, that the warbler preferred natural growth. As noted previously (Mayfield, 1960: 15), the birds enter a planting later and leave it earlier than in a natural growth. To explain this fact, I focused attention on the lack of openings and the tendency of the limbs close to the ground to die early in a plantation. Now I point to another aspect of plantations that may be unfavorable also, namely, the deep furrowing of the soil in normal planting practice. This causes severe disruption of the original ground cover, consisting normally of slow-growing perennials and woody plants, leaving much bare ground and

sparse grass. This may reduce the security of the nests in some degree, including their vulnerability to cowbird molestation, a major factor in the warbler's survival (Mayfield, 1960: 144–181; 1961: 174–179). Unfortunately, I do not feel I have enough data on nests in each type of habitat to put this hypothesis to a thorough test. This would be a worthy subject for further study.

In special plantings for the benefit of Kirtland's Warblers on State Forest lands, we have recommended frequent openings and reduction of furrowing, to minimize these presumed disadvantages of man-made habitat.

POPULATION DENSITY

Norman A. Wood (1904: 10), describing his field work in 1903 when he discovered the first nest, remarked, ". . . I examined hundreds of acres where the conditions seemed all right, and found none." Down through the years others also have expressed surprise that the warblers fall so far short of filling the habitat available to them. Many promising areas are empty, and even the occupied areas usually have fewer warblers than one would expect. More than one person visiting a colony briefly, with birds singing all about, has exclaimed that there might be "at least 50 here" or "almost one pair per acre," when the true number was far less.

The highest density yet counted was in a large area in southeastern Oscoda County reported by A. J. Berger and party in 1961. There, in an irregularly shaped area of about 260 hectares (640 acres) extending across parts of two sections, were 63 males, or one male per four hectares (10 acres). Another remarkably high count was that of Lawrence Ryel and party in northwestern Ogemaw County: 114 males on about 618 hectares (1,530 acres) of suitable habitat, or one male per 5.7 hectares (14 acres). Also we have found similar densities several times on smaller areas.

Much more typical, however, was a large area I studied in southwestern Oscoda County in 1961. Here the trees seemed of ideal size, dating from a fire in April 1946, the same time as the fire on Berger's area. I counted 18 males in three scattered clusters (colonies) in about 242 hectares (600 acres) of suitable habitat, or about one male per 13 hectares (32 acres). This is very close to the average density (one male per 33 acres) found in the 1951 census for more than 4,000 hectares (10,000 acres) on which observers recorded this information (Mayfield, 1953: 19). These calculations do not include tracts where there were no warblers. Most of the acreages are rough approximations, because the habitat usually tapers off here and there into large trees or grasslands, and it is impossible to be sure how much is acceptable to the warblers.

As remarkable as the sparsity of the population in occupied areas is the very small amount of suitable habitat produced by fires even in the heart

of the pinelands. For example, three large fires in April 1946 covered 4,100 hectares (10,107 acres) in southern Oscoda County, and subsequently the pine on these lands regenerated naturally. Fifteen years later one of these areas had jack pines only in scattered patches not extensive enough to attract warblers; the other two had scattered colonies of warblers totalling 121 birds on about 1,000 hectares (2,480 acres) of suitable habitat. Thus, only about 25 per cent of these burns became suitable as judged by the human eye, and only one pair was present per 34 hectares (84 acres) of land burned at the same time in nearly ideal country.

Another interesting case was the Canada Creek fire in northwestern Montmorency and southwestern Presque Isle counties. Here 11,537 hectares (28,556 acres) burned in May 1939. In 1951 the area held 72 males, and in 1961, 92 males, an average of less than one pair per 120 hectares (300 acres) of burn.

ACCURACY OF COUNT

As in the first census, I believe the possible error in the count may be of the order of 20 per cent. Experience has strengthened the conviction that we miss few warblers through failure to discover colonies. Therefore, the principal uncertainty, I believe, is the possibility of missing birds that are not singing during the period of a brief visit or two.

In the instances that have come to my attention, independent observers have agreed on their counts within about 10 per cent. For example, in 1961 Eugene Kenaga counted 30 males in an area of eastern Iosco County, and Nita Greer a few days later counted 32 here. In 1957 on our first morning trip through a familiar area, my son John and I counted 16 males. On this day and the next Donald J. Borror spent portions of two days recording bird songs on this area, and his notes also listed 16 birds. Later in the month I spent five days studying the area more intensively to find nests and concluded that there were 17 males present. Smaller colonies than these are easier to count, and I have had many instances when separate observers agreed exactly on groups of four or five birds.

On the other hand, it is possible that other males are present and not singing because not at the moment defending territory. This possibility is suggested by an occasional chance observation of a silent male moving through a territory with a singing male in sight all the while. Several times Frank Novy has netted another male while attempting to catch a singing male on territory. And once in a study area where we had banded nearly all the males, we were surprised by the appearance of three or four unbanded birds late in the nesting season; we speculated that these were males trying a new territory after having been unsuccessful in getting a mate elsewhere. I thought I detected such restlessness and exploration on one occasion when I found an unmated male singing vigorously for a part

of a day more than a kilometer from the territory he occupied before and after his excursion.

Some quiet males may be missed. But in estimating the total population, this error may be offset by overestimating the number of females. There is reason to believe that there may be a small surplus of males over females in this species as in many other species of birds. If so, the total population may be less than double the number of males.

These questions need to be studied more fully.

SOIL TYPE

Several years ago Harold Wing pointed out to me that all the Kirtland's Warblers he had been able to trace over a period of years were nesting on one soil type, Grayling Sand. This soil is characterized by a humus layer from two to four cm thick and by dryness, looseness, and perviousness to a depth of two to three meters or more. To test this idea further in the 1961 census, he supplied each group leader with a large-scale map showing areas of Grayling Sand in detail. His copies were traced from maps of county soil surveys published in the 1920's by the U.S. Department of Agriculture.

There is some variation in the actual soil profile mapped as Grayling Sand from county to county during the period 1920 to 1935. Nevertheless, only three colonies were found in the 1961 census on soils other than those classified as Grayling Sand. All the exceptions were in pine plantations, and had other unusual features.

At one small colony near Frederic in northwestern Crawford County, the jack pines were planted in 1950 in order to keep the loose sand from blowing. The trees were distorted, with exaggerated growth of the lower limbs near the ground, as a result of repeated killing of the terminal buds by insect infestation. The ground cover was almost entirely of grasses. There are no other stands of jack pine for several miles.

Another small colony, 1.6 km (one mile) from the west edge of Kalkaska County, was on land originally classified as Rubicon Sand, but possibly it had deteriorated to a wind-eroded phase of Rubicon Sand as a result of agricultural activity. Here red and jack pines were planted in alternate rows with an open strip separating each of four adjacent 16-hectare (40-acre) plots. This is the westernmost colony in history, although Norman Wood, the discoverer of the nesting ground of the species, had marked on a map in his files that there were nesting warblers in western Kalkaska County in the 1920's.

The largest colony of these three, near the southeastern corner of Kalkaska County, was on Rubicon Sand planted with jack pines and red pines.

Rubicon Sand is more fertile than Grayling Sand and therefore less likely to produce a solid stand of pines, except where planted.

ANOMALIES

Very few areas planted or burned before 1941 still have warblers. By now the trees are too large. An interesting exception is the vast Canada Creek burn in northwestern Montmorency County and southwestern Presque Isle County. This fire occurred in May 1939, and the first warblers appeared in 1946. The pines, however, were sparse and slow growing in parts of this area, and, although the trees are now too large in some places, others have reached the right stage slowly, and this area will retain warblers for several more years.

In 1948 10 km (six miles) south of Mio in Oscoda County, the first instance of nesting among red pines was discovered, seven years after these pines were planted. This area still had a small colony in 1961, although the pines were 22 years old, assuming that they were two years old when transplanted to this location.

Near Mack Lake in Oscoda County, Robert Radtke found a singing male in a 2.47-hectare (one-acre) experimental planting of scrub pine, *Pinus virginiana,* adjacent to a larger tract of jack pines of suitable size. He found no nest but made no extended search.

COOPERATORS

Forty-eight people participated in this census. Their names and assigned areas were as follows; asterisks mark leaders who submitted group reports:

Alcona Co.—John Byelich,* Jack L. Cook, Verne Dockham, Harold Dykema.
Antrim Co., southeast—Mary Edwards, Irene Jorae.*
Clare Co., northwest—Norman L. Ford,* Robert W. Storer, Harrison B. Tordoff.
Crawford Co., northwest—Fenn M. Holden,* Doris Souders, Faith Stripe.
northeast—Fenn M. Holden, Douglas S. Middleton,* Walter P. Nickell.
south—Ralph I. Blouch,* Robert Curtis, Dr. and Mrs. Daniel S. McGeen.
Iosco Co., northwest—Mr. and Mrs. John Maxfield, Mr. and Mrs. Harold F. Wing.*
northeast—Milton B. Irvine, Eugene Kenaga,* Les Line, Mark A. Wolf.
Kalkaska Co., northwest—Ford Kellum.*
east—C. T. Black,* William R. Freeman.
Missaukee Co., north—Ralph I. Blouch.*
southeast—Norman L. Ford,* Robert W. Storer, Harrison B. Tordoff.
Montmorency Co., west—Olive Betcher, Martha L. Lengemann,* Alice Miller, Myrtle Terpening, Ann Vanderheide, Marian Zimmerman.
northeast—Frank Novy, Richard E. Olsen.*
Ogemaw Co., northwest—Jack L. Cook, Victor Jansen, William W. Oliver, Lawrence Ryel.*
Oscoda Co., northwest—Douglas S. Middleton.*
southwest—Harold Mayfield,* Dr. and Mrs. Lawrence H. Walkinshaw.*
northeast—Harold Mayfield.*

southeast—A. J. Berger,* Helen Blanchet, Bette Jane Johnston, Bruce Radabaugh, R. E. Radtke.
Otsego Co., southeast—Douglas S. Middleton,* Walter P. Nickell.
Presque Isle Co., southwest—Frank Novy, Richard E. Olsen.*
Roscommon Co., northwest, southwest, southeast—Ralph I. Blouch.*
northeast—Victor Jansen, William W. Oliver, Lawrence Ryel.*

In addition to the cooperators in this list, the following people helped by supplying information without participating in the field work: L. A. Pommerening, Forest Supervisor of the Lower Michigan National Forests; and Donald W. Douglass, Lewis A. Dorman, John Gunderson, and Wayne B. Tennant of the Michigan Department of Conservation.

LITERATURE CITED

AMERICAN ORNITHOLOGISTS' UNION. 1957. Check-list of North American birds. 5th ed. 691 pp.

MAYFIELD, H. 1953. A census of the Kirtland's Warbler. Auk, **70:** 17–20.

MAYFIELD, H. 1960. The Kirtland's Warbler. Cranbrook Inst. of Sci., Bloomfield Hills, Mich. 242 pp.

MAYFIELD, H. 1961. Cowbird parasitism and the population of the Kirtland's Warbler. Evol., **15:** 174–179.

MITCHELL, J. A., and D. ROBSON. 1950. Forest fires and forest fire control in Michigan. Michigan Dept. of Cons. and U.S. Dept. of Agric. 82 pp.

VAN TYNE, J. 1953. *Dendroica kirtlandii* (Baird). Kirtland's Warbler. *In* Arthur Cleveland Bent, Life histories of North American Wood Warblers, U.S. Nat. Mus. Bull., **203:** 417–428.

WOOD, N. A. 1904. Discovery of the breeding area of Kirtland's Warbler. Bull. Michigan Orn. Club., **5:** 3–13.

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