MOUNTAIN BIRDWATCH 2002

FINAL REPORT TO THE UNITED STATES FISH AND WILDLIFE SERVICE

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Abstract

Mountain Birdwatch is a long-term monitoring program for songbirds that breed in high-elevation forests of the Northeast. Skilled volunteers conduct annual surveys along 1-km routes that are located on mountains in New York, Vermont, New Hampshire, and Maine. Primary emphasis is placed on Bicknell's Thrush, the region's only endemic bird species, and a montane fir specialist that is vulnerable to ongoing and projected habitat loss. Other focal species include Blackpoll Warbler, Swainson's Thrush, White-throated Sparrow, and Winter Wren. In 2002, Mountain Birdwatchers gathered observations from 142 locations, with point count surveys completed on 118 routes. As in 2001, Blackpoll Warblers and White-throated Sparrows were abundant and occurred on nearly every route. However, their numbers were 10-13% lower than the previous year. Swainson's Thrush and Winter Wren occupied a second tier of abundance, with unchanged numbers since 2001. Bicknell's Thrush remained uncommon, detected during just half of the surveys by point count. Ultimately, observers documented the species on 80% of the routes through chance encounters and audioplaybacks. Despite its rarity, Bicknell's Thrush maintained constant numbers and undiminished distribution in 2002.

In addition to monitoring population levels, VINS biologists and volunteers measured habitat characteristics on 45 routes, collected GPS coordinates on 62 routes, and completed photographic documentation of 52 routes. This information will help determine what factors influence avian abundance and distribution on northeastern mountains, an essential consideration in conservation planning. To provide a basis for such planning, we constructed a GIS model of Bicknell's Thrush breeding habitat (Lambert et al. 2003) and used conservation lands data to identify key management units and conservation opportunities. This assessment revealed the significance of the White Mountain National Forest and the Adirondack Park Forest Preserve, which contain 35% and 22% of modeled U.S. habitat, respectively. Although most of the region's Bicknell's Thrush habitat is conserved, management approaches vary among landowners and large gaps in coverage remain. In western Maine, less than one in four hectares of potential habitat occurs on conservation land. Mountain Birdwatch will continue to monitor the Northeast's high-elevation bird populations, as well as the patterns of land management that affect them.

Background and Rationale

Bicknell's Thrush (*Catharus bicknelli*), once considered a subspecies of Gray-cheeked Thrush (*C. minimus*), gained full species status in 1995. Since then, it has been recognized as one of the most at-risk passerines in eastern North America. Partners in Flight ranks Bicknell's Thrush as the top conservation priority among Neotropical migrants in the Northeast (Pashley et al. 2000), while the International Union for the Conservation of Nature classifies the songbird as "vulnerable" on its list of threatened species (BirdLife International 2000).

A number of factors contribute to the vulnerability of Bicknell's Thrush, including its limited breeding range. In the United States, Bicknell's Thrush breeds in montane fir forests of New York and northern New England (Atwood et al. 1996) and is often associated with recently disturbed areas characterized by vigorous regrowth (Wallace 1939, Rimmer et al. 2001). In southeastern Canada, it inhabits montane fir (Ouellet 1993), maritime spruce-fir (Erskine 1992), and regenerating mixed forest (Nixon et al. 2001). The species is similarly restricted in its wintering distribution, occurring primarily in wet, broadleaf forests of the Dominican Republic. These forests have been reduced to less than 10% of their historic extent in the last 30 years (Stattersfield et al. 1998).

Loss of the Northeast's montane fir habitat may also threaten Bicknell's Thrush. Expansion of recreation areas, cell tower construction, and wind power development have received the most regulatory attention, as each results in highly visible forest loss. Effects of airborne pollutants on Bicknell's Thrush are unclear, but potential threats include forest decline from acid deposition (Johnson et al. 1992) and heavy metal toxicity (Gawel et al. 1996), mercury poisoning by uptake in the food chain, and egg-laying irregularities associated with calcium limitation, a possible consequence of acidified soils (Graveland et al. 1994). Climate change represents the most far-reaching, long-term threat to the species. A warming climate is expected to cause incremental, but widespread changes in the composition and structure of high-elevation forests. Forest ecologists predict that balsam fir (*Abies balsamea*) will be substantially diminished, if not lost from the Northeast if atmospheric concentrations of CO_2 double, as expected within the next century (Iverson et al. 1999).

In the past fifty years, extirpations of Bicknell's Thrush appear to have occurred at isolated summits in southern New Hampshire (Mount Monadnock and Mount Sunapee), southern Vermont (Mount Aeolus, Mount Ascutney, Mount Carmel, Mount Glebe, Molly Stark Mountain), and western Massachusetts (Mount Greylock, Saddleball Mountain) (Atwood et al. 1996, VINS unpubl. data). To monitor changes in the status of Bicknell's Thrush and other songbirds that breed in mountain forests, the Vermont Institute of Natural Science (VINS) added high-elevation survey routes to the Vermont Forest Bird Monitoring Program (FBMP) in 1993. Highly skilled FBMP volunteers conduct two surveys each June, recording the number of all bird species seen and heard during five 10-minute point counts. In the spring of 2000, we launched Mountain Birdwatch as a simplified and complementary monitoring program. Mountain Birdwatchers conduct 5-minute counts and focus on a small group of species, consisting of: Bicknell's Thrush, Swainson's Thrush (*Catharus ustulatus*), Blackpoll Warbler (*Dendroica striata*), White-throated Sparrow (*Zonotrichia albicollis*), and Winter Wren (*Troglodytes troglodytes*). Novice and intermediate birdwatchers receive training in the identification of these species to ensure accurate counts.

Mountain Birdwatch increases the opportunity for volunteer participation, adds substantially to the number of sampled habitat units, and expands the geographic scope of high-elevation bird study in the Northeast. Consequently, the program boosts the statistical power to detect population change and increases the capacity to record changes in breeding distribution. Furthermore, Mountain Birdwatch avoids duplication of effort since its design allows data to be pooled with subsampled results from the Forest Bird Monitoring Program.

During Mountain Birdwatch's 2000 pilot season, we tested and refined training materials, sampling protocols, and route selection standards on 44 survey routes in Vermont (Lambert et al. 2001). Using the computer program Monitor (Gibbs 1995), we determined that at least 100 routes would be required to achieve > 90% power to detect a 5% annual decline in Bicknell's Thrush within five years. Annual surveys of 100 routes would enable detection of a 2% annual decline within a decade. The program's capacity to detect declines in Swainson's Thrush and Winter Wren populations is somewhat greater. It is highest for the most abundant species, Blackpoll Warbler and White-throated Sparrow. As few as seven years may be required to detect 2% annual declines in these two populations.

In 2001, Mountain Birdwatchers (hereafter including high-elevation FBMP volunteers) completed surveys on 117 routes (112 in suitable conditions) and submitted Bicknell's Thrush sightings from 24 additional locations. These data established a regional benchmark for future monitoring and enabled a preliminary investigation of factors that influence Bicknell's Thrush abundance in montane fir forests. From this analysis, elevation, latitude and their interaction term emerged as highly significant factors. However, they explained little variability in the data ($R^2 = 0.16$). Neither landscape configuration nor landscape composition appeared to have an effect on Bicknell's Thrush numbers, suggesting that stand-level habitat features may be of primary importance (Lambert et al. 2002).

In 2002, we conducted habitat surveys along selected routes in addition to carrying out the basic monitoring procedures. Vegetation sampling was designed to measure the influence of forest-stand characteristics on Bicknell's Thrush abundance. We used Global Positioning Systems (GPS) to pinpoint survey stations and facilitate improved landscape metrics in future analyses. We photographed the area surrounding survey points to provide a repeatable, visual record of northeastern montane forests near the turn of the millennium. Finally, we used geographic information systems (GIS) to perform a conservation assessment of Bicknell's Thrush breeding habitat in New York, Vermont, New Hampshire, and Maine.

METHODS

Volunteer engagement

We announced the opportunity to volunteer for Mountain Birdwatch on our web site (www.vinsweb.org/cbd/mbw) and in VINS publications. Cooperating conservation organizations publicized the project through electronic and print media. The Adirondack Mountain Club and the Wildlife Conservation Society sponsored a volunteer training session in Lake Placid that was attended by approximately 40 people. In all, about 175 people participated in the survey in 2002, including companions of the primary route monitors. Mountain Birdwatchers received maps, survey instructions, an identification guide to high-elevation songbirds, and a training tape with an auditory identification quiz. A perfect score on the quiz was a prerequisite for participation. Repeat surveyors were encouraged to review the written and recorded material in order to maintain a high level of proficiency. In March of 2003, we introduced "Feathers and Fir", a newsletter designed to further inform and engage volunteers.

Site selection, route placement and coverage

Site selection was based on a geographic information systems (GIS) model of potential Bicknell's Thrush (BITH) habitat that incorporates elevation, latitude, and forest type (Lambert et al. 2003). Developed with recent BITH location data, the model depicts conifer-dominated forests above an elevation threshold that drops 84 m for every one-degree increase in latitude (-84 m/1º latitude). The threshold's slope corresponds closely with the latitude-elevation relationship for treeline in the Appalachian Mountain chain, which is -83 m/1º latitude (Cogbill and White 1991). Six routes have been established on peaks lying below the elevation threshold. Over thirty additional routes cross the threshold, due to the limited length of trails and/or extent of modeled habitat at a given mountain. We made an attempt to randomize site selection by randomly assigning priority ranks to discrete units of high-elevation habitat. However, the choice of sites was constrained by the availability of volunteers and the location of existing trails.

When placing routes, we favored distinct starting points (e.g. trail junction), extensive conifer stands, and upper elevations. Volunteers establishing a route for the first time placed five points at 325-step (200- to 250-m) intervals along a mapped course. Monitors submitted a detailed description of each station in order to facilitate its location in future years.

In 2002, Mountain Birdwatchers conducted 118 surveys on routes scattered throughout New York (35), Vermont (40), New Hampshire (28), and Maine (15). Of the 118 routes, 72 had been completed in 2001. Forty-one routes were surveyed for all species according to FBMP protocols, while 77 were monitored for the five focal species only. We gathered Bicknell's Thrush observations from 24 additional mountains.

Survey Methods

Surveys were conducted under acceptable weather conditions between 4:00 a.m. and 8:00 a.m., on dates ranging from 1 to 21 June. Observers listened quietly for five minutes at five stations. They recorded the number of each focal species seen or heard at each station, noting Bicknell's Thrush observations between points, as well. If Bicknell's Thrush was not detected during or between point counts, surveyors returned to each point and broadcast a three-minute recording of the bird's vocalizations in order to elicit a response from present, but silent birds. Audioplaybacks were discontinued upon detection of one or more individuals. If no Bicknell's Thrushes responded to the broadcasts, the status of the species was classified as unknown. Monitors who completed their surveys without encountering Bicknell's Thrush were asked to conduct follow-up, audioplayback surveys at dusk or dawn before 15 July (after Atwood et al. 1996). In many cases, VINS staff substituted for volunteers who were unable to complete follow-up surveys. If no observations of Bicknell's Thrush were made during the second visit, the species was presumed to be absent from that site.

Because Red Squirrels are common nest predators in montane fir forests, Mountain Birdwatchers counted them, as well. Volunteers in the five-species program kept a running tally of Red Squirrels between the start of the first count and the end of the last.

Data analysis: avian distribution and abundance

To include FBMP data in our analyses, we subsampled records of the five focal species from the first five minutes of each ten-minute count. Where two point count series were conducted, we used results from the first survey only. We measured frequency of occurrence and relative abundance for each of the focal species. To calculate frequency of occurrence, we divided the number of routes on which a species was detected during point counts by the total number of routes surveyed by this method. For Bicknell's Thrush, we also calculated the proportion of survey routes on which the species was detected by any means (point count, chance, playback, or follow-up). We used the number of individuals detected per route for displaying 2002 relative abundance on species count maps. For between-year comparisons, we calculated the average number of individuals per point on a route by route basis. This correction was necessary because close to 30% of the routes surveyed in 2001 contained fewer than five stations (mean = 2.87 stations). These routes were extended below the threshold in 2002 to meet the 5-point standard. For each focal species, we averaged per-point values across routes to produce an overall index of relative abundance in 2001 and in 2002. The data we present are best suited for quantifying changes in species occurrence and abundance over time. We advise caution in comparing frequency of occurrence and relative abundance measures among species, due to interspecific differences in detectability.

Habitat sampling

We measured habitat characteristics on 45 routes throughout the survey region. Two vegetation plots were established for each point count station, for a total of ten per route. The plots were circular, with a radius of 5 m. We randomly placed one plot within 50 m of a point and a second at a distance of 50 to 100 m. For each plot we recorded the aspect, slope, number of standing or leaning snags, and the average, estimated height of the canopy, subcanopy, and shrub layers. We measured shrub stem density by walking a 1 m x 5 m strip transect from the center point toward each cardinal direction. Within these strips, we counted all vertical shrub and sapling stems (< 8 cm in diameter and > 50 cm-high) in three classes: conifer, deciduous, dead. At the end of the strip, we sighted back toward the center point through a 12 cm x 10 cm pane of plexiglass with twelve 2.5 cm x 2.5 cm stickers applied in a checkerboard pattern. The instrument was held vertically with the top edge at eye level. To estimate understory foliage volume, we recorded the number of unobscured squares in which green foliage was visible between the observer and the center point.

To describe canopy characteristics, we recorded the dominant canopy species (one or two species that made up > 40% of the canopy) and estimated the percent of the canopy comprised of each dominant species. We measured total canopy cover with spherical densiometer readings taken at the center point, facing each cardinal direction. From this same point, we divided the circle into four quadrants and identified the closest tree within each quadrant, its distance from the center point, and its diameter at breast height. This point quarter method will yield importance values for each species, while quantifying overall tree density and basal area for the plot. Finally, we used a 2 m-radius circular plot to visually estimate the percent ground cover of shrubs, ferns/herbs/grass, moss, leaf litter/soil, woody debris, and rock/lichen. We plan to continue this work, as resources permit, over the next few summers until 120 routes have been sampled. The results will enable future analysis of habitat features underlying avian distribution and abundance on northeastern mountains.

Route documentation

We used Garmin 76 GPS units in 3D positioning mode to record the location and elevation of survey stations on 62 routes. The maximum allowable estimate of error was 10 m. From each point on 52 routes, we took digital photographs of the forest in the four cardinal directions. GPS data will be used to improve route maps, locate unmarked survey stations in the field, and refine quantitative descriptions of landscape attributes. Photographs establish a visual baseline against which changes in forest composition and structure may be monitored over time. Repeatable habitat metrics, point photos, and remotely sensed images will facilitate comprehensive assessments of climate-change impacts in the future.

Conservation Assessment of Bicknell's Thrush Habitat

We first gathered boundary and ownership data for conservation lands in New York (NY State Bureau of Public Lands 2000), Vermont (Capen 2002), New Hampshire (Complex Systems Research Center 2002), and Maine (Krohn et al. 1998). Next, we overlaid our GIS model of Bicknell's Thrush habitat in ArcView 3.2 (Environmental Systems Research Institute 1999) and calculated the extent of modeled habitat in each state and in eleven ownership classes. Ownership classes included: state forest, state park, national forest, national park, private conservation land, tribal land, town forest, forest preserve, Department of Defense, timberland with easement, and other conservation land. Finally, we determined the proportion of U.S. habitat occurring within each state and ownership class.

RESULTS

Distribution and abundance

We compared 2001 and 2002 data for all routes surveyed as well as for the 72 routes surveyed in both years. The two approaches yielded nearly identical results for both relative abundance and occurrence frequency (Figures 1 and 2). As in 2001, Blackpoll Warbler and White-throated Sparrow were counted on the greatest proportion of routes and in the highest numbers. Nonetheless, tallies of each were down by 10-13%. Swainson's Thrush and Winter Wren occupied a second tier of abundance, with unchanged numbers since 2001. Observers encountered Winter Wren on approximately nine out of ten routes in 2002, compared to three out of four routes the previous year. Bicknell's Thrush remained sparse, detected by point count just half of the time and by any means (including chance and audioplayback) on 80% of all thoroughly surveyed routes. The species maintained constant numbers and undiminished distribution (Figure 4) in 2002. Red Squirrel numbers on repeated routes showed the most dramatic change (-76%), averaging 0.55 individuals per route in 2001, compared to 0.13 individuals per route in 2002. Occurrence frequency also dropped sharply from 0.32 to 0.10.

Conservation assessment

Our GIS model of Bicknell's Thrush habitat identifies 111,346 ha of potentially suitable forest in the northeastern United States. New Hampshire contains the greatest portion (45%), followed by New York (24%), Maine (23%), and Vermont (8%) (Figure 9). Regionwide, 81% of modeled habitat occurs on conservation lands (Table 1), primarily in national forests and state forest preserves. Of these, the White Mountain National Forest and the Adirondack Forest Preserve are especially important, containing 35% and 22% of modeled U.S. habitat, respectively. The pattern of ownership varies among states from a low of two ownership classes in New York to a high of nine ownership classes in New Hampshire and Maine. Although the overall level of protection is high, significant gaps remain. In Maine, only 41% of the area depicted by the model is conserved, a level that falls below 25% in western Maine.

Figure 1. Relative abundance of five songbirds surveyed along 112 high-elevation routes in 2001 and 118 routes in 2002. Frequency of occurrence values appear as column numbers and refer to the proportion of routes on which a given species was detected during point counts.

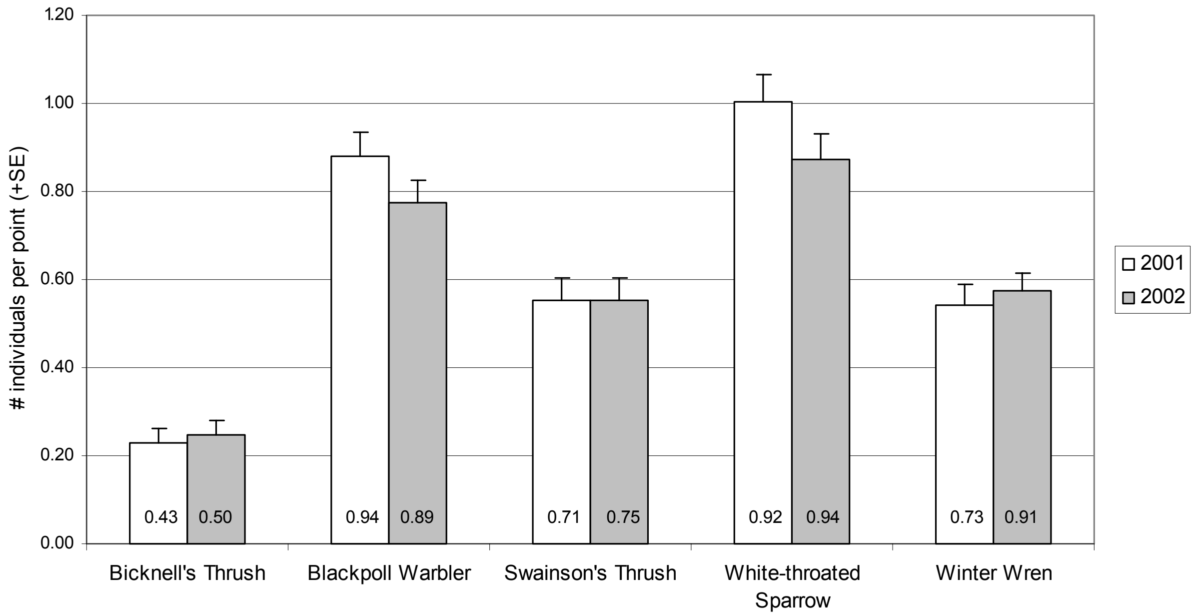


Figure 2. Relative abundance of five songbirds on the 72 high-elevation routes surveyed in both 2001 and 2002. Frequency of occurrence values appear as column numbers and refer to the proportion of routes on which a given species was detected during point counts.

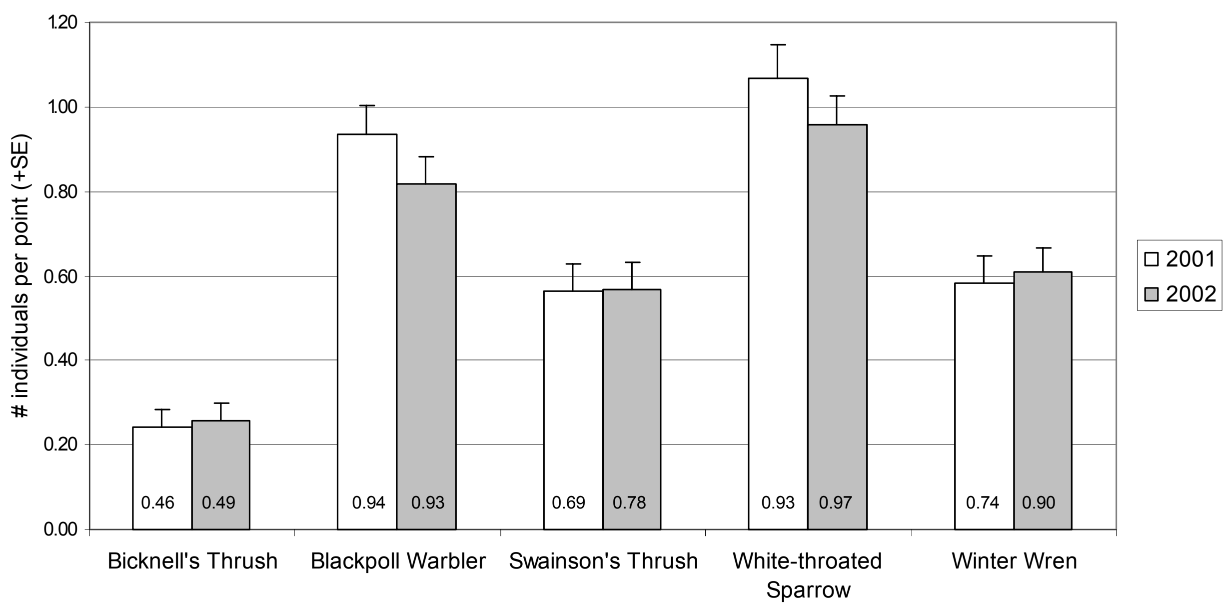


Figure 3. Bicknell's Thrush count map.

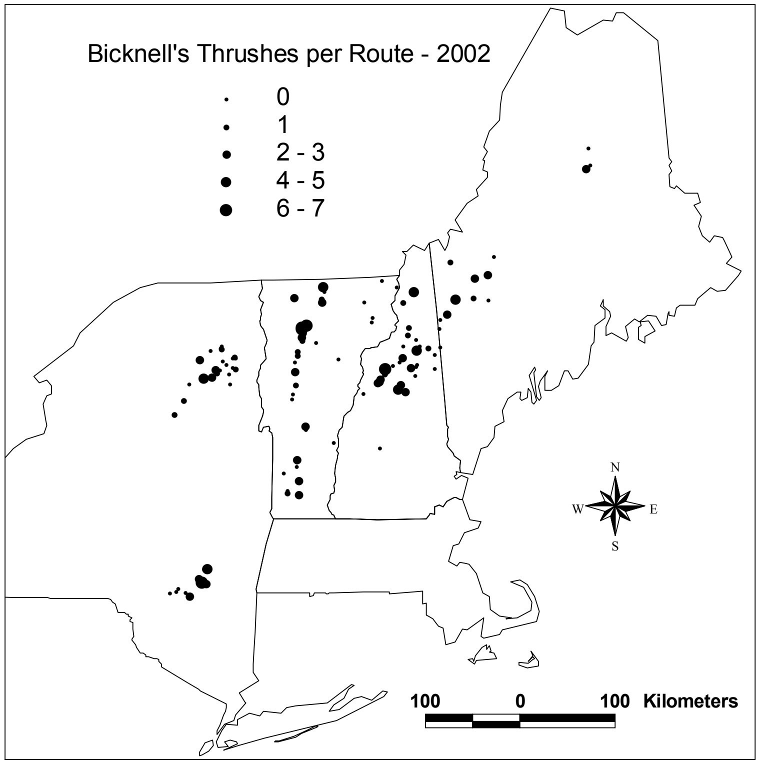


Figure 4. Bicknell's Thrush occurrence map; includes 24 off-route observations.

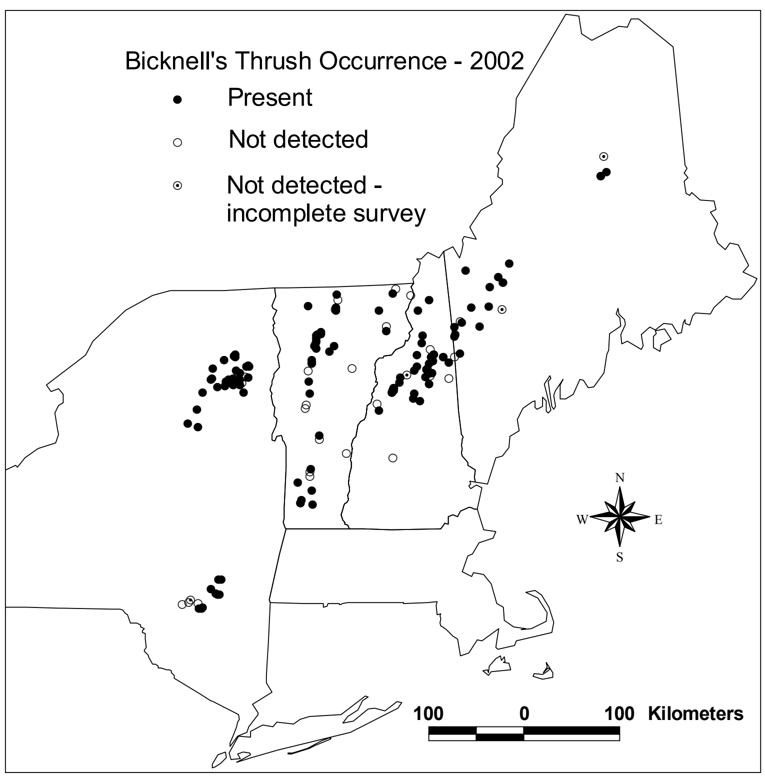


Figure 5. Blackpoll Warbler count map.

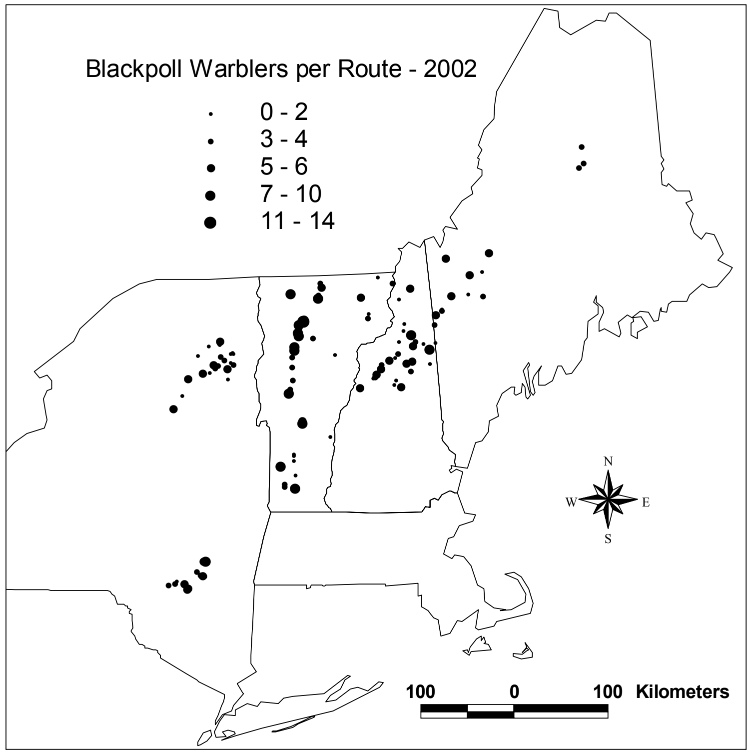


Figure 6. Swainson's Thrush count map.

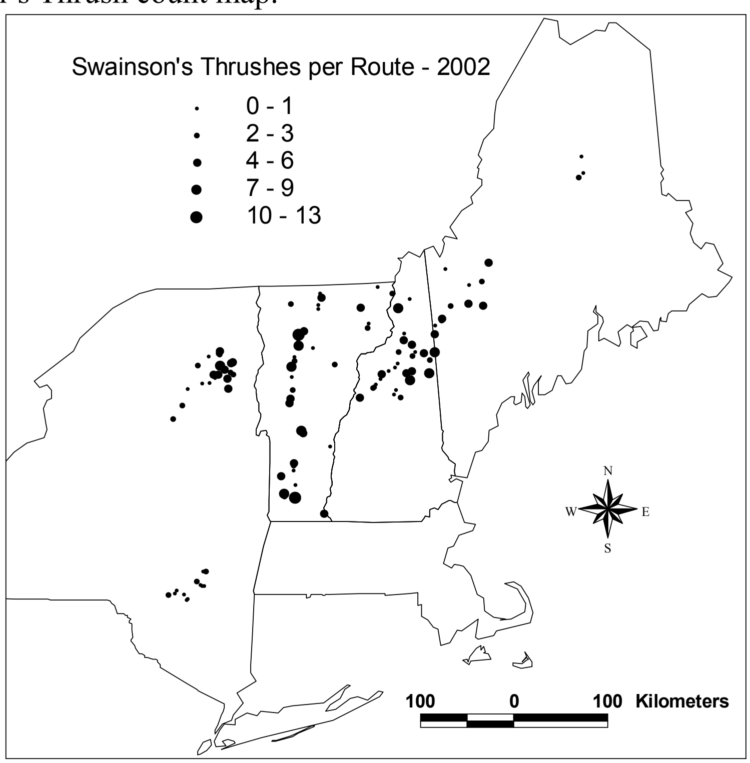


Figure 7. White-throated Sparrow count map.

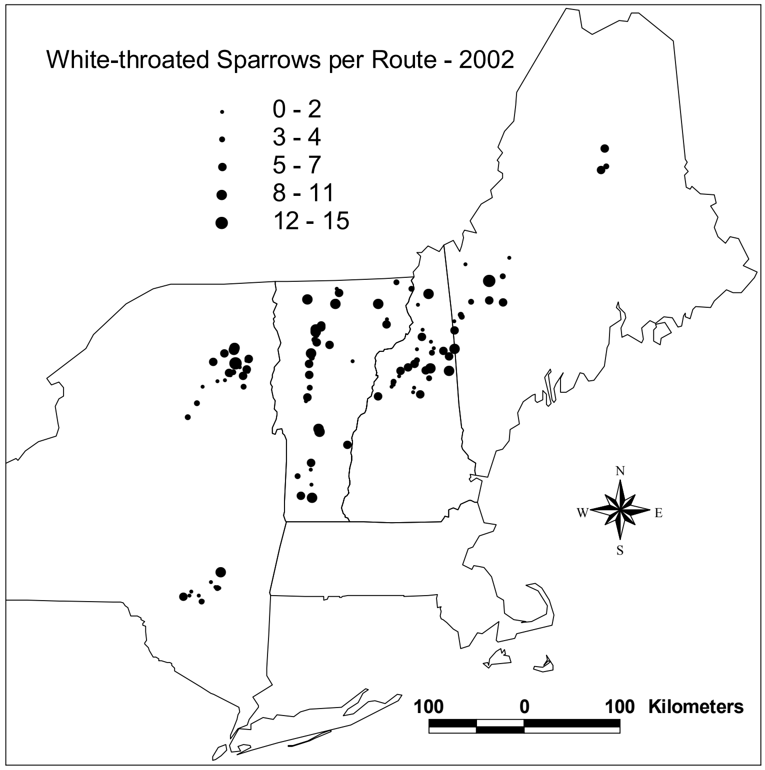


Figure 8. Winter Wren count map.

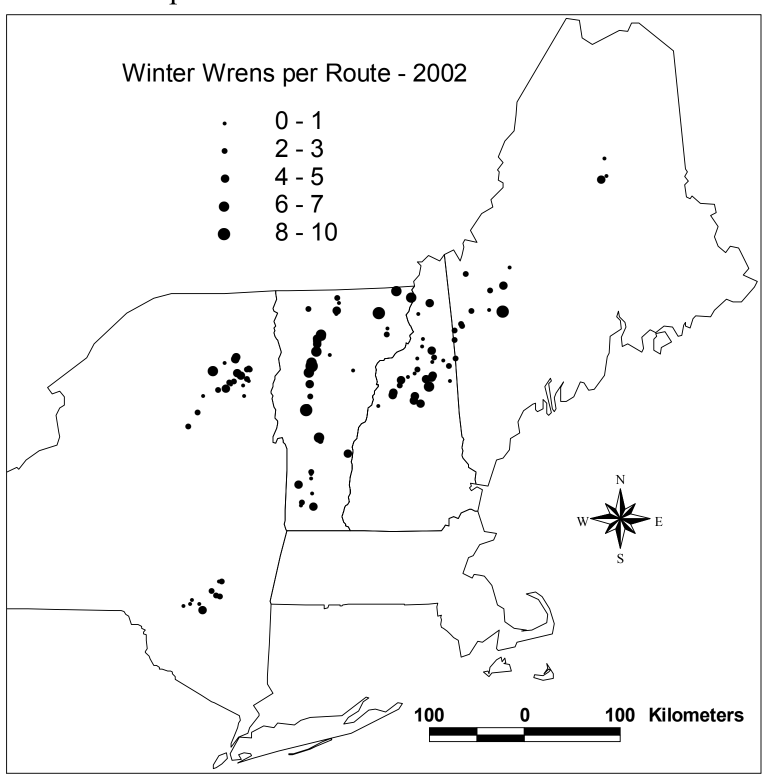
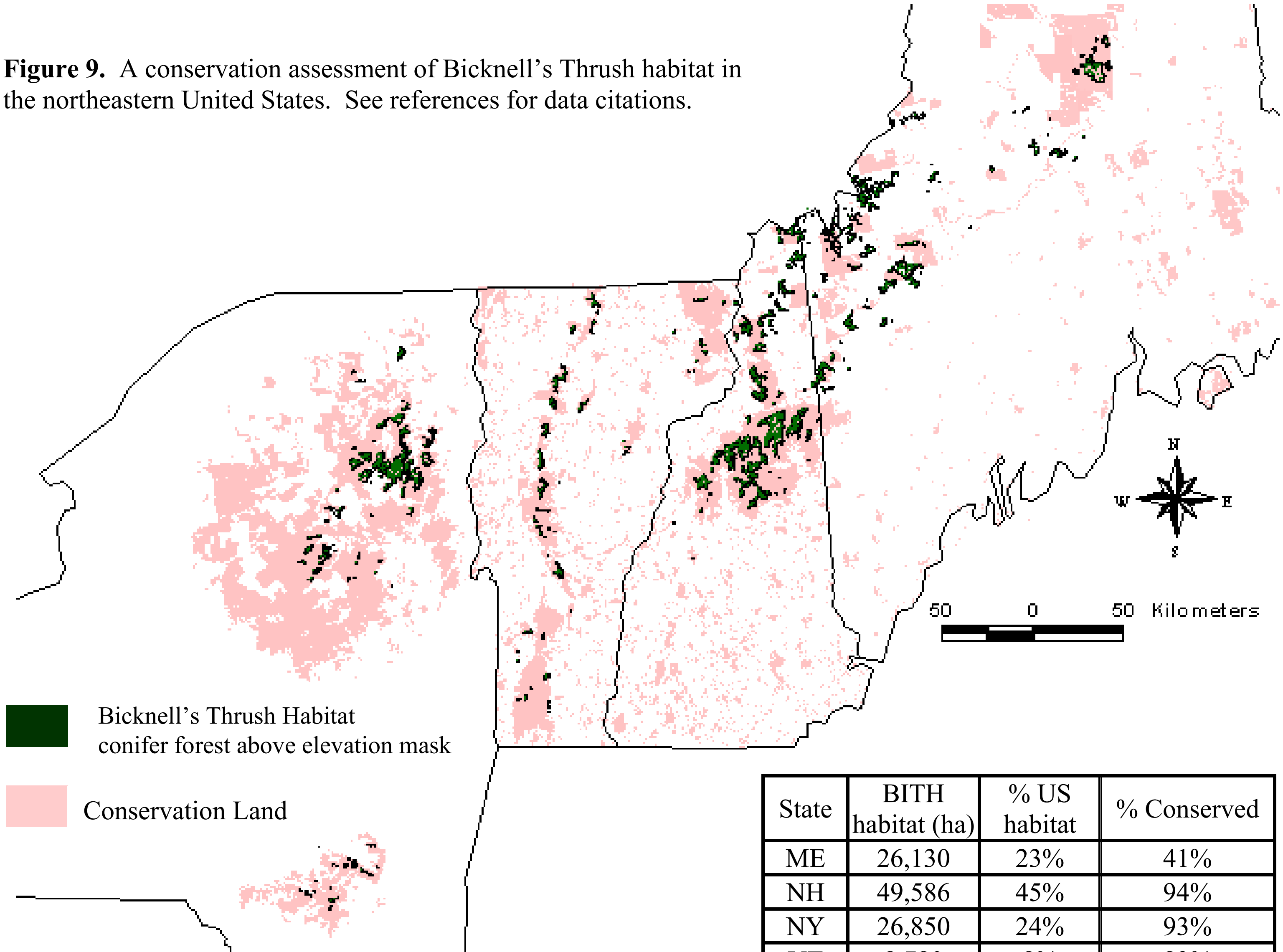


Figure 9. A conservation assessment of Bicknell's Thrush habitat in the northeastern United States. See references for data citations.



State	BITH habitat (ha)	% US habitat	% Conserved
ME	26,130	23%	41%
NH	49,586	45%	94%
NY	26,850	24%	93%
VT	8,780	8%	83%

Table 1. Bicknell's Thrush habitat occurrence on conservation lands in the northeastern U.S.

	Maine			New Hampshire			New York			Vermont			Total	
	Area (ha)	P state*	P US**	Area (ha)	P state	P US	Area (ha)	P state	P US	Area (ha)	P state	P US	**Area (ha)**	**P total**
State Forest***	2615	0.10	0.02	2196	0.04	0.02	0	0.00	0.00	3097	0.35	0.03	**7908**	**0.07**
State Park	153	0.01	< 0.01	407	0.01	< 0.01	0	0.00	0.00	474	0.05	< 0.01	**1034**	**0.01**
National Forest	1	< 0.01	< 0.01	38937	0.79	0.35	0	0.00	0.00	2458	0.28	0.02	**41396**	**0.37**
National Park	1664	0.06	0.01	241	< 0.01	< 0.01	0	0.00	0.00	0	0.00	0.00	**1905**	**0.02**
Priv. Conservation	38	< 0.01	< 0.01	1890	0.04	0.02	313	0.01	< 0.01	290	0.03	< 0.01	**2531**	**0.02**
Tribal Lands	244	0.01	< 0.01	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	**244**	**< 0.01**
Forest Preserve****	4617	0.18	0.04	1051	0.02	0.01	24634	0.92	0.22	0	0.00	0.00	**30302**	**0.27**
Town Forest	0	0.00	0.00	200	< 0.01	< 0.01	0	0.00	0.00	0	0.00	0.00	**200**	**< 0.01**
U.S. Dept. of Defense	543	0.02	< 0.01	0	0.00	0.00	0	0.00	0.00	60	0.01	< 0.01	**603**	**0.01**
Timberland with Easement	798	0.03	0.01	1797	0.04	0.02	0	0.00	0.00	768	0.09	0.01	**3363**	**0.03**
Other	0	0.00	0.00	18	< 0.01	< 0.01	0	0.00	0.00	130	0.01	< 0.01	**148**	**< 0.01**
Total	**10673**	**0.41**	**0.10**	**46737**	**0.94**	**0.42**	**24947**	**0.93**	**0.22**	**7277**	**0.83**	**0.07**	**89634**	**0.81**

* Proportion of statewide habitat conserved in given management category

** Proportion of US habitat conserved in given management category and state

*** Includes Maine Public Reserve Lands

**** Includes Catskill Forest Preserve, Adirondack Forest Preserve, Baxter State Park, and Connecticut Lakes Headwaters Natural Area, but not natural or wilderness areas located within other management units

Discussion

Distribution and abundance

Bird population levels change in response to a wide variety of natural and anthropogenic factors (Askins et al. 1990). Often, data gathered over brief time periods belie long-term trends (Holmes and Sherry 2001). These tenets of avian population monitoring confound efforts to evaluate short-term results. To reduce the likelihood of misinterpreting Mountain Birdwatch data, we will defer trend analyses for at least the first five years. Until then, we will limit discussion to methodological issues and the most noteworthy results. In so doing, we recognize that many years of continuous effort may be required to reach meaningful conclusions with regard to population trends.

Among the focal species, only Blackpoll Warbler and White-throated Sparrow showed appreciable change in number. Both species decreased in between-year comparisons of all surveyed routes and of the 72 routes surveyed in both years. Drops of similar magnitude occurred on the 53 routes containing five survey stations in both years (unpubl. data). Although the addition of points below the elevation threshold in 2002 did not appear to affect relative abundance estimates for the most common species, it may have elevated measures of occurrence frequency for Winter Wren. The proportion of routes on which Winter Wren was detected (0.91 versus 0.73 in 2001) matched the occurrence frequency measure in Mountain Birdwatch's 2000 pilot season (0.92), before the elevation threshold was temporarily applied. Observer notes on forest structure and composition indicate that many new points were placed in mature conifer and mixed-wood stands, forest types that support especially high densities of Winter Wren in Appalachian highlands (Haney et al. 1999). Consistent use of 5-point routes will eliminate the potential for sampling bias in the future.

The sharp drop in Red Squirrel distribution and abundance occurred in sync with a two-year population cycle that is linked to boom-and-bust cone production. The autumn ripening of the 2002 cone crop is expected to boost Red Squirrel numbers in 2003. Such pulses elevate the risk of reproductive failure, particularly among open-cup nesters (VINS, unpubl. data).

Conservation Assessment

The northeastern United States has a long history of conserving rugged landscapes, a legacy that benefits mountain-dwelling wildlife, especially Bicknell's Thrush. The two breeding areas of greatest significance to the species, the White Mountains and the Adirondacks, were largely conserved many decades before Bicknell's Thrush was separated from Grey-cheeked Thrush. Now, an estimated 81% of the region's breeding habitat is held and managed by a variety of private and public conservation owners. No other bird species in the region enjoys a greater level of protection. Whether by chance or design, the measure of protection befits the bird's vulnerability and its unique dependence on the Northeast for global survival.

Most of the suitable habitat in New York, Vermont, and New Hampshire is conserved. However, substantial gaps in conservation coverage exist in Maine, particularly near the border with Québec and between Grafton Notch and Baxter State Parks. Much of this region is managed for timber production, a use that may be compatible with the needs of Bicknell's Thrush at the upper latitudes of its breeding range. Bicknell's Thrush has been observed using densely structured, regenerating clearcuts in the highlands of Québec (Connolly et al. 2002) and New Brunswick (Nixon et al. 2001). Still, their value as breeding sites remains unknown, as do the effects of common silvicultural practices, such as precommercial thinning.

Even where Bicknell's Thrush habitat is primarily conserved, competing management interests weaken the level of protection. Stewards of conserved lands have permitted habitat removal for ski area expansion, wind power development, and communications tower construction. They have also suppressed natural fires that might favor regeneration of Bicknell's Thrush habitat. Developing common goals and strategies across management units may help avoid detrimental, cumulative effects of habitat loss. A framework for this dialogue has been established in two VINS documents, "Bicknell's Thrush Vegetation Management Plan: Draft Management Recommendations for Vermont Ski Areas" (VINS 1999) and "Wind Power Development in Vermont and Bicknell's Thrush: A Primer" (VINS 2002). In 2003, we will carry out a more thorough analysis of management standards currently applied within the network of conserved lands. Ultimately, we will recommend a path toward coordinated stewardship of Bicknell's Thrush breeding habitat. The greatest challenge facing such an enterprise may be addressing threats to the high-elevation bird community that can not be managed on the ground, such as airborne pollutants and climate change.

In the spirit of cross-boundary collaboration, VINS is working with the Canadian Wildlife Service and Bird Studies Canada (BSC) to extend our GIS model of Bicknell's Thrush habitat northward into Quebec, New Brunswick, and Nova Scotia. We are also coordinating our efforts with BSC's Atlantic Program and with the White Mountain National Forest, which administer monitoring programs of their own. The alignment of sampling protocols and integration of results will considerably enhance the value of each individual initiative.

Stewards of mountain habitat require an understanding of the ecology and status of high-elevation songbirds in order to support vulnerable populations with informed management decisions. Mountain Birdwatch provides the information they need. Results have already been used to produce a regional habitat model, delineate a Bird Conservation Area in the Adirondacks, identify Important Bird Areas in Vermont, inform National Forest policy in Vermont and New Hampshire, and evaluate potential impacts of wind power development in Vermont and Maine. There will be more opportunities to apply our findings as the program continues.

ACKNOWLEDGMENTS

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Appendix 1

Locations of 24 off-route Bicknell's Thrush observations reported in 2002

State	Mountain
ME	Goose Eye Mountain
ME	Haystack Mountain
ME	Mount Redington
ME	Whitecap Mountain
NH	Middle Carter Mountain
NH	Mount Eisenhower
NH	Mount Jackson
NH	Mount Jefferson
NH	Mount Washington
NH	Mount Webster
NH	Smarts Mountain
NY	Donaldson Mountain
NY	Lower Wolfjaw Mountain
NY	Mount Colvin
NY	Mount Marcy
NY	Mount Marshall
NY	Mount Skylight
NY	Panther Gorge
NY	Seward Mountain
NY	Slide Mountain
NY	Snowy Mountain
VT	Gore Mountain
VT	Mount Ethan Allen
VT	Mount Worcester

APPENDIX 2

2002 Mountain Birdwatch results summarized by route

State	Mountain	BITH status*	BITH	BLPW	SWTH	WTSP	WIWR
ME	Baldpate Mountain	1	2	3	2	3	2
ME	East Royce Mountain	5	0	0	8	8	2
ME	Little Bigelow Mountain	2	0	6	4	0	1
ME	Little Jackson Mountain	1	1	0	5	6	0
ME	Mount Abraham	1	2	1	2	4	5
ME	Mount Blue	4	0	4	5	6	10
ME	Mount Carlo	2	0	4	6	5	2
ME	Mount Katahdin	1	3	4	3	5	4
ME	North Traveler Mountain	4	0	3	0	6	0
ME	Old Blue Mountain	1	5	6	3	4	3
ME	Old Speck Mountain	2	0	5	0	0	2
ME	Saddleback Mountain	1	2	6	0	15	3
ME	South Turner	2	0	3	1	4	0
ME	Surplus Mountain	5	0	2	5	4	3
NH	Dickey Mountain	1	4	0	1	1	4
NH	Dixville Peak	1	5	5	0	8	4
NH	Kearsarge North	5	0	1	9	9	0
NH	Kinsman Mountain (North Peak)	1	7	4	4	7	5
NH	Middle Carter Mountain	1	1	0	4	6	1
NH	Mount Blue	1	3	6	0	3	1
NH	Mount Cabot	1	1	1	0	0	0
NH	Mount Clay	1	4	5	3	3	1
NH	Mount Crawford	3	0	5	5	9	5
NH	Mount Cube	5	0	5	4	6	1
NH	Mount Hale	1	2	3	1	4	2
NH	Mount Kearsarge	5	0	0	1	9	0
NH	Mount Lafayette	3	0	6	0	7	0
NH	Mount Madison	2	0	4	1	1	3
NH	Mount Martha	2	0	1	3	1	0
NH	Mount Moosilauke (South Peak)	1	1	0	0	2	4
NH	Mount Nancy	1	2	5	6	5	4
NH	Mount Osceola	1	2	4	0	2	1
NH	Mount Randolph	5	0	7	4	1	5
NH	Mount Starr King	1	1	1	4	5	1
NH	Mount Tecumseh	1	2	0	0	1	4
NH	Mount Tremont	2	0	4	8	3	7
NH	Mount Wolf	1	1	5	0	1	3
NH	North Baldface	2	0	7	3	6	2
NH	Sandwich Mountain	1	2	6	2	5	4
NH	South Twin Mountain	2	0	0	0	7	0
NH	Stairs Mountain	2	0	4	0	4	5
NH	Sugarloaf Mountain	1	1	1	8	1	0
NY	Ampersand Mountain	1	3	1	3	7	6
NY	Balsam Lake Mountain	5	0	4	2	5	1
NY	Balsam Mountain	3	0	0	0	1	1
NY	Bear Den Mountain	5	0	5	6	6	1
NY	Big Crow Mountain	2	0	0	5	1	2

State	Mountain	BITH status	BITH	BLPW	SWTH	WTSP	WIWR
NY	Blackhead Mountain	1	4	8	2	9	3
NY	Blue Mountain	1	1	2	3	3	2
NY	Cornell Mountain	2	0	5	1	3	5
NY	Eagle Mountain	5	0	3	0	0	1
NY	Esther Mountain	2	0	5	5	10	4
NY	Giant Mountain	1	1	4	2	2	1
NY	Hopkins Mountain	5	0	1	3	5	2
NY	Hunter Mountain	1	2	4	2	0	2
NY	Hurricane Mountain	1	2	1	2	2	4
NY	Kempshall Mountain	2	0	6	0	1	1
NY	Little Whiteface Mountain	1	1	2	3	4	2
NY	McKenzie Mountain	2	0	1	1	6	0
NY	Mount Adams	1	2	0	1	1	5
NY	Mount Colden	1	1	4	0	0	0
NY	Panther Mountain	5	0	6	0	1	1
NY	Phelps Mountain	2	0	4	4	4	3
NY	Pitchoff Mountain	2	0	4	7	13	5
NY	Plateau Mountain	1	7	4	1	1	3
NY	Porter Mountain (East Peak)	2	0	3	5	2	4
NY	Santanoni Peak	1	4	6	1	2	2
NY	Soda Range	1	1	2	4	6	2
NY	Sugarloaf Mountain	2	0	5	1	4	1
NY	Sunrise Mountain	2	0	2	4	3	1
NY	Thomas Cole Mountain	1	1	6	0	0	1
NY	Twin Mountain	1	3	3	0	2	3
NY	Wakely Mountain	1	1	5	2	3	2
NY	Weston Mountain	2	0	0	3	3	3
NY	Whiteface Mountain	2	0	2	3	9	5
NY	Wittenberg Mountain	1	2	5	1	2	1
NY	Wright Peak	1	2	5	4	5	3
VT	Bald Mountain	2	0	6	6	9	8
VT	Bear Head	1	1	3	0	6	3
VT	Belvidere Mountain	1	2	8	0	10	1
VT	Big Jay	1	4	4	1	2	3
VT	Bolton Mountain	1	2	7	0	3	1
VT	Bromley Mountain	5	0	2	0	2	1
VT	Brousseau Mountain	5	0	2	1	4	7
VT	Buchanan Mountain	5	0	5	5	6	1
VT	Burke Mountain	2	0	3	2	7	3
VT	Camels Hump	1	1	8	1	11	6
VT	Dewey Mountain	1	2	4	0	3	5
VT	East Haven Mountain	5	0	1	0	2	1
VT	Gillespie Peak	5	0	8	5	1	9
VT	Glastenbury Mountain	1	1	4	3	6	1
VT	Haystack Mountain	1	3	7	3	9	3
VT	Killington Peak	1	3	5	7	8	7
VT	Madonna Peak	1	6	14	5	6	4
VT	Molly Stark Mountain	5	0	3	7	7	6
VT	Monadnock Mountain	5	0	3	3	4	6

State	Mountain	BITH status	BITH	BLPW	SWTH	WTSP	WIWR
VT	Morse Mountain	2	0	5	3	7	6
VT	Mount Abraham	1	3	4	0	6	4
VT	Mount Ascutney	5	0	0	0	5	4
VT	Mount Equinox	2	0	10	5	4	4
VT	Mount Hunger	2	0	3	1	6	1
VT	Mount Ira Allen	1	1	10	2	4	9
VT	Mount Mansfield	1	6	3	1	8	4
VT	Mount Mansfield (The Forehead)	1	6	8	11	8	5
VT	Mount Mayo	2	0	3	1	1	1
VT	Mount Snow	1	3	8	13	8	4
VT	Mount Wilson	1	1	4	3	3	3
VT	North Glastenbury	2	0	3	8	2	2
VT	Peru Peak	1	3	0	5	7	3
VT	Ricker Mountain	1	1	9	8	7	6
VT	Shrewsbury Peak	5	0	9	4	8	2
VT	Spruce Mountain	5	0	1	2	2	1
VT	Stratton Mountain	1	3	2	1	1	1
VT	Styles Peak	5	0	2	2	1	1
VT	Tillotson Peak	1	1	4	0	2	5
VT	Worth Mountain	5	0	4	4	6	2
VT	Unnamed betw. Tillotson & Belvidere	4	0	4	5	4	3

* Key to BITH status
1 = present, detected by point count
2 = present, detected by chance, playbacks, or on follow-up survey
3 = not detected during point counts, no playbacks or follow-up
4 = not detected during point counts or playbacks, no follow-up
5 = presumed absent, not detected by point count, playback, or follow-up