

Brood Parasitism: Reducing Interactions between Kirtland's Warblers and Brown-headed Cowbirds

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Since its discovery as a migrant near Cleveland, Ohio, in 1851, the Kirtland's Warbler (*Dendroica kirtlandii*) has always been considered a rare bird. At various times people have called it America's rarest songbird. Its wintering ground in the Bahama Islands was discovered in 1879, and if we may judge from the frequency with which collectors found it there, its peak population within historic times occurred in the 1880's and 1890's.

At about that time two significant developments occurred on the nesting ground, one beneficial and temporary, the other detrimental and permanent. First, the pinelands of northern Michigan were lumbered rapidly, and the practices of the loggers led to vast fires that created an unprecedented amount of habitat for the nesting warblers. Second, as agriculture crept northward and the farmers cleared the hardwood forests from much of the southern Great Lakes region, the Brown-headed Cowbird (*Molothrus ater*) extended its range from the grasslands of the Midwest up into northern Michigan. This brood parasite, which lays its eggs in nests of other birds, found the Kirtland's Warbler the perfect host. It steadily grew in numbers and took an increasingly heavy toll up to the present time when control of cowbirds was instituted (Mayfield, 1977).

An appraisal of the true numbers of Kirtland's Warblers did not become possible until 1903 when the nesting ground was discovered in northern lower Michigan. At that time, before organized fighting of forest fires, the population might have been a few thousands of birds. Today a fairly accurate census is feasible because of our knowledge of the bird's requirements and behavior. In breeding season the pairs occupy small territories, and the males are loud and persistent singers. The habitat is highly distinctive. The nesting bird lives only among young pines the size of Christmas trees, growing densely enough to form thickets. The ground cover

must be low but ample to conceal the nests, which are imbedded in the ground. Nests are built on pervious soils that do not flood during rainstorms. The right forest stage occurs naturally about 8 years after forest fire, where regrowth consists mainly of Jack Pines (*Pinus banksiana*). Fortunately, the warbler will accept plantations of pines also if the tracts are extensive. Although the Jack Pine ranges from British Columbia to Nova Scotia and from the Great Lakes to the arctic, all the necessary conditions apparently come together only on the sandy plains of a small part of Michigan. All nests four to date have been on one soil type, Grayling Sand, and 90 percent of them have been located in the drainage of one stream, the Au Sable River (Mayfield, 1960).

The first census was taken in 1951, probably the first complete count of an entire songbird species in the world (Mayfield, 1953). This census and the second one, a decade later, showed the population remaining essentially stable at about 500 singing males. Since females are believed to be approximately equal in numbers, the total population of adults was about 1,000 (Mayfield, 1962). Field studies in the 1940's and 1950's caused me to doubt the species was maintaining itself, but dire predictions were not confirmed until the third census in 1971, when the count dropped 60 percent to about 400 birds (Mayfield, 1973a).

Alarmed by this decline, John Byelich of the Michigan Department of Natural Resources and G. William Irvine of the Huron-Manistee National Forests, called together a group of interested people in November 1971. These included members of the Kirtland's Warbler Committee of the Michigan Audubon Society, originally established in 1956 to advise the agencies. Many possibilities were discussed, including attention to problems on the wintering ground and censuses every year on the nesting ground, but discussion centered on preservation efforts that could be started immediately. Control of cowbirds promised instant results; whereas improvement of habitat would not benefit the warblers for years.

Concern about the cowbird was not new. Its effect on the warbler was well-documented, and means of control had been explored. The cowbird causes damage at every stage of the nesting process. First, it removes from the nest about as many of the host's eggs as it lays of its own. It usually accomplishes this unnoticed because the action is synchronized with the host's egg-laying, a time when nests are not ordinarily attended. Next, since the cowbird is usually larger than the host, its egg gets more than its share of the heat from the incubating host, thereby reducing the hatching success of the other eggs. Finally, cowbirds hatch two or three days ahead of the host young, and by virtue of their larger size and maturity, they trample nestlings of the host species. At the time of Kirtland's Warbler hatching, cowbird nestlings already in the nest weigh about five times as much as the warbler nestlings and are much stronger and more active.

In my field studies of the 1940's and 1950's, I found about 55 percent of Kirtland's Warbler nests parasitized by cowbirds, and losses from this cause alone reduced production of young by 36 percent (Mayfield, 1961). Parasitism rates climbed in the 1960's, exceeding 70 percent in some years (Walkinshaw, 1972). The effect

of increased parasitism was disproportionately severe; as more nests were parasitized, increasing numbers of nests contained two or more cowbird eggs each (Mayfield, 1965). In small host species, two or more cowbird eggs in a nest are almost always lethal to the entire host brood. In one 1966 sample, 83 percent of the nests received cowbird eggs, and only 2 warblers fledged from the group of 29 nests (Cuthbert and Radabaugh, *personal communication*).

The effect of the cowbird is particularly insidious because its effect on any one host is not density-dependent. Utilizing various hosts at all times and not dependent on any one, the cowbird pressure does not relent even though the host population is reduced toward extinction.

The decline in population revealed by the 1971 census called for emergency measures. A way to meet the cowbird problem had been pointed out by N. Cuthbert and B. Radabaugh. They found that cowbirds could be trapped efficiently and that the warblers produced many more young when protected from cowbirds. So, in 1972 trapping of cowbirds began on the warbler's major nesting areas. From the outset, the project was a cooperative effort. The Michigan Audubon Society provided the materials, the Michigan Department of Natural Resources constructed the traps, and the U. S. Fish and Wildlife Service and the U. S. Forest Service attended the traps.

The traps used in this program are generally known as "blackbird traps." Basically, they are rectangular cages of chickenwire netting (5 m square and 2 m high). The walls and ceiling are made of 1-inch mesh wire except for the entrance way, which is about 1 X ½ m in area and floored with 2-inch mesh wire, recessed about ½ m into the center of the ceiling. Here the birds enter but cannot find their way out. Sunflower seeds provide food for captured birds, but the prime attraction is the voices and movement of cowbirds left in the trap at all times. These decoys attract cowbirds from considerable distances, and one trap of this kind effectively removes cowbirds within a radius of more than 1 km, while capturing relatively few birds of other species. Cowbirds are removed daily and dispatched quickly. Other species are released, except for Blue Jays (*Cyanocitta cristata*), which are known predators on Kirtland's Warbler eggs and young, and these are transported 160 km and released (Shake and Mattsson, 1975). Trapping begins about 1 May and continues until about 15 July. Between 15 and 38 traps have captured from 3,100 to 4,300 cowbirds each year after the first, when coverage was not complete and the catch was somewhat smaller. In 6 years of trapping, a total of 17,529 cowbirds have been removed.

Fortunately for preservation efforts, nearly all the present nesting areas are on public lands. Beginning in 1957, the Michigan Department of Natural Resources set aside three tracts of 4 square miles (surveyor's sections) each, 3,100 ha in all, to be managed for the benefit of Kirtland's Warblers. In 1962 the U. S. Forest Service followed suit, setting aside about 1,700 ha in the Huron National Forest (Radtke and Byelich, 1963; Mayfield, 1963). These areas are all in the center of the nesting range. When the population shrank in the 1960's, it collapsed back into this central portion of its range, where the bird remained as densely distributed as before.

Nearly half the nesting warblers now are on lands dedicated to their management.

The success of cowbird control has been phenomenal. Parasitism of nests has been reduced to negligible levels, and the production of young has been higher than that reported for any other North American warbler. This experience has laid to rest any doubts about the fecundity of the species. Continuing field work by Walkinshaw and Faust (1975) and their associates have monitored the effect of the program from the start. Working mainly in two nesting areas, they have gathered data on about 15 percent of all warbler nests through the period 1972-1977. Among the nearly 200 studied warbler nests, the parasitism rate has usually been below 5 percent. The mean number of warbler eggs was about 4.6 per nest, and the mean number of fledglings was almost 3 per nest. However, enough pairs produced two broods in one season to raise the production slightly above 4 fledglings per pair per year. This is a remarkably high yield for a warbler, most of which produce only one brood per summer. Previously, before the cowbirds were controlled, the production had been less than 1 per pair per year.

The cowbird control program has accomplished its goal. It took a burden off the nesting warblers, allowing them to approach more nearly their full breeding potential. Yet, for the last 7 years the adult population has continued to teeter along at about 200 singing males (pairs) as follows: 1971 (201), 1972 (200), 1973 (216), 1974 (167), 1975 (179), 1976 (200), 1977 (219) (Mayfield, 1972, 1973a, 1973b, 1975; Ryel, 1976, 1977). We take some comfort from the steady increase of the last three years, but we find more assurance in the evidence that we have arrested the disastrous decline of the previous decade. Had the former low production of young continued and the same survival rate persisted, the species would be close to extinction today.

We have no completely satisfactory hypothesis to account for the slow recovery of the species. Since the adults consistently show a rate of return from one June to the next of 65 percent of the previous year's count, we deduce a survival rate of less than 20 percent for the first year of life. We do not identify enough yearlings to measure their mortality and survival directly, but it is clear the detrimental factor, whatever it may be, bears mainly on birds in their first year of life.

The mystery has prompted the following speculations: Possibly, the amount of ideal nesting habitat is not sufficient for an expanded population, although to our eyes the nesting birds do not seem crowded. Possibly, the loss of fledglings is severe in the postbreeding period on the nesting ground, although our scanty field observations during this stage have not revealed evidence of high mortality. Possibly migration has been particularly hazardous in recent years, although we are not aware of unusual hurricane patterns on the migration route, and the danger of pesticides along the way in the southeastern states seems to be subsiding. Possibly, competition for food and space with other North American migrants and endemic birds in the wintering region limits the species, although conditions in the Bahama Islands appear to

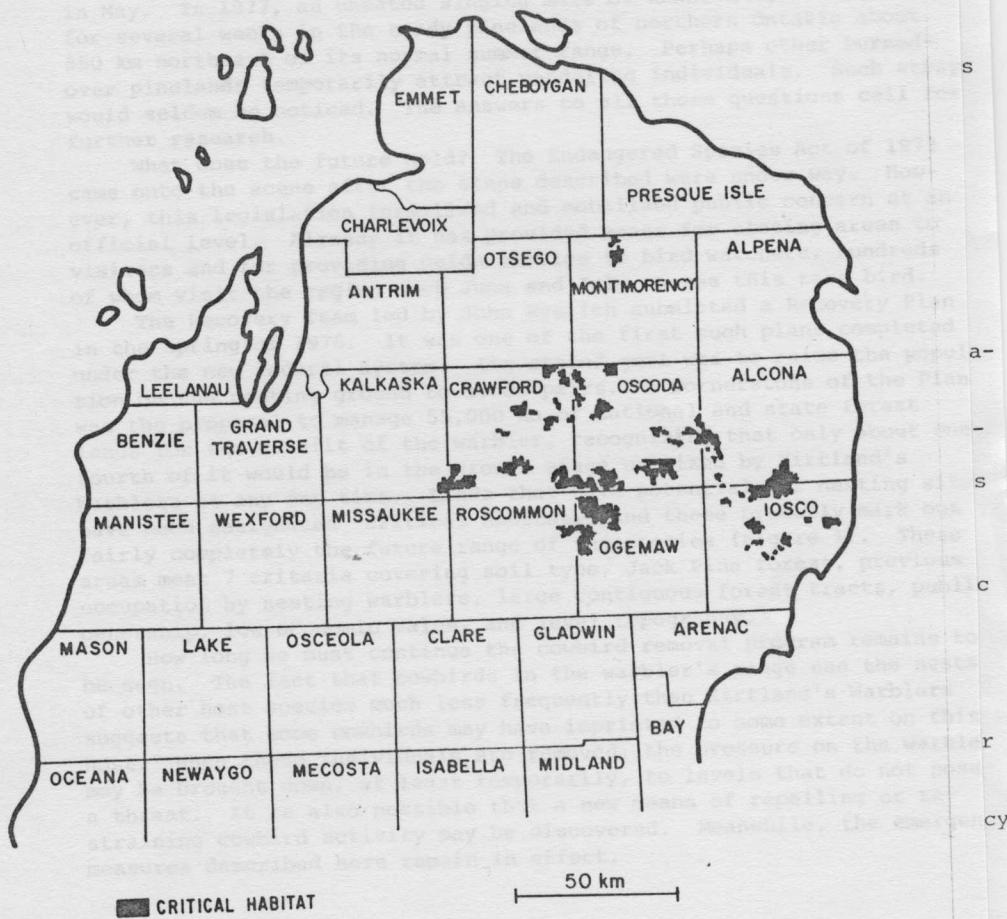


FIGURE 1. Critical habitat for the Kirtland's Warbler exists in the indicated portions of 8 counties in northern Lower Michigan. (Map prepared by Michigan Dept. of Natural Resources).

have changed little in recent centuries. Possibly, the extremely reduced nesting range of the present decade presents a difficult target for inexperienced birds making their first flight northward in May. In 1977, an unmated singing male of unknown age remained for several weeks in the sandy pinelands of northern Ontario about 550 km northeast of its normal summer range. Perhaps other burned-over pinelands temporarily attract wandering individuals. Such strays would seldom be noticed. The answers to all these questions call for further research.

What does the future hold? The Endangered Species Act of 1973 came onto the scene after the steps described were under way. However, this legislation formalized and mobilized public concern at an official level. Already it has provided means for closing areas to visitors and for providing guide service to bird watchers, hundreds of whom visit the region each June and July to see this rare bird.

The Recovery Team led by John Byelich submitted a Recovery Plan in the spring of 1976. It was one of the first such plans completed under the new federal system. Its stated goal was to raise the population on the nesting ground to 1,000 pairs. A cornerstone of the Plan was the proposal to manage 55,000 ha of national and state forest lands for the benefit of the warbler, recognizing that only about one-fourth of it would be in the growth stage utilized by Kirtland's Warblers at any one time. Lands that have potential for nesting sites have been designated "critical habitat," and these probably mark out fairly completely the future range of the species (Figure 1). These areas meet 7 criteria covering soil type, Jack Pine forest, previous occupation by nesting warblers, large contiguous forest tracts, public ownership, low economic value, and level topography.

How long we must continue the cowbird removal program remains to be seen. The fact that cowbirds in the warbler's range use the nests of other host species much less frequently than Kirtland's Warblers suggests that some cowbirds may have imprinted to some extent on this host. When these individuals are removed, the pressure on the warbler may be brought down, at least temporarily, to levels that do not pose a threat. It is also possible that a new means of repelling or restraining cowbird activity may be discovered. Meanwhile, the emergency measures described here remain in effect.

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At about that time two significant developments occurred on the nesting ground, one beneficial and temporary, the other detrimental and permanent. First, the pine lands of northern Michigan were lumbered rapidly, and the practices of the loggers led to vast fires that created an unprecedented amount of habitat for the nesting warblers. Second, as settlers crept northward and the forests cleared the hardwood forests from much of the southern Great Lakes region, the Brown-headed Cowbird (*Molothrus ater*) extended its range from the grasslands of the Midwest up into northern Michigan. This brood parasite, which lays its eggs in nests of other birds, found the Kirtland's Warbler the perfect host. It gradually grew in numbers and took an increasingly lower toll as the present time when control of cowbirds was instituted (Mayfield, 1977).

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