

A Research Proposal for a Study of the Non--breeding  
Biology of the Kirtland's Warbler (Dendroica kirtlandii).

Prepared by

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## Abstract

Recent data strongly suggest that the critically endangered Kirtland's Warbler has been suffering significant stresses in the non-breeding season, and that cowbird control on the breeding grounds, though necessary, may be insufficient to guarantee recovery of the species. To date there have been no comprehensive studies on the biology of the species during the post-fledging stage, migration, or on the wintering grounds, so the specific problems they face are speculative. Among the possibilities, it is conceivable that the birds are having difficulty finding the wintering or breeding grounds because of the smallness of the targets. On the other hand, there could be problems with habitat changes, particularly cutting of pine, or with predation by feral cats on the wintering grounds in the Bahamas. There do not appear to be any practical methods for study of the birds in the non-breeding season other than radio-telemetry, and we do not recommend any other methods. While radio-telemetry introduces some risks into the study, these risks are probably acceptably small, providing the program is carefully administered.

## I. Introduction and Summary of Proposal Development

A preliminary plan for a study of Kirtland's Warbler, developed from a review of pertinent literature and telephone interviews with experts on the species, was sent to you on September 30, 1976. Aware of the need for direct and extended input from individuals knowledgeable about the warbler, and for familiarity with actual field conditions on the wintering grounds in the Bahamas, we convened a meeting in Nassau, Bahamas, from November 10-13, 1976. The participants, in addition to ourselves, included Harold Mayfield, Mary Clench, and William Cochran. The events associated with this conference are listed below.

November 10. A two hour overflight of Grand Bahama, the Berry Islands, and northern Andros, en route from Ft. Lauderdale, Florida, to Nassau, Bahamas.

November 10-12. Planning sessions, where background information on Kirtland's Warbler on the breeding grounds (Mayfield), on migration and the wintering grounds (Clench), and on the applicability of radio-telemetry to a warbler study (Cochran) preceded the development of an in-depth research proposal. Tentative agreement was reached on the research proposal design, delegation of responsibility, approximate funding needs, and assignment of administrative obligations.

The warbler meeting was held in conjunction with an international conference on the White-crowned Pigeon, a forum that provided opportunities for extensive contact with biologists familiar with the Bahamas and included representatives of the Bahamian government and leaders of the Bahamas National Trust, the major conservation agency in that country. Social functions for the conference, to which we were invited, allowed a free and informal interchange of ideas among all parties.

November 13. Presentation of the biology of the warbler, and our tentative study plans, to members of the Bahamian government, including Claude Smith, Director, Ministry of Agriculture, Fisheries, and Local Government, Oris Russell, Permanent Secretary for External Affairs, and David Campbell, Director, Bahamas National Trust. In addition, Sandy Sprunt, Director of Research, National Audubon Society, and interested biologists from the pigeon conference attended the formal session on Kirtland's Warbler.

November 13-19. Intensive reconnaissance of southern Abaco Island by C. Kepler, N. Snyder, and A. Kepler.

November 20-22. Reconnaissance of New Providence Island by the Keplers, and meetings with Claude Smith and David Campbell.

The results of the meetings and field work are embodied in the attached research-proposal.

## II. The need for expanded research on Kirtland's Warbler

Kirtland's Warbler is a critically endangered species with a peculiar and restricted range. As far as has been determined, the entire breeding population is limited to a small area of scrub jack pine in north-central Michigan. The species nests almost exclusively in the early successional stages of pine following forest fires, and it apparently has been able to survive only in Michigan, largely because this region has been subjected to frequent enough burning that such habitat has been continuously available there. However, jack pine occurs in a huge range across southern Canada and the northern U.S., and much of this range is sparsely populated by man. It is not impossible that additional undetected breeding populations of the warbler might exist.

So far as is known from specimen records, the entire wintering range of Kirtland's Warbler is the Bahama Islands. However, a recent sight record from Mexico (Lane 1975) raises the possibility of a second wintering population. To date, the records of Kirtland's Warblers in migration have been too few and too scattered to rule out the possibility of wintering populations in areas additional to the Bahamas and breeding populations in areas additional to central Michigan. What the records do suggest is that if there are additional wintering and breeding populations these are probably of secondary importance to the presently known wintering and breeding populations (see maps in Mayfield 1960, and Clench 1973).

The breeding biology of Kirtland's Warbler has been thoroughly studied over a period of decades, especially by Van Tyne, Mayfield, and Walkinshaw. Mayfield (1960) summarized the state of knowledge for the species and suggested that it was suffering an enormous loss of reproductive potential due to cowbird parasitism. He suggested that the rate of parasitism (55% of nests) was sufficiently high that it was doubtful that the species could continue to sustain itself. Cowbirds evidently moved into Michigan in the latter part of the 19th century and have been increasing there since that time. The warbler has no known behavioral or ecological defenses against the cowbird.

Complete counts of the Michigan breeding population run between 1951 and 1972 suggested a declining warbler population in the 1960's, as predicted by Mayfield:

<u>Year</u>	<u># Singing Males</u>
1951	432
1961	502
1971	201
1972	200

While Mayfield (1960) reported 55% of nests parasitized by cowbirds, later studies by Walkinshaw (1972) and others indicated even higher parasitism rates of 70% and above. It appeared there was no need to look further

than the cowbird for the warbler's difficulties. Accordingly, a program of cowbird control was begun in the breeding range in 1972. This program has proved to be almost completely successful in eliminating cowbirds and cowbird parasitism (see Shake and Mattsson 1975).

Although reproduction in the warbler from 1972 until the present has been exceedingly good (circa 4 young fledged per pair per year), the breeding population has surprisingly failed to show a clear increase. The number of singing males found in 1976 was the same as the number found in 1972:

<u>Year</u>	<u># Singing Males</u>
1972	200
1973	216
1974	167
1975	179
1976	200

How we should interpret the continued depressed population level of the species is a matter of critical concern. Most workers agree that the species probably is not presently limited by availability of breeding habitat, and as mentioned above, recent reproductive success could hardly be any better. Presumably the present difficulties must be encountered in the post-fledging stage, in migration, or on the wintering grounds. It seems a fairly safe conclusion that the species would have declined a great deal more had not cowbird control been instituted, but it now seems quite unsure that cowbird control is enough to guarantee recovery. Present evidence suggests that the primary stresses may be ones affecting the first-year birds, as annual survival of adults determined from banded birds has continued to be excellent - about 60% (see Mayfield, 1975).

One could adopt an optimistic point of view and take comfort in the fact that the breeding population has increased in 3 and declined in only 1 of the 4 years of cowbird control. Perhaps something unusual occurred during late 1973 or early 1974 that resulted in the 23% decline at that time - perhaps some weather difficulties that might not occur again for many years - freak winds on migration, etc. This possibility cannot be excluded, although as yet no direct evidence for it has been assembled. On the other hand, one could more conservatively argue that the population figures from 1972 to present suggest that removal of the cowbird threat has only allowed the population to "stabilize" at a very low and unsafe level.

Clearly there is not enough information available at present to allow confident predictions about recovery of the species. Almost no research has been done on Kirtland's Warbler during migration or on the wintering grounds, and almost no systematic work has been done on the post-fledging stage on the breeding grounds. With a near-vacuum of information on these stages of the life cycle it is difficult to plot a rational

management plan for the species. While one alternative is to do nothing to expand research, hoping that the small increases of the population in the last two years might represent the start of a trend, we suggest that such a stance on the part of the Fish and Wildlife Service might prove to be very risky in the long run. We believe that informative research on many aspects of the post-fledging, migratory, and wintering habits of Kirtland's Warbler can be accomplished at reasonable expense and with acceptably low hazards to individuals of the species. While no one can guarantee that such research will yield practical means for species management, we think the chances are promising enough that expanded research merits consideration.

### III. Research Objectives and Methods

The primary goal of expanded research on Kirtland's Warbler should be to determine (1) where in the non-reproductive cycle the species is experiencing significant difficulties, and (2) to what extent these difficulties can be reduced by management techniques. Clearly, specific proposals for (2) will be a future development that will depend entirely on the outcome of (1), so the rest of this report will deal exclusively with (1).

The proposed research conveniently resolves into four major concerns: post-fledging stage, fall migration, wintering grounds, and spring migration. At all these stages there are formidable practical difficulties in making observations by conventional methods. For example, recent systematic attempts to locate the species in the Bahamas in winter have been notably unsuccessful. Hundreds of man days have been expended by Mayfield and Van Tyne in 1949, Emlen in 1968-69, Radabaugh in 1972 and 1973, Clench in 1976, and others (including ourselves in 1976) with almost completely negative results (Radabaugh found one Kirtland's Warbler). Almost all recent records of the species on the wintering grounds have been incidental sightings by amateurs, and many of these sightings are of questionable validity because of field identification problems with the species. Although Kirtland's Warbler, as illustrated in the field guides, appears to be distinct enough from other similar warblers that winter in the Bahamas, an examination of museum specimens quickly reveals that all these species are quite variable in plumage and are not always clearly separable from one another. With sufficient motivation a remarkable diversity of species can be "transformed" into Kirtland's Warblers under field observation conditions.

Even when the species can be definitely confirmed in the field on the wintering grounds, the dense scrub habitat typical of the Bahamas makes extended observation of individuals extremely difficult, yet meaningful studies on the wintering grounds will have to entail long-term observations. Although one might entertain hopes that large-scale systematic searching of the wintering range might yield enough sightings to begin to answer such questions as habitat preferences, the odds do not appear to be very good that this may prove to be the case. Records of Kirtland's Warblers have come from all corners of the Bahamas, and the Bahamas include over 4000 square miles of habitat divided among 700 islands and over 2000 cays.

If the warblers are relatively uniform in distribution, this works out to on the order of one adult per 10 square miles. Although there may be some gregariousness of the species on the wintering grounds, all recent reports are of single individuals.

There is a possibility that many of the migrant Kirtland's Warblers may funnel through Grand Bahama or Abaco on their way into and out of the islands, and it has been suggested that extensive searching or mist-netting on these islands might yield significant numbers of warblers. However, there is no evidence presently available that suggests such a funnelling actually occurs; even if it did and could be exploited to locate birds, there still remains the problem of following them for any length of time in brushy habitat. The birds do not sing at this time of year and it is doubtful that much can be done with tape playback techniques. Grand Bahama, it should be noted, is an island 70 miles long, an impractically large area to cover in any thorough fashion, and Abaco is a similar length. If finding, identifying, and studying the warblers on the wintering grounds by conventional methods is beset with enormous practical difficulties, the situation is even far more discouraging for studying the birds during migration.

The only practical way out of the observational difficulties appears to be radio-telemetry, and this is the general approach we wish to recommend in the report. The state of the art is now sufficiently developed that radio-telemetry on Kirtland's Warbler is not just a desperate hope for the distant future. Transmitters weighing less than a gram that would be practical for this species already exist, and refinements in technology to tailor transmitters specifically for Kirtland's Warbler have been estimated to entail about 6 month's development time (Cochran, pers. comm.).

We hasten to acknowledge that the use of telemetry on Kirtland's Warbler poses some risks to the birds involved, but we believe that with proper safeguards these risks can be kept acceptably small, and well worth the benefits that can reasonably be envisioned. Specifically, we believe that the initial stages of research with transmitters for Kirtland's Warbler should proceed only with other smaller species of warblers until an optimal means of attaching the transmitter to the warbler is found and tested under field conditions. The transmitter attachments used should be limited to glue-on or feather attachment types that guarantee that the transmitters will fall off the birds at some future date. Further, the number of Kirtland's Warblers radioed should always be kept small, with the program under continual review to insure that detrimental effects be detected and minimized.

Of utmost importance is the choice of personnel to carry out radio-telemetry work, as the development of working techniques that can yield worthwhile data is still as much an art as it is a science. Fortunately, Mr. William Cochran, unquestionably the most competent individual working with avian radio-telemetry today, has indicated his interest in participating in a research program with telemetry of Kirtland's Warbler, and has



been instrumental in developing the proposals that follow. We would not want to recommend radio-telemetry as a procedure for studies of Kirtland's Warbler in the hands of less qualified mortals.

#### IV. The Risks of Radio-telemetry to Kirtland's Warblers

We anticipate that the strongest reservations about the proposed research will concern uncertainties about risks to the birds that are tagged. These risks fall generally into three categories:

1. Risks of injury or death in capturing and radio-tagging the birds.
2. Stress on the birds from carrying an additional weight of a fraction of a gram and from having a foreign object on the back. This stress presumably might be most significant during migration.
3. A possibly increased susceptibility to predation because of losses in maneuverability resulting from the transmitter.

There is no good information available on the magnitude of these stresses with other birds that have been radio-tagged, but the consensus seems to be that while these are real risks, they may often be rather small in magnitude: 1) The risks of injury or death in capturing and radio-tagging the birds probably are negligibly greater than the risks that have been considered acceptable in the past as regards banding of Kirtland's Warblers. 2) The weight stress of a .5 gram transmitter is probably likewise not an inordinate problem as birds the size of Kirtland's Warblers are known to undergo weight changes of several grams seasonally. The migration path of Kirtland's Warbler is almost entirely over land and if the extra weight decreases overnight flight distances to some extent this probably will not be a severe problem. The part of the migratory flight that crosses water is short compared with flight paths of other warblers that cross the oceans, as it involves at most a flight between the Carolinas and the Bahamas. The records of Kirtland's Warblers in migration are not abundant enough to make clear whether in fact the warblers fly over the ocean between the Carolinas and the Bahamas or whether they leave the continent further south in Georgia or Florida. It should be noted that Kirtland's Warblers are basically strong-flying birds (Mayfield, pers. comm.). In extensive work following radio-tagged thrushes in migration Cochran has not seen any obvious difficulties attributable to the transmitters. 3) The possibility of increased predation on radio-tagged birds is difficult to evaluate, but we suspect it may be important only to the extent that maneuverability is affected. According to Cochran (pers. comm.) radio-tagging programs on other species suggest that maneuverability is not greatly affected by the transmitters, so long as the weight of the transmitter is kept on the order of 5% or less of body weight (a .5 gram transmitter represents roughly 4% of body weight for Kirtland's Warbler) and so long as the transmitter is attached in a balanced and non-irritating way to the bird (generally speaking, so long as it is glued to the back plumage of the bird rather than attached by a harness).



Even in the worst conceivable case - that transmitter causes the death of the bird, - it must be remembered that the bird might have been one that would never have survived in any case. First-year survival of juveniles has been running only on the order of 20% in recent years, so four-fifths of the juveniles radioed would not be expected to become breeders in any case. For adults the survival has been much better in recent years - about 60% annual returns - and a lethal effect of a transmitter would correspondingly have a much greater effect on the population than it would for juveniles. The point of these observations is only that effects of radio-telemetry on populations can be expected to be considerably less than effects on individuals.

The proposed radio-telemetry research on Kirtland's Warblers is envisioned as taking place over a four-year period, with numbers of birds radioed in any year kept to a minimum. If it is felt that the number of birds radioed in any year is too high, the same research objectives can be achieved if the number radioed in any one year is reduced and the program is carried out over a longer period of years. The expenses of a longer program presumably would be greater than for a shorter program, but we do not feel that this should be the primary consideration in determining how many birds should be radioed in any one year. Clearly for meaningful conclusions there will have to be a certain sample size achieved for most aspects of the research, and although one can learn an enormous amount about migration of the species from following a single individual, there is always some question about how representative this individual is for the species. Because of loss of transmitters it is necessary to radio more birds than one hopes to follow, and this factor is taken into account in the proposal that follows.

#### V. The research proposal

This proposal represents a consensus opinion of those attending the Kirtland's Warbler conference in Nassau - Clench, Cochran, Kepler, Mayfield, and Snyder. The broad outlines of each research program, and a rough estimate of anticipated costs, are presented. More detail is not given because we both feel that within the broad guidelines discussed below, each researcher should have enough latitude to continuously evaluate and re-develop the specifics of his research. Likewise, the dollar figures are approximate only. For example, \$36,000 is budgeted for ground teams in the Bahamas - an anticipated 2 man-years of effort (a two-man team for 6 months for each of two winters). The same cost would result from having two two-man teams for 4 months in each of three winters, and this could prove to be a far more functional approach if birds can not be followed through an entire winter. We would hope that this type of flexibility could be a part of any funded program. If the proposed years in which each research phase is to be undertaken appear unrealistic, they too can be modified as appropriate.

#### A. Development of radio-tracking capability with warblers.

1. Research and development on transmitter design, transmission strength vs. battery life, and attachment techniques.

Schedule: January - June (1977)

Principal investigator: W. Cochran

Discussion: Transmitter capability has been developed and tested by Cochran for thrushes weighing as little as 40 grams, and he has functional radio transmitters weighing only .8 g, a size that could conceivably be carried by a Kirtland's Warbler (mean weight is 13.5 g, with pre-migratory fat weight is often over 16 g). He feels, however, that lighter transmitters would increase research efficiency by decreasing stress on the birds and decreasing transmitter loss, and believes that functional transmitters weighing only about .35 g could be developed. He envisions about 6 man-months of research and development to design and test these mini-transmitters, and study the most efficient way of attaching them to Dendroica warblers. In this initial research phase, no transmitters would be applied to Kirtland's Warblers.

- \* Cost: \$7,000.00. Note: We strongly recommend that the remaining money allocated to the development of this research proposal be used to fund this necessary development program. Further research is contingent upon this.

2. Radio-tracking migrant and resident Dendroica sp. (not kirtlandii).

Schedule: spring-summer (1977)

Principal investigator: W. Cochran

Discussion: When requisite small radio-transmitters have been developed, they must be tested under field conditions before being used with an endangered species. The principal investigator and his assistant will attach a radio to one or more migrant Dendroica warbler(s) during migration, and follow them north to the breeding grounds or until losing contact. Similarly, resident territorial birds will be instrumented and followed in Illinois or in the Michigan jack pine habitat.

- \* Cost: \$5,000.00.

- B. Post-fledging behavior, habitat preferences, patterns of dispersal, and survival in Michigan.

Schedule: July-August, 2 years (1977-1978)

Principal investigators: Mayfield and Cochran

Discussion: Although nesting Kirtland's Warblers have been color-banded by Walkinshaw and Faust (1974), and followed for 2 to 3 weeks

after fledging, no systematic, detailed study of the post-fledging biology, especially survival, of the species has been undertaken. Most studies have terminated with fledging, and it is conceivable that young fledglings experience difficulty in the crucial period prior to migration. Mayfield reports that color-banded family groups can be followed visually for up to three weeks after fledging, during which time they become increasingly elusive. Mayfield believes that fledglings could be captured with little difficulty or stress up to two weeks after leaving the nest, and radio-transmitters could be attached at that time. This would allow practical field-testing of radios on Kirtland's Warblers (and will be done only after prototype studies on other species have been concluded) prior to migratory studies, and near-constant contact with a small sample (maximum of 10 each year) of birds to determine if differential mortality is occurring in the population. Mayfield will coordinate work on the breeding grounds, cooperate with Walkinshaw in banding juveniles, recruit volunteers to help follow the birds, and help in observing and netting selected family groups for radio-tracking. At that point Cochran would radio the birds and follow them, utilizing Mayfield's continued observational help, until the birds migrated.

★ Cost: \$18,000, as follows:

Mayfield and assistants (transport and lodging) \$2,000 per season =	\$4,000
Cochran and assistants (salary, transport lodging, and radio-telemetry equipment)	
\$8,000 first season	8,000
\$6,000 second season	6,000

★ *from Mayfield/Cochran*  
C. Fall Migration

1. Fall departure direction.

Schedule: September, 2 seasons (1977-78)

Principal investigator: W. Cochran

Discussion: It is possible that juveniles experience orientation difficulties when leaving the breeding grounds, and are therefore more likely to choose an inappropriate migratory direction than adults. Do they migrate with their parents, with other groups of warblers, or alone? In what direction do they head? Do any birds head toward Mexico? Adults and juveniles can be tagged with radios emitting different frequencies, so the age classes can be detected. Cochran can monitor selected portions of the breeding grounds and obtain directional information on radio transmitters passing over him. Information on departure could be correlated with environmental parameters (weather systems, temperature, wind speed and

direction at different elevations, etc.) to determine what conditions are important for migrant Kirtland's Warblers.

★ Cost: \$5,000 (\$2500/season)

2. Radio-track Kirtland's Warblers during fall migration.

Schedule: September, 2 seasons (1978, 1979).

Principal investigator: W. Cochran

Discussion: Mr. Cochran has had extensive experience in radio-tracking migrant thrushes and raptors from automobiles and aircraft, and feels confident that he could follow one or more Kirtland's Warblers each fall. Five birds would be radio-tagged each season. He does not foresee any insurmountable problems in following birds across the Appalachian Mountains or the narrow stretches of the Atlantic between the U.S. coast and the Bahamas, or between the innumerable Bahama Islands. Radio receivers and a fully equipped vehicle for following the birds are already at hand. The critical necessity for Bahamian cooperation becomes obvious in this endeavor: permission to overfly any or all the Bahamas at night with a radio-equipped airplane at a moment's notice, or no notice at all, must have been obtained well in advance, and Mr. Oris Russell should be notified when entry to the Bahamas appears imminent. Following migrants would yield much valuable information on orientation mechanisms, migratory elevation under different atmospheric conditions, route taken, stop-over locations, stop-over duration, behavior in transit, entry islands in the Bahamas, and many other variables. To date, the sum of our knowledge of fall migration consists of approximate departure dates from Michigan, scattered sight and specimen records, and a single prolonged stop-over near Pittsburgh (Clench 1973).

★ Cost: \$30,000 (\$15,000 per season; air time, travel by vehicle, equipment, salaries).

D. The wintering grounds.

A major effort will be needed on the wintering grounds. The role that radio-telemetry will play will be an essential part (ie., finding and maintaining contact with radio-tagged birds) of a larger research program. One or more two-man teams, one member of which must have radio-tracking competence, will make detailed observations of radio-tagged Kirtland's Warblers, including such aspects of their wintering biology as habitat preferences, detailed botanical descriptions of all areas utilized by them, daily activities, feeding strategy, foraging and roosting areas, interactions with resident and migrant birds, sources and extent of predation (Cochran has recovered active radios in predator scats), etc. The ground team would be expected to pursue other suggested research methods, such as the maintenance of mist net stations on potential entry islands (Grand Bahama, Abaco), follow-up identification

of reported Kirtland's Warbler sightings, visual and tape-recorder censusing, and searching for warblers in optimal habitat (when that becomes known). It must be stressed, however, that the primary responsibility of each ground team will be to maintain radio-contact with radio-tagged birds. If enough is learned of real habitat preferences, the team may then search such habitat types on a systematic basis, hopefully to find, net, band, and radio-tag additional Kirtland's Warblers, although, as stated earlier, it is unrealistic at this time to expect many positive results from these activities. It is further suggested that each team restrict its activities to a single, or at most two adjacent, islands, for complete, thorough coverage is far more efficient in the Bahamas than hopping from one island to the next.

Mr. Claude Smith has suggested that Bahamian citizens be used in this program, and we fully concur with his wishes. By using Bahamians, the number of teams can be increased, and Bahamians can become involved in and part of an active research program, while at the same time increasing their own understanding and appreciation of biological research and conservation problems. It may also prove practical in that Bahamians could possibly provide or locate reasonably-priced accommodations in an area where resort prices generally prevail. We would also recommend that any Bahamians participating in this program have an opportunity to assist workers in Michigan in order to gain familiarity with Kirtland's Warbler and radio-telemetric techniques. Mr. Claude Smith can provide valuable assistance in locating and recommending qualified people for this work.

Mr. Sandy Sprunt has offered the services of the National Audubon Society in designing and producing a poster depicting the warblers of the Bahamas, to be used in schools in the islands in an effort to increase local awareness of any research program, and the Kirtland's Warbler study. We recommend that contacts be made with Mr. Sprunt if this study is funded so that they can help in this way.

As currently envisioned, there would be three study approaches to research on the wintering grounds. All involve radio-telemetry.

1. Translocate juveniles from Michigan to Grand Bahama Island.

Schedule: Two seasons (1978, 1979)

Principal investigators: W. Cochran and M. Clench

Discussion: This is a unique and potentially very useful technique. Up to 5 Kirtland's Warblers would be captured in Michigan in September and immediately flown to Grand Bahama Island by charter flight, radio-tagged, and released (within 18 hours of capture, preferably an overnight flight). If the birds do not migrate further, ground teams could then follow and study these released birds, which we anticipate would settle into normal patterns of behavior within a day or two at most. The advantages of this technique are obvious:

an adequate sample of wintering birds would be available for detailed study. We fully realize that it is possible the birds will fly 1500 miles further southeast and be lost, but we feel that the potential advantages to this approach merit deep consideration, and that it be attempted on a trial basis.

★ Cost: Radio-telemetry: \$6,000.00 (\$3,000/season)

Ground teams: \$36,000.00 (\$3,000/mo./team; 12 team months)

2. Relocate birds radio-tagged in Michigan.

Schedule: two winters (1979, 1980)

Principal investigators: W. Cochran and M. Clench

Discussion: This would involve radio-tagging up to 10 Kirtland's Warblers on the breeding grounds each fall with low output, long-life radios, and flying over all the Bahama Islands after migration to relocate them. This is contingent upon development of the proper radios, but W. Cochran feels this might be feasible, and that some of the birds could possibly be found. The ground team would then follow-up with detailed ecological studies of the located birds, including re-capturing them at intervals to replace the radios with fresh units.

★ Cost: Radio-telemetry: \$20,000 (\$10,000/season)

Ground teams: No additional cost above No. 1.

3. Find and radio-tag unmarked wintering birds.

Schedule: One season (1978)

Principal investigator: M. Clench

Discussion: Mary Clench has offered to immediately fly to the Bahamas to attempt verification of any reported Kirtland's Warbler sighting. While this approach will obviously entail serious difficulties, such as inaccurate reports or inability to relocate reported birds, we feel that in the initial phases of this program it might have some merit. Clench should be fully instructed in radio-tagging, and be prepared to net, band, and tag any birds she finds, and follow the tagged birds as long as possible. This approach is more relevant early in the program and will be of decreasing importance if methods one and two are successful.

★ from Cochran/Clench



★ Cost: \$3,500.00 (\$3,000.00 for 3 trips to the Bahamas, \$500.00 for a trip to Cochran's lab to learn how to attach radios to warblers. If Clench does find, radio, and tag a Kirtland's Warbler, ground teams should be assembled to follow the bird.)

E. Spring Migration

Schedule: As opportunity arises, one season (1980)

Principal investigator: W. Cochran

Discussion: Any opportunity for research on spring migrants will be totally dependent upon successful accomplishment of research on the wintering grounds. If birds can be studied throughout the winter, then captured and radio-tagged again in March, Cochran could attempt to follow them north. However, battery life under field conditions in the Bahamas is expected to be less than two months, so re-tagging at least three times will be necessary to follow a bird throughout the winter. The likelihood of each recapture may be on the order of 75%, so the probability of following a bird through the winter will probably be under 50%. We feel, however, that funds should be available for Mr. Cochran to attempt following a spring migrant should a radio-tagged bird become available in March.

★ Cost: \$3,000.00

F. Publication

Schedule: Upon completion of each research unit (excluding A1).

Principal investigators: Mayfield, Cochran, Clench

Discussion: Provision must be made to pay for all publication costs.

★ Cost: \$2500.00 for entire study (4 years).

★ from Mayfield / Cochran / Clench



Number of Kirtland's Warblers to be radio-tagged

	1977	1978	1979	1980	# used in each experiment	Total K.W. w/radios
<b>A. R &amp; D.</b>						
1. Development	0	-	-	-	0	
2. Field Testing	0					
<hr/>						
<b>B. Post-fledging</b>	10	10	-	-	20	(20)
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<b>C. Fall Migration</b>						
1. Departure					20	(10 new)
Direction	+5 new birds <sup>a</sup> (to total 10)	+5 new birds <sup>a</sup> (to total 10)	-	-		
2. Following	-	5 (same birds)	5		10	( 5 new)
<hr/>						
<b>D. Wintering grounds</b>						
1. Relocate		-	10	10	20	(20)
2. Translocate	-	5	5	-	10	(10)
3. Find		-				
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<b>E. Spring Migration</b>	-	-	(1)	(1)	(2)	(2)
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<b>Max. Total</b>	15	20	20 (21)	10 (11)	80 (82)	(67)

<sup>a</sup>A maximum of ten birds will be used in this experiment, and it is anticipated that at least 5 of the post-fledging study birds can be recaptured for this purpose. Thus, up to 5 new birds will need to be caught.

Rough Estimate of Projected Cost of Kirtland's Warbler Research Program

	1977	1978	1979	1980	Total
<b>A. R&amp;D.</b>					
1. Development	7,000	0	0	0	\$12,000.00
2. Field testing	5,000				
<b>B. Post-fledging</b>					
	10,000	8,000	0	0	18,000.00
<b>C. Fall Migration</b>					
1. Departure					
Direction	2,500	2,500	0	0	5,000.00
2. Fall		15,000	15,000	0	30,000.00
<b>D. Wintering Grounds</b>					
1. Translocate	0	21,000*	21,000*	0	42,000.00*
2. Relocate		0	10,000	28,000*	38,000.00*
3. Find		3,500	0	0	3,500.00
<b>E. Spring Migration</b>					
	0	0	0	3,000	3,000.00
<b>F. Publication</b>					
	0	0	0	2,500	2,500.00
<b>Total</b>	<b>24,500</b>	<b>50,000</b>	<b>46,000</b>	<b>33,500</b>	<b>154,000.00</b>

\*Component figures that cover more than one operation.

*\* Costs estimated by Mayfield/Cochran/Clench.  
Do not include University or Federal overhead and probably not salaries in full.*

## VI. The Coordination of Expanded Research on Kirtland's Warbler

The research outlined in this report directly involves a diverse number of individuals and organizations, and it is a matter of great importance that should the proposed research be undertaken, a clear organizational framework be set up to coordinate the program. We feel that the most logical organizational focal point is the Kirtland's Warbler Recovery Team. The team should be responsible for the development of further plans and for implementation of whatever research is agreed upon. We see no reason why research could not begin in 1977 and we recommend that the unused balance of the \$15,000 allocated to us for development of a research proposal be immediately channeled to Mr. William Cochran for development of radio-telemetric hardware, if our recommendations prove to be acceptable to all concerned. As the initial radio-telemetric work would involve species other than Kirtland's Warbler there need be no delays involving the Federal Register in getting a program rolling. It would be unfortunate to lose the benefits of starting research in 1977 because of delays in the machinery.

We feel that our own usefulness in development of plans has now reached a logical conclusion, and wish to pass on this responsibility to others who will be more directly concerned with implementation of research. Mr. Cochran has offered to write up detailed proposals for the radio-telemetric work, and this might be the most appropriate next step in development of research plans.

We wish to emphasize the very special nature of our relationship with the Bahamas government with regard to Kirtland's Warbler research. The Bahamas government, specifically Mr. Oris Russell, Permanent Secretary for Internal Affairs, and Mr. Claude Smith, Director, Ministry of Agriculture, Fisheries, and Local Government, are anxious to cooperate in the research and wish to be kept informed of all developments. They are particularly concerned with being given sufficient lead time for consideration of proposals and with the extent to which research can be set up to utilize native Bahamian collaborators - especially to provide training for local residents in wildlife research. Mr. Russell and Mr. Smith will also need time to issue the wide variety of permits so that Kirtland's Warblers may be imported, captured, banded, radioed, and tracked in the Bahamas. We believe that full cooperation between the U.S. and the Bahamas is an essential condition for a successful research program and we agree that direct participation by local Bahamians in the program is an essential part of this cooperative approach. As outlined in the specific proposals there will be a critical need for manpower in the radio-telemetric aspects of studies to be carried out in the Bahamas, so there should be ample opportunities for bringing in resident Bahamians at this stage.

Annotated List of key persons for a Kirtland's Warbler study

Bahamas National Trust  
(Dir. David Campbell)  
P.O. Box N4105  
Nassau, Bahamas

The major conservation agency in the Bahamas, a source of help and encouragement in any Bahamian research.

Mr. John Byelich  
Mich. Dept of Natural Resources  
Div. of Wildlife  
Mason Bldg.  
Lansing, Michigan 48926

Leader, Kirtland's Warbler Recovery team.

Dr. Mary H. Clench  
Section of Birds  
Carnegie Museum  
Pittsburgh, Pa. 15213

Ornithologist currently working with Mr. Mayfield on Kirtland's Warbler migration and wintering behavior. Interested in pursuing additional work on the wintering grounds.

Mr. William Cochran  
Illinois Natural History Survey  
279 Natural Resources Building  
Urbana, Illinois 61801

Foremost expert on avian radio-telemetry.

Mr. Harold Mayfield  
River Road  
R.F.D.  
Waterville, Ohio 43566

Recognized expert on the Kirtland's warbler, member of Kirtland's Warbler recovery team.

Mr. Don Merton  
New Zealand Wildlife Service  
Dept. of Internal Affairs  
Private Bag  
Wellington, N.Z.

Has wide and extensive experience capturing, translocating and releasing wild caught endangered species in New Zealand.

Mr. Lew Ohman  
Northcentral Forest Exp. Station  
Univ. of Minnesota  
St. Paul, Mn. 55108

U. S. Forest Service official who may hire a U.S.F.S. biologist to study the Kirtland's Warbler. If USFS does hire a warbler biologist, many of the projected costs will decrease or could be shared.

Mr. Oris Russell  
Permanent Secretary for  
External Affairs  
Ministry of External Affairs  
P.O. Box N792  
Nassau, Bahamas

As permanent Secretary, Mr. Russell would be the contact for authorization of most field activities in the Bahamas. He attended the Kirtland's Warbler meeting in Nassau, and is conversant with this proposal.

Mr. Claude Smith, Dir.  
Dept. of Agriculture, Fisheries,  
and local Government  
P.O. Box N3028  
Nassau, Bahamas

Mr. Sandy Sprunt  
115 Indian Mound Trail  
Tavernier, Florida 33070

Mr. Smith, as Director of Agriculture, would be the principle contact for permits regarding capturing, banding, and radio-tagging Kirtland's Warblers in the Bahamas. He is keenly interested in conservation, is fully conversant with this proposal, and a good contact for promising local biologists.

As director of research for the National Audubon Society, Mr. Sprunt has a continuing interest in this study, could be helpful with logistics, and has offered to help in promoting local awareness of this study in the Bahamas.

## References

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- Walkinshaw, L. H. 1972. Kirtland's Warbler - endangered. American Birds 26:3-9.
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MEM 3/28/77  
Ward 3/29/77  
Paradise 3/29  
Spinks 3/29

MAR 30 1977

In Reply Refer To:  
FWS/OES Sp

To: Associate Director - Federal Assistance  
From: Chief, Office of Endangered Species  
Subject: Proposal to Study the Non-breeding Biology of  
Kirtland's Warbler

This is an excellent, unusually well-planned and detailed proposal by two of the most qualified scholars in the world. There would be little doubt that the proposed work would be of the highest caliber and would result in a wealth of valuable data. The fate of our Endangered migratory species, when they are in the little known part of their range that is beyond our borders, has been neglected in conservation planning, but is critically important.

Our only concern is that the proposal seems partly based on the unconfirmed presumption that difficulty on the wintering grounds may be preventing rapid recovery of the species. Prior to committing ourselves to the study, it might be advisable to discuss this matter in more detail with the applicants. We also might as well wait and get a count of the 1977 breeding population to see if any trend pertinent to the proposal seems to be going on. Finally, the Recovery Team and the Regions should be involved in the review.

Regardless of these reservations, the study would be desirable and we would recommend it for funding. Its priority would of course have to be evaluated relative to other important projects.

(Sgd) John L. Spinks, Jr.

cc:  
AFA  
OES/RMNOWAK/mem 3/25/77