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All articles and communications intended for publication or review should be sent to the editor. Manuscripts should be typewritten, with writing on one side of the paper only and lines double-spaced. Photographic prints, submitted for half-tone illustrations, must have good contrast and detail and should preferably be printed on 8 x 10-inch glossy paper. Please send prints unmounted with accurate data attached.

The current issue of *The Jack-Pine Warbler* is printed by the Beimer Printing Company, Kalamazoo, Michigan.

Polygamy In The Kirtland's Warbler

Bruce E. Radabaugh

Mayfield (1960:57-58), discussing polygamy in the Kirtland's Warbler (*Dendroica kirtlandii*), cites a single instance of a male with two females on his territory (occurring in 1947). One of the females in his example incubated five eggs for 21 days (average incubation period 14 days) and then abandoned the nest. The nest of the second female was abandoned during incubation. These two nests were ". . . about 150 meters . . ." apart.

The implications a reader might draw from these data are that polygyny is very rare in this species and that even when it occurs fertilization may not be successful. It therefore seems appropriate — as well as of considerable interest — to publish information on nine additional cases of polygyny in the Kirtland's Warbler. This information was gathered during field studies carried out at the Mack Lake area, Oscoda County, Michigan, during the period from 1961 to date. The greatest concentration of the work was from 1963 through 1968.

Mayfield also states that he knew of no examples of a Kirtland's Warbler changing mates within a given season. Therefore I should like to detail here briefly — incidentally to the polygyny reported — a single case of successive polyandry I observed in 1968.

Of the nine instances of polygyny, there were three each in the seasons of 1966, 1967, and 1968. Nine distinct cases of polygyny would involve nine males and 18 females. We have never discovered a male with more than two mates. In the examples cited, however, due to returns of some of the birds from one year to the next, as well as more than a single participation in polygyny by some of the individuals, only seven males, and 16 females were involved. All seven males, and 13 of the females were banded. No two unbanded females were involved in polygyny on the same territory, so all individuals were separable in the field.

These polygynous matings resulted in 24 discovered nests (including six renests). One nest was abandoned during construction. In the remaining 23 nests there were 88 warbler eggs observed. Of these 54 eggs hatched and 40 nestlings fledged. Seven of the nests were parasitized with a total of eight cowbird eggs, none of which hatched. The cowbird pressure here is low because of a cowbird removal program on this area during these years.

The distances between the nests of the "opposing" females on the nine territories involved ranged from 230 to 500 m (with a mean of 320 m).

Mayfield (1960:49) gives the average territory size of the male Kirtland's Warbler as 8.4 acres or 3.4 hectares (from 12 territories measured over a period of 20 years). Assuming a circular shape (which at least approaches reality) we see the average-sized territory with an area of 34,000 square meters and a diameter of slightly over 200 m. This is a lower value than the minimum distances observed between nests described

above. This line of evidence suggests either an unusually elongated territory for polygynous matings, or a larger than average territory. I did not measure the outlines of any of these nine territories. However, from somewhat subjective evidence derived from observing the males (mostly noting their singing positions) I favor the idea of an elongated territory. Actually the largest territory Mayfield reported was 16.5 acres. This comes out at 6.68 ha and, if circular, such a territory would have a diameter of around 290 m. This distance would include four of the nine measurements dealt with here.

The male Kirtland's feeds the incubating female on the nest and it appeared to me, without having enough observations to note fully how the males' time was spent, that the males with two incubating females more or less alternated their attention between the two. In fact attention at both nests by the male was the only way polygyny was discovered at all. It was also apparent that once one clutch hatched the male spent most of his time at that nest, no longer dividing his time evenly between the two.

Considering the total nesting period (from the beginning of nest-building to conclusion, be it fledging, predation, or abandonment) for each polygynous territory as the maximum number of days that there is at least one active nest on the territory, we can compute the proportion of these total days during which two nests were active simultaneously. This will give us a fair idea of how much time males have two active nests on their territories. Listing the nest numbers within their appropriate groups we obtain the following results:

TABLE 1

Polygynous nestings of the Kirtland's Warbler showing nest numbers grouped by territory with the total number of days *any* nest was observed on the given territory, the number of days two nests were observed (overlap) and the percentage of this overlap.

NEST NUMBERS AND TERRITORIES	TOTAL DAYS	OVERLAP	PERCENTAGE
			OVERLAP
1. (66-9, 66-14)	36	17	47.2
2. (66-12, 66-29)	36	24	66.7
3. (66-6-A, 66-22)	30	8	26.7
4. (67-9, 67-52)	50	9	18.0
5. (67-8=43, 67-48)*	42	12	28.6
6. (67-5, 67-17=42)	53	10	18.9
7. (68-13, 68-14=22=27)	62	3	4.8
8. (68-8=15, 68-11)	28	15	53.6
9. (68-7=24, 68-32)	52	13	25.0
Means	43.2	12.3	32.1

* = indicates renests by the same female.

Thus we see that polygynous males have both mates actively engaged with nesting only about a third of the time. Any nests not found, and there must have been some, would increase this figure.

The 24 nests resulting from these polygynous matings represent only 10.7 percent of the 223 nests located during this study on several areas. All these instances, however, occurred on what I designated the "east Mack Lake area." Even so, of the 172 nests found there, the 24 account for only 13.9 percent. If one bears in mind that not much time was spent on the east Mack Lake area during the seasons of 1969, 1970, and 1971, it could be argued that polygyny probably existed there in these seasons, too, but was not observed. This seems reasonable and if we restrict ourselves to the seasons 1963 through 1968, the seasons wherein reasonably adequate searches appear to have been made, we then would have a 145-nest total, with the 24 representing 16.5 percent of these. Furthermore, it appears to be a truism that we may overlook things that we are not looking for. Only one instance of polygyny had been reported previously, some 20 years before. Van Tyne, Mayfield, Berger, Walkinshaw, and many others continued considerable field work through 1957. Because they had turned up no additional cases, and because no examples had come to light prior to 1947, it appeared to be an isolated phenomenon. Therefore I had not really been looking for polygyny until I "stumbled" onto it in 1966. From then on, during adequate field studies, I found the cases detailed here. Even now I can vaguely remember a few unusually elongated territories from the seasons of 1964 and 1965, a "bimodal" distribution of singing, which I failed to investigate further. Instead I passively accepted the interpretation that the male was merely singing elsewhere on his territory, and attached no further significance to it.

At the very least we can say that polygynous matings accounted for 29.6 percent of the 81 nests found on the east Mack Lake area during 1966, 1967, and 1968. Put in other terms, the 23 adults involved with these nests in these three seasons represent 32.9 percent of the total of 70 adults involved with all 81 nests (the 16 females representing 44.4 percent of the 36 females; the seven males representing 20.6 percent of the 34 males).

At least, then, for the three-year period 1966-68 about one-third of the adults present on the east Mack Lake area were involved in polygynous matings, and about one-third of the nests found on this same area resulted from these matings.

Before we could assume that this same proportion might apply to *any* well-searched nesting area we would have to consider at least three possibilities. These are:

1. The presence of another nesting area ("west Mack Lake area") only about 2.4 km away with a large population greatly decreasing during the 1960's. Seventy-one singing males were counted there in the 1961 decennial census. The singing male count had dropped to 14 by 1966, stood at nine in 1967, was seven in 1968, and was only four in the decennial census of 1971. This decline is attributed to an aging habitat. It resulted, of course, in many warblers seeking suitable nesting habitat in other areas, and the closest area was east of the lake. The habitat east of the lake was presumably filled to near capacity, so new arrivals would

experience difficulty in establishing themselves there. It seems reasonable that females would have a slightly easier time establishing themselves than males, as male-male encounters are more decisive. Thus, on this hypothesis, we might see a few extra females with subsequent polygyny. If the foregoing were true we would not expect the incidence of polygyny to approach one-third for the entire population because not every nesting area would have the special circumstance of a large, rapidly decreasing nesting group nearby.

2. Another circumstance unique to the east Mack Lake area and alluded to above with regard to the cowbird pressure, was the cowbird removal program carried out on this area by Nicholas Cuthbert in cooperation with the U. S. Forest Service in the years 1965 to date. This program and the discovery of polygyny have a coincidence in time. Although I prefer the previous hypothesis over this one, there may be some as yet unrealized effect of removing almost all the cowbirds from a warbler nesting area that somehow results in increased polygyny. I can think of no reason for this at present but the chronological coincidence of these events warrants some thought (and any suggestions would be most welcome).

3. Aside from the cowbird removal program, there may have been some other special circumstance(s) present that acted to cause or increase polygyny. Such a circumstance may also have been present in 1947 — and possibly in other years when less field work was done.

Due to the possibilities above which cannot be negated at present we can make no statement concerning polygyny in this species that will extend beyond the area where it was found. We can say, however, that polygyny occurs much more often than was formerly thought, and that it was fairly common on the area east of Mack Lake during some of the years of this study.

Finally, I should like to detail the single observed instance of a Kirtland's Warbler changing mates within a season. This was a female with two mates (in 1968), also on the east Mack Lake area. The situation amounts to a case of successive polyandry.

We found nest 68-1 on 15 June 1968 containing four warbler eggs and one cowbird egg. Both the male and female were color-banded. The nest was robbed on 20 June. On 8 July I found nest 68-28 with three warbler and two cowbird eggs. On 10 July the 68-28 female was caught and her band number verified (she was the same female that had been involved with 68-1). She now had a new mate and her new nest was about 1.9 km west from 68-1. Only one cowbird egg hatched from the 68-28 clutch (on 11 July). Working backwards in time, we estimate that she began building 68-28 about 25 June — i.e., about five days after the break-up of 68-1. The 68-28 cowbird was banded on 19 July and promptly fledged. The 68-1 male remained on his territory, singing, until at least 8 July. He was last seen on 10 July slightly off his territory and may have begun wandering. He was not heard singing after 8 July.

Previous to that he had spent much time around a particular place and I was very suspicious of this but failed to find a nest. On 25 June I saw a female here briefly (not the 68-1 female), but lost her. It is possible he had another mate on this territory. If so, this nest failed also (as had 63-1) as I am sure I would have observed feeding during the time expended there.

LITERATURE CITED

Mayfield, H. 1960. The Kirtland's Warbler. Bulletin 40. Cranbrook Institute of Science. Bloomfield Hills, Michigan.

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LIFE FELLOW MEMBER

The newest life fellow member in the Michigan Audubon Society is Mrs. Claude Lamoreaux of Holland, Michigan. Vivian, as those who attend campouts know her, is the mother of Calvin Lamoreaux. To others she is known as the lady that makes that delightful stationery with tatted birds and flowers. This fall she painted a series of flat beach stones showing a real artistic flair, and is now a steady contributor to the Audubon Craft Shop. Selling her hand work at the Holland Outdoor Festival and again at the Hastings Centennial, she tatted and sold enough to raise her life membership to a Life Fellow at \$300.00.

Retired from teaching a few years ago, she eased off by teaching twenty piano lessons a week, and heading Junior Church, all except the weekends of the campouts. She belongs to the Tulip City Gem and Mineral Society, the Women's Literary Club, the Holland Friends of Art, the Hope College Piano Teachers Piano Forum and Holland Garden Club. To the children in the neighborhood she is known as Grandma Lamoreaux, the person who can identify rocks, birds' nests, etc., and who will play checkers or flinch in the evenings in the basement. At a campout she is the youngest, most appreciative person there, despite 75 active years of contributing to others.

— Robert A. Whiting, 2504 St. Jude, Jackson, Michigan 49203.