

A PRELIMINARY ASSESSMENT OF THE POPULATION STATUS OF BICKNELL'S THRUSH IN NEW ENGLAND

Submitted To:

Dr. Peter Stangel
National Fish and Wildlife Foundation
1120 Connecticut Avenue, NW
Suite 900
Washington, DC 20036

Submitted By:

Vermont Institute of Natural Science
Church Hill Rd.
Woodstock, VT 05091

Phone: (802) 457-2779

Contact:

Chris Rimmer, Director of Research

A PRELIMINARY ASSESSMENT OF THE POPULATION STATUS OF BICKNELL'S THRUSH IN NEW ENGLAND

Abstract -- The Bicknell's Thrush (*Catharus [minimus] bicknelli*) is a neotropical migrant endemic to northern New England, New York, and parts of Quebec and Nova Scotia. Its current breeding distribution and population status are poorly known, but evidence suggests that Bicknell's Thrush may be seriously threatened. In New England and New York, its restricted alpine spruce-fir habitat faces threats from acid precipitation, ski area development, and transmission tower construction. Although detailed survey data are lacking, population declines have been reported in New York, Vermont, Nova Scotia, and southern Quebec. The species has apparently disappeared from its single site of historic occurrence in Massachusetts. In its restricted Caribbean wintering range, Bicknell's Thrush is also likely threatened due to habitat changes. Preliminary data suggest that the species' winter habitat may be limited to primary tropical forest, which has been severely reduced in extent throughout the Caribbean as a result of human population pressures.

In collaboration with the Manomet Bird Observatory, the Vermont Institute of Natural Science proposes in 1992 to collect baseline scientific data needed to evaluate the current population status of Bicknell's Thrush in the United States. The overall goal of this proposed work is to document the conservation status and needs of this species, and to assess its potential role as an indicator of ecological change in the alpine spruce-fir zone of northern New England and New York. Specifically, our 1992 objectives include: 1) coordination of standardized, volunteer-based surveys in New York, Vermont, New Hampshire, and Massachusetts to better define the current distribution of Bicknell's Thrush; 2) comparison of current distribution with historic information to document distributional changes; 3) integration of survey data into a Geographic Information System (GIS) database; and 4) focused research to determine the most effective method of censusing Bicknell's Thrush, as preparation for future efforts to estimate population size and trends.

The research proposed here will provide a focal point for the formulation of a sound management plan to conserve Bicknell's Thrush populations. The cooperation of state and federal natural resource agencies in the statewide distributional surveys should foster a coordinated approach to management of Bicknell's Thrush and its habitat. Data collected on the population status and, ultimately, ecology of this species, in combination with other long-term datasets on climate, acid deposition, and plant and insect ecology, should lead to an integrated conservation strategy for forest and wildlife communities of the montane spruce-fir zone in the Northeast.

The U.S. Fish and Wildlife Service has pledged \$15,000 of the \$30,000 needed for this study, with the requirement of a \$15,000 match. VINS seeks \$7,500 from the National Fish and Wildlife Foundation to use as a match in securing an additional \$7,500 from private sources. We plan to approach the Wharton Trust, the Windham Foundation, the Vermont Monitoring Cooperative, and several prospective individual donors for the remaining funds.

A PRELIMINARY ASSESSMENT OF THE POPULATION STATUS OF BICKNELL'S THRUSH IN NEW ENGLAND

PROJECT NEED AND BACKGROUND

Considerable concern has recently been expressed concerning the population status of many species of neotropical migratory birds (Robbins et al. 1986, Collins and Wendt 1989, Terborgh 1989, Askins et al. 1990, Finch 1991, Hagan and Johnston *in press*). In general, habitat loss or modification on the breeding and/or wintering grounds has been implicated as the cause of documented declines. However, only four species of neotropical migrants (Kirtland's Warbler, *Dendroica kirtlandii*; Golden-cheeked Warbler, *D. chrysoparia*; Black-capped Vireo, *Vireo atricapillus*; Least Bell's Vireo, *V. bellii-pusillus*) have declined to the point that official protection has been granted under the U.S. Endangered Species Act.

Recent studies by Canadian taxonomists suggest that Bicknell's Thrush (*Catharus [minimus] bicknelli*) is specifically distinct from the northern and more widely distributed Gray-checked Thrush (*Catharus minimus*) (Ouellet 1991, Seutin 1991). Bicknell's Thrush inhabits stunted boreal forests, primarily those areas dominated by red spruce (*Picea rubens*) and balsam fir (*Abies balsamea*). Its historic breeding distribution extended from the north shore of the Gulf of St. Lawrence, the Gaspé Peninsula, and Seal Island (southwestern Nova Scotia) south into Maine, New Hampshire, Vermont, New York, and Massachusetts (American Ornithologists Union 1957). In New England and New York, suitable nesting habitat is restricted almost exclusively to elevations greater than 3000 feet (Wallace 1939, Able and Noon 1976, Kibbe 1985, Peterson 1988). Probable threats to this limited habitat include the long-term effects of acid precipitation and cloudwater pollution (Schreiber and Newman 1988, DeHayes et al. 1991), habitat loss from ski area development, and construction of transmission towers. Possible global climate changes may also profoundly impact the long-term health and viability of montane spruce-fir forests. Although detailed survey data are lacking, Bicknell's Thrush population declines have been suggested by observers in New York, Vermont, Nova Scotia, and southern Quebec. The species has apparently disappeared from its single site of historic occurrence in Massachusetts. Currently available information concerning the absence of Bicknell's Thrush from areas of former occurrence is being summarized by H. Ouellet and J. Marshall (pers. comm.).

Bicknell's Thrush is also likely threatened due to habitat changes on its restricted wintering grounds. The only confirmed specimens have been collected in Haiti and the Dominican Republic (J. Marshall, pers. comm.). Winter sightings of Gray-checked Thrushes from other Caribbean islands (Jamaica, Mona Island, and Puerto Rico) (Arendt *in press*) may represent *C. bicknelli*. Preliminary data suggest that the species' winter habitat may be limited to primary tropical forest (Arendt *in press*), which has been severely reduced in extent throughout the Caribbean as a result of human population pressures.

Baseline scientific data are critically needed to assess the current population status of Bicknell's Thrush in the United States. Although some evidence indicates that the species may warrant formal protection under federal or state endangered species laws, adequate information is simply not available at present. Especially lacking are detailed data on the current distribution and population levels of Bicknell's Thrush. Such data represent an essential starting point for the development of a conservation strategy for this neotropical migrant. This project proposes to collect critical background data on New England and New York's only endemic songbird, as a foundation for future efforts to document its population size and trends, habitat requirements and breeding ecology, and overall conservation status.

A broader goal of this proposed research is to evaluate Bicknell's Thrush as a biomonitor of ecological change in high elevation forests. The isolated patches of alpine spruce-fir habitat that Bicknell's Thrush occupy may themselves be threatened. Although 90% of Vermont's historically undisturbed forests occur at high altitudes (C. Cogbill, pers comm.), little research has been conducted in this zone. The strong elevational zonation shown by Bicknell's Thrush (Able and Noon 1976) and the narrow breadth of its ecological niche qualify the species as a potentially valuable bioindicator of habitat quality and change. With mounting concern for the long-term health of montane spruce-fir forests, due to climatic warming, atmospheric cloud deposition, and human-related development, the need for an integrated biomonitoring scheme is compelling.

OBJECTIVES AND PURPOSE

The overall purpose of this proposed research is to collect baseline biological data needed to evaluate the population status of Bicknell's Thrush in the United States and to begin an assessment of its potential role as an indicator of ecological change in the alpine spruce-fir zone.

Specifically, the objectives of this project include:

- 1) coordination of a standardized, volunteer-based survey effort aimed at determining the presence or absence of Bicknell's Thrush on the majority of high elevation areas in New York, Vermont, New Hampshire, and Massachusetts;
- 2) comparison of distributional data from 1992 with historic information to document changes in Bicknell's Thrush distribution;
- 3) integration of survey data into a Geographic Information System (GIS) database to map current distribution, to calculate aerial extent, perimeter, and degree of isolation of each high elevation habitat "island" in the survey area, and to assess the effects of these variables on Bicknell's Thrush presence or absence;
- 4) focused research to determine the most effective and efficient method of censusing Bicknell's Thrush;
- 5) assessment of the effects of time of day, season, and weather on censusing efficiency;
- 6) technical analysis of results and preparation of a final report, including recommendations for censusing protocols to be used in future studies of Bicknell's Thrush, specific areas in need of further distributional survey, and additional research needed to assess the population status of the species.

METHODS

I. ASSESSMENT OF CURRENT DISTRIBUTION IN NEW YORK, VERMONT, NEW HAMPSHIRE, AND MASSACHUSETTS

Relatively extensive areas of high elevation land (>2500 feet) exist in New England (excluding Maine and including New York). For example, over 70 distinct mountaintop "islands", characterized by elevations >3000 feet, occur in Vermont alone. Of these, approximately 23 are larger than 0.5 square mile in size and may support habitat suitable for Bicknell's Thrush. At higher latitudes, such as in the Canadian Maritimes and parts of Maine, Bicknell's Thrush may breed at lower elevations (Wallace 1939, J. Marshall, pers. comm.). This proposal does not include needed research on the species' distribution and ecology in Maine or Canada, for which funding will be sought elsewhere.

Although the great majority of Bicknell's Thrush breeding records in New York, Vermont, New Hampshire, and Massachusetts occur in areas located >3000 feet in elevation, it is important in this preliminary survey to include some lower elevation sites, where the species is not expected to occur, in order to eliminate these areas from consideration during future research activities. Wallace (1939) noted that "scattered pairs may be found breeding as low as 2500 feet on some mountains". Additional research efforts planned for 1993 and beyond will quantitatively analyze the specific habitat characteristics of Bicknell's Thrush, including the distribution of the species in relation to elevation.

A. Coordination of Volunteer Survey Efforts

The breeding biology of Bicknell's Thrush dictates that surveys aimed at determining its presence or absence must be conducted between 5 June and 15 July, during which time males sing territorially at dawn and, even more so, at dusk (Wallace 1939, Dilger 1956). Because difficult access to many locations may prevent a single observer from surveying more than one site per day, complete or near-complete coverage will be achieved only by the careful advance coordination of a network of volunteer field birders. In addition, careful oversight of volunteer efforts will be necessary to ensure standardized data collection. A major flaw in our current knowledge of Bicknell's Thrush distribution has been the absence of standardized surveys that provide comparable data among various locations and observers.

This volunteer coordination effort will include 7 major steps:

- 1) solicit participation of local field birders through contacts with state and local Audubon chapters and birding clubs, also with state and federal natural resource agencies, and through announcements in local, statewide, and national bulletins or newsletters. This will include identifying and working with state coordinators for New York and New Hampshire;
- 2) identify discrete sites (giving priority to areas >3000 feet in elevation but also including, where possible, elevation from 2500-3000 feet) for which the species' current status is uncertain, and identify volunteers willing to visit each of these sites during June and July of 1992;
- 3) provide written instructions describing survey techniques to ensure comparability of results among volunteers;
- 4) provide each volunteer with a loop tape recording of Bicknell's Thrush song to use during surveys (and to improve accuracy of song identification);
- 5) provide XEROX copies of appropriate sections of USGS topographic maps to each volunteer, as well as standardized data forms;
- 6) encourage volunteer cooperation and follow-through by means of phone and written contacts; and
- 7) ensure collection of data forms and tape recordings at end of survey period, through follow-up contacts if necessary.

Exact survey protocol may vary somewhat according to location and the number of available volunteers, but in general will emphasize visits to appropriate spruce-fir habitat immediately after sunset and/or immediately before dawn. In some situations visits may only be possible during mid-day time periods; any data collected under such circumstances will be analyzed separately from results obtained at dawn or dusk. Ideally, "islands" of apparently suitable habitat where Bicknell's Thrush is not documented will be visited on multiple days, with different specific areas being surveyed on each visit. In this study, careful determination of species absence will be as important as documented presence.

Variables to be recorded on standardized data forms will include: a) precise locations surveyed, marked on USGS topographic maps; b) date; c) starting and ending times; d) temperature; e) wind speed and direction; f) cloud cover extent; g) general description of vegetation type; h) presence or absence of Bicknell's Thrush, i) basis of identification (because of the possibility of confusion between *C. bicknelli* and other *Catharus* thrushes, observers will be asked to provide detailed documentation of their sightings including, where possible, tape recordings of birds identified as Bicknell's Thrush); and j) other species

of birds heard or observed (as a crude index of observer competence). Volunteers will be requested to estimate the number of thrushes present, although a true population census is beyond the scope of the present, preliminary study.

Project staff will cover those priority sites for which volunteers can not be assigned.

B. Technical Analysis of Results

The final project report will summarize the survey results, and analyze these field data in conjunction with information obtained from a Geographic Information System (GIS) database. In particular, GIS will be used to calculate the aerial extent, perimeter (as an index of possible edge effects), and degree of isolation of each high elevation habitat "island" in the study area. The effects of these variables will be assessed relative to thrush presence or absence at each site. Maps will be produced to indicate distribution of Bicknell's Thrush relative to federal and state lands, as well as important private land-holdings. Additionally, areas in special need of further study will be clearly identified.

II. COMPARISON OF POSSIBLE CENSUSING TECHNIQUES

Obtaining accurate census information for Bicknell's Thrush poses a number of difficulties. The species' occurrence in the U.S. at high elevation, relatively inaccessible sites makes it impossible to monitor using standard techniques such as the roadside-based Breeding Bird Survey. Robbins et al. (1986) had too few records of this species (or "Gray-cheeked" Thrush) to conduct any analysis of population trend. Breeding Bird Survey routes from Canada's Maritime provinces and central Ontario and Quebec showed decreases in Gray-cheeked Thrush (probably including *C. bicknelli*) population indices between the years 1966-77 and 1978-83 (Collins and Wendt 1989). However, small sample sizes precluded any test of statistical significance of these trends.

Unknown aspects of the species' breeding biology also complicate census efforts. Some observers have suggested that Bicknell's Thrush is best censused under windy, rainy conditions (J. Marshall, pers. comm.), while others have regularly heard it singing during less inclement weather. Wallace (1939) found that singing activity peaked during the period immediately after sunset, but Rimmer (pers. obs.) has recently heard the species singing during mid-day. Seasonal effects may also occur - censuses conducted in mid-June may yield results different from those in mid-July. Given the logistical difficulties in reaching many of the areas occupied by Bicknell's Thrush, the question of which census technique will provide the most accurate and efficient estimation of population size is an important one. These problems will be addressed through a focused study of the Bicknell's Thrush population breeding on Mt. Mansfield, Vermont.

A. Determination of Most Efficient Censusing Technique

This phase of the project will include: a) territorial mapping of singing male Bicknell's Thrushes using conventions and techniques established by Robbins (1970), and b) comparison of these baseline density values with results obtained using fixed radius circular plots (Reynolds et al. 1980) and fixed width transects (Emlen 1971). The ultimate goal is to identify a technique that will permit an observer to briefly visit a site and conduct a survey that will yield a density value. This value can then be used in conjunction with GIS data identifying amount of suitable habitat to provide population estimates.

Territorial mapping of singing males, in which the location and behavior of each bird seen or heard are recorded on a detailed map of the study plot on each of 8-10 visits, is generally regarded as one of the most precise methods of determining bird density (International Bird Census Committee 1970). The resultant series of field maps allows the researcher to delimit the location of each singing

male's territory, thus providing a fairly exact picture of the distribution of the species on the study plot. Unfortunately, this technique is extremely labor intensive, even for relatively small plots of land. For extensive regions, it is impractical except as a means of obtaining scattered subsamples.

In this study, territorial mapping will be used to determine the number of Bicknell's Thrushes present on a 10 hectare study plot located on Mt. Mansfield in Stowe, Vermont. The study plot will be visited on 10 dates between 5 June and 15 July, with mapping of Bicknell's Thrushes being conducted at dawn and dusk on each date. Standard data on weather conditions will be recorded on each visit. These results will be summarized in a standard map depicting the territorial boundaries of thrushes on the study plot.

Simultaneous to these mapping activities, densities of Bicknell's Thrush will be estimated using fixed width transects and fixed radius circular plots located within the study area. In the first of these techniques, several 1 km transect lines will be established through the study area. Observers will record the number of Bicknell's Thrushes registered in each of several bands located at right angles to the transect line (Emlen 1971, 1977).

It is anticipated that the dense vegetation characterizing the spruce-fir zone occupied by Bicknell's Thrush may render the transect method difficult or ineffective. Fixed radius circular plots (Reynolds et al. 1980) may prove a more efficient method of determining Bicknell's Thrush densities. In this technique, points are established at fixed intervals throughout the study area, with each point forming the center of non-overlapping circles of fixed radius (distance determined by limit of detection of Bicknell's Thrush song). The number of circles included in the sampling protocol will be determined by the size and configuration of the study plot itself. Observers standing at the center point of each circle will record the number of singing Bicknell's Thrushes registered in that circle during a 3-minute period. Longer sampling periods have been shown to increase the number of birds detected, but also to increase the possibility of inaccuracies resulting from a single individual being recorded from multiple sites within a circle.

Each fixed width transect and fixed radius circle will be visited on the same 10 dates used for the territorial mapping effort, with simultaneous counts using each method being conducted at dawn and dusk on each date. These data will be converted to density estimates and compared with results yielded by territorial mapping.

In addition to providing a focal study area for comparing census techniques in 1992, the 10 ha plot on Mt. Mansfield will serve as a baseline study site for future detailed investigations of Bicknell's Thrush habitat use, breeding biology, and population ecology. Coincident with censusing of Bicknell's Thrush in 1992, data will be recorded on numbers of other breeding passerines, using the three methods described above. Density estimates obtained for other species on the study area will be used to assess the relative abundance of Bicknell's Thrush and to provide a comparative baseline for future studies of its population trends in the alpine spruce-fir zone of Mt. Mansfield. Additionally, the 10 ha plot will be used to coordinate future research with the Vermont Monitoring Cooperative (VMC). This consortium of federal, state, and private agencies is initiating long-term monitoring of environmental conditions (air quality, climate, etc.) and forest ecosystem health on Mt. Mansfield. Detailed data on the population status, ecology, and habitat use of Bicknell's Thrush may provide an important measure of organismal responses to ecological change in alpine spruce-fir forests.

B. Assessment of the Influence of Time of Day, Season, and Weather on Singing Behavior

Wallace (1939) early noted that Bicknell's Thrush singing activity is concentrated during the period preceding sunrise and, to an even greater degree, immediately following sunset. However, no quantitative studies have been conducted, and the effect of time of day on Bicknell's Thrush singing behavior is uncertain. Consequently, it is not known whether censuses conducted at dawn are comparable to those

conducted at dusk. Similarly, it is not clear whether observations made during other hours of the day will suffice to at least determine the species' presence or absence.

To assess the influence of time of day on Bicknell's Thrush singing activity, observers will record the number of songs heard from a single location during 5-minute periods spaced at 30-minute intervals from dawn (30 minutes before sunrise) to dusk (30 minutes after sunset). Such song counts will be conducted on at least 10 dates between 5 June and 15 July.

Seasonal variation in singing activity also complicates efforts to census Bicknell's Thrush. In general, migrant passerines sing extensively upon return to their breeding grounds, as a means of establishing territory boundaries. As the nesting season progresses, the amount of song decreases (O'Connor 1980). Assuming that Bicknell's Thrush follows this pattern, censusing conducted during the first few weeks after the species' return from its breeding grounds should be the most effective in providing accurate population estimates. This phase of the project will attempt to provide at least a preliminary assessment of seasonal variation in Bicknell's Thrush singing activity, using song count data described above.

Finally, weather is also a factor that frequently affects passerine singing activity, or at least the ability of observers to detect song (Robbins 1981). No quantitative studies have been conducted of Bicknell's Thrush singing activity under different weather conditions. Some observers familiar with the species suggest that only censuses conducted under foggy, windy conditions will yield accurate results, while others report hearing normal singing behavior under clear, calm conditions. This study is unlikely to definitively answer this question, as the 10 song count dates may not include an adequate variety of weather conditions to permit comparisons. However, the results obtained should provide at least a preliminary framework for the design of future studies.

C. Analysis of Results and Recommendations for Future Census Work

Descriptive statistics will be presented using standard graphical and tabular methods. Statistical analyses will use standard nonparametric techniques (due to small sample sizes). In particular, the following questions will be addressed:

1. What is the relationship between density values obtained through territorial mapping vs. those obtained through fixed width transects and fixed radius circle plots?;
2. Do censuses conducted during early June yield comparable results to those conducted in late June and early July?;
3. What is the similarity in results between censuses conducted at dawn vs. dusk;
4. Are mid-day visits adequate to determine the species' presence or absence?; and
5. Do particular weather conditions strongly influence census results?

These analyses will form the basis for recommendations for research activities in 1993 and beyond.

BENEFITS TO THE WILDLIFE RESOURCE

The Bicknell's Thrush is a little-known neotropical migrant that is clearly experiencing habitat degradation at both ends of its migratory spectrum and may be undergoing population declines. It occupies a very narrow ecological niche on its breeding grounds, and possibly within its restricted wintering range as well. This species, the only endemic songbird in the northeastern United States, may be one of the more seriously threatened neotropical migrants in the country. This study proposes to collect baseline biological data needed to assess the population status of Bicknell's Thrush, in order to begin the formulation of a conservation strategy.

In a larger sense, Bicknell's Thrush is an indicator species of alpine spruce-fir habitat, being almost exclusively restricted to that narrow zone for breeding in New England and New York. Data collected in this preliminary study and during anticipated future research activities may provide a foundation to evaluate the status of the entire avian community occupying high elevation spruce-fir forests in the Northeast. Further, Bicknell's Thrush may serve as an important vertebrate biomonitor of the ecological health of that habitat and as a model to assess the effects of various disturbance regimes. The fragility of stunted alpine forests, their geographic isolation as habitat "islands", and the narrowly distributed, discontinuous populations of plant and animal species that they support demand concerted, careful monitoring.

MANAGEMENT IMPLICATIONS

Knowledge of the population status of Bicknell's Thrush will be essential to formulate a sound management or recovery plan, if warranted. If the species is determined to be seriously threatened, careful management of breeding populations will likely be critical to ensure its long-term viability. In addition, research on Bicknell's Thrush may provide important information on the alpine bird community in general; this may be needed to develop an overall management plan for the conservation of avian diversity in high elevation forest habitats. The probable role of Bicknell's Thrush as a useful biomonitor of ecological change may yield information that leads to the long-term protection of critical alpine habitat. Finally, the eventual integration of Bicknell's Thrush population and ecology data with data from other studies of climate, meteorology, airborne pollution, and plant and animal ecology may lead to broad-based management and other policy decisions that will protect the ecological integrity of high elevation habitats in the Northeast.

PROJECT STAFF AND ORGANIZATIONS

This proposed project will involve a collaborative effort between the Vermont Institute of Natural Science (VINS) and the Manomet Bird Observatory (MBO). VINS is a private, non-profit, membership-based statewide environmental research and education organization founded in 1972 and headquartered in Woodstock, Vermont. Its research program focuses on avian ecology and conservation biology, with emphasis on threatened and endangered species and long-term population studies. MBO is a private, non-profit, membership-based ornithological research organization founded in 1969 and centered in Manomet, Massachusetts. Its work is hemispheric in scope and focuses on the conservation biology and population dynamics of landbirds, shorebirds, wading birds, seabirds, and marine mammals.

Christopher C. Rimmer, Director of Research at VINS (resume attached), will serve as the co-principal investigator of this study. He will coordinate, supervise, and participate in the fieldwork, and will assist in the data analysis and preparation of the final report. Dr. Jonathan L. Atwood, Senior Staff Scientist at MBO (resume attached), will serve as the other co-principal investigator. He will be responsible for the bulk of data analysis, will assist in the coordination of fieldwork, will participate in field activities, and will co-write the final report. A graduate student assistant will be hired to carry out most logistical details, GIS data entry, and to participate in field activities. Two field assistants will be hired to participate in both phases of the fieldwork. State survey coordinators for New Hampshire and New York will be provided a small honorarium to compensate for their time and expenses.

STATUS OF CHALLENGE GRANT

The Office of Migratory Bird Management, U.S. Fish and Wildlife Service has pledged \$15,000 (50%) of the project's overall cost of \$30,000 (letter of intent attached). VINS seeks \$7,500 from the National Fish and Wildlife Foundation to use as a challenge grant in securing an additional \$7,500 from private sources. Sources of funding to be solicited to meet this challenge include the Wharton Trust, the Windham Foundation, the Vermont Monitoring Cooperative (Vermont Department of Forests and Parks), and several prospective individual donors.

PROJECT BUDGET

Salaries

Co-principal Investigator (Rimmer)	\$8,000
Co-principal Investigator (Atwood)	\$8,000
Graduate Research Assistant	\$3,500
Field Assistant	\$2,000
Field Assistant	\$2,000
New York Survey Coordinator	\$1,000
New Hampshire Survey Coordinator	\$1,000

Supplies

Topographic maps	\$275
Loop Tape cassettes	\$75
Cassette recorders (3)	\$150
Miscellaneous supplies	\$150

Miscellaneous

XEROX	\$150
Postage	\$200
Phone, FAX	\$500
Computer time	\$500
Mileage: 8000 miles (est.) @	\$2,000
Office support, preparation of final report	\$500

TOTAL \$30,000

\$15,000 (50%) of the total projected budget has been pledged by the U.S. Fish and Wildlife Service (letter of intent attached). VINS seeks \$7,500 from the National Fish and Wildlife Foundation to use as a challenge grant in securing the remaining \$7,500 needed for this project from private sources.

LITERATURE CITED

- Able, K.P., and B.R. Noon. 1976. Avian community structure along elevational gradients in the northeastern United States. *Oecologia* 26: 275-294.
- American Ornithologists' Union. 1957. Check-list of North American birds. Fifth ed. American Ornithologists' Union, Baltimore, Maryland.
- Arendt, W. J. Status of North American migrant landbirds in the Caribbean. *In*: J.M. Hagan and D.W. Johnston [eds.], Ecology and conservation of neotropical migrant landbirds. Smithsonian Press, Washington, D.C., *in press*.
- Bull, J. 1974. Birds of New York State. Comstock Publishing Associates, Ithaca, New York.
- Collins, B.T., and J.S. Wendt. 1989. The breeding bird survey in Canada 1966-1983: analysis of trends in breeding bird populations. Tech. Rep. Series No. 75. Canadian Wildlife Service, Ottawa, Ontario.
- DeHayes, D.H., Thornton, F.C., Waite, C.E. and M.A. Ingle. 1991. Ambient cloud deposition reduces cold tolerance of red spruce seedlings. *Can. J. For. Res.* 21: 1292-1295.
- Dilger, W.C. 1956. Hostile behavior and reproductive isolating mechanisms in the avian genera *Catharus* and *Hylocichla*. *Auk* 73: 313-353.
- Emlen, J.T. 1971. Population densities of birds derived from transect counts. *Auk* 88: 323-342.
- Emlen, J.T. 1977. Estimating densities of birds from transect counts. *Auk* 94: 455-468.
- Finch, D.M. 1991. Population ecology, habitat requirements, and conservation of neotropical migratory birds. Gen. Tech. Rep. RM-205. U.S. Dept. Agriculture, Forest Service. Rocky Mountain Forest and Range Exp. Station. Fort Collins, Colorado.
- Forbush, E.H. 1927. Birds of Massachusetts and other New England states. Vol. 2. Mass. Dept. Agriculture; Boston.
- Hagan, J.M., and D.W. Johnston. Ecology and conservation of neotropical migrant landbirds. Smithsonian Institution Press, Washington, D.C., *in press*.
- Kibbe, D.P. 1985. Species account: Gray-cheeked Thrush *Catharus minimus*. Pp. 242-243, *in*: S.B. Laughlin and D.P. Kibbe [eds.], The atlas of breeding birds of Vermont. University Press of New England, Hanover, New Hampshire.
- O'Connor, R.J. 1980. The effects of census date on the results of intensive Common Birds Census surveys. *Bird Study* 27: 126-136.
- Ouellet, H. 1991. Is Bicknell's Thrush a Gray-cheeked Thrush? Abstract No. 15, annual meeting of the American Ornithologists' Union, Montreal, Quebec.
- Peterson, J.M.C. 1988. Species account: Gray-checked Thrush. Pp. 320-321, *in*: R. Andrie and J. Carroll [eds.], The atlas of breeding birds in New York State. Cornell University Press, Ithaca, New York.

- Reynolds, R.T., J.M. Scott, and R.A. Nussbaum. 1980. A variable circular plot method for estimating bird numbers. *Condor* 82: 309-313.
- Robbins, C.S. 1970. Recommendations for an international standard for a mapping method in bird census work. *Audubon Field Notes* 24: 723-726.
- Robbins, C.S. 1981. Bird activity levels related to weather. Pp. 301-310, *in*: C.J. Ralph and J.M. Scott [eds.], *Estimating numbers of terrestrial birds*. *Stud. Avian Biology* 6.
- Robbins, C.S., D. Bystrak, and P.H. Geissler. 1986. The breeding bird survey: its first 15 years, 1956-1979. Res. Publ. 157. U.S. Dept. of the Interior, Fish and Wildlife Service.
- Schreiber, R.K., and J.R. Newman. 1988. Acid precipitation effects on forest habitats: implications for wildlife. *Conservation Biology* 2: 249-259.
- Seutin, G. 1991. The Grey-checked Thrush: one species or two? An analysis of mtDNA. Abstract No. 14, annual meeting of the American Ornithologists' Union, Montreal, Quebec.
- Terborgh, J.W. 1989. *Where have all the birds gone?* Princeton University Press, Princeton, New Jersey.
- Wallace, G. J. 1939. Bicknell's Thrush, its taxonomy, distribution, and life history. *Proc. Boston Soc. Nat. History* 41: 211-402.