

Population Studies of Bicknell's Thrush (*Catharus bicknelli*) on Mount Mansfield, Vermont

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Abstract: Research on the population ecology of the Bicknell's Thrush (*Catharus bicknelli*) in Mt. Mansfield's subalpine spruce/fir forest was continued in 1994. Studies were concentrated on a 8.8 ha plot established in 1992 at 1160-1200 m elevation. Intensive spot mapping of territorial males yielded similar density estimates in all 3 years (36-52 pairs/40 ha in 1992, 50-59 pairs/40 ha in 1993, 55-65 pairs/40 ha in 1994). To examine questions of population stability, territory size, movements, site fidelity, territorial turnover, productivity, and survivorship, a concerted effort was made to capture and band all thrushes occurring on the study plot. A total of 57 thrushes (31 adult males, 10 adult females, 16 juveniles) were banded over three years on or near the study plot yielding a survivorship of 42.8 percent. Nest searching and monitoring produced 8 nests (4 active) over the 3-year period. Two nests were abandoned, one was predated and one fledged two young. Analysis of nest site microhabitat data indicated that nest site selection appears to be keyed to high shrub stem (woody plant with DBH <8cm and >0.5 m tall) density. Seven of 8 nest trees were live, healthy balsam firs 1.85-2.80 m tall. Nests tended to be located in the southeastern quadrant of the tree against the trunk. Long-term habitat monitoring plots were established and sampled within the study area.

Additionally, long-term monitoring of the entire avian community was initiated during 1994, using the continent wide constant-effort mist-netting program, Monitoring Avian Productivity and Survivorship (MAPS). Six mist nets were used in this trial year. An additional four mist nets will be placed in 1995 to complete the establishment of the study station. Mist netting was conducted for 6 morning hours in nine 10-day periods throughout the breeding season for a total of 329 hrs of netting. Sixty-five birds (39 adults, 26 juveniles) of 15 species were captured and banded. Six banded individuals were recaptured.

Anticipated plans for 1995 research on Mt. Mansfield include: 1) continued monitoring of Bicknell's Thrush using existing field protocols; 2) monitoring several individuals with radio telemetry; 3) completing the second year of MAPS monitoring using four additional mist nets; 4) monitoring fall passerine migration on Mt. Mansfield using banding and censusing to assess stopover usage of the subalpine spruce/fir forest; and 5) monitor transmission tower strikes by birds during fall migration to assess the extent of mortality.

Introduction

The Bicknell's Thrush (*Catharus bicknelli*), recognized as a subspecies of the Gray-cheeked Thrush (*Catharus minimus*) since its discovery on Slide Mountain in the Catskills of New York in 1881, has recently been given full species status and listed as a Category 2 species under the Federal Endangered Species Act. The Bicknell's Thrush is the only songbird endemic to the high altitude forests of the Northeast, qualifying it as a potentially valuable indicator species for the subalpine avian community and forest habitat health.

In 1992 VINS established an 8.8 ha long-term study plot on Mt. Mansfield to examine the population ecology of Bicknell's Thrush. In 1994 research was expanded to examine the entire avian community. The purpose of the study was to: 1) monitor the density of breeding pairs of Bicknell's Thrush; 2) mist net and color band thrushes to examine site fidelity, survivorship and population stability; 3) locate and monitor Bicknell's Thrush nests to determine site selection and productivity; 4) conduct standardized mist-netting of all breeding bird species to monitor productivity and survivorship; 4) select and implement a vegetation sampling protocol for habitat monitoring.

Methods

Studies were concentrated on an 8.8 ha permanent study plot along the summit ridge (1160-1200 m elevation). Spot mapping has been completed since 1992. For each bird seen or heard a compass bearing and distance estimate was recorded from marked vantage points. The data were plotted on a base map of the study area. Simultaneous registration of two or more vocalizing birds was used as the primary means of discriminating between adjacent territories. Sightings of color banded birds were recorded and mapped in the same manner in an attempt to identify each territory with a known identity bird.

Using strategically placed mist nets in combination with tape recorded playbacks of Bicknell's Thrush vocalizations and a life-like wooden decoy, an attempt was made to capture and color band all known breeders on the study area. Up to 10 mist nets were used simultaneously to passively capture thrushes as a complement to the use of vocal and visual lures. This facilitated the capture of females, which are not readily lured into nets. Detailed mensural (e.g., wing chord, weight) and body condition (e.g., subcutaneous fat, molt, feather wear) data were recorded for all captured birds. Capture locations were plotted on a master study plot map. Site fidelity, territorial turnover, survivorship, and population stability were investigated on Mt. Mansfield by searching for color banded birds.

From early June to mid-July, careful searching of the study plot was conducted to locate active and recently used nests. Each nest location was mapped. For active nests chronology and success were monitored, and nestlings were banded. Nest monitoring was conducted according to the guidelines established by the Breeding Biology Research & Monitoring Database Program (BBIRD 1994). After fledging, nest site selection and microhabitat data were collected in accordance with BBIRD (1994).

Twenty vegetation monitoring plots were permanently marked and sampling was conducted in August and September 1994. Protocols followed those prescribed by BBIRD (1994) and were a modification of the standard James and Shugart (1970) method.

Research was initiated in 1994 to monitor the productivity and survivorship of the entire avian community as part of the continentwide Monitoring Avian Productivity and Survivorship Program (MAPS). Six mist nets were utilized in our study plot for this first year trial. We plan to use an additional four nets in 1995 to complete the study plot establishment. This study must be relatively long-term in order to gain statistically valid and meaningful results. We captured birds during one morning in each of nine 10-day periods from May 31 to August 28. For each bird captured and recaptured we recorded net location, age and sex, degree of skull pneumatization, unflattened wing chord, fat class, mass, cloacal protuberance or brood patch class, and molt condition.

Results

Density estimates : Spot mapping of vocalizing males yielded density estimates for Bicknell's Thrush of 36-52 pairs/40 ha in 1992, 50-59 pairs/40 ha in 1993, and 55-65 pairs/40 ha in 1994 (Figure 1). The territories of 8, 11, and 12 pairs were located entirely within the borders of the study plot in 1992, 1993, and 1994, respectively. The total number of territories on the plot was estimated at 11.5 in 1992, 13.0 in 1993, and 14.25 in 1994. Independent evaluation of our data by an individual experienced in spot mapping but unfamiliar with the plot yielded estimated totals of 11.75 territories in 1992, 13.25 territories in 1993, and 12.5 territories in 1994. For the purpose of these calculations, the maximum density values were obtained by including percentages of territories estimated to be located within the boundaries of the study plot. The minimum density values were calculated by excluding all "partial" territories from consideration.

Location of Color Banded Birds : Only nine individual color marked thrushes were visually identified in over 1,000 people hours on the study plot in 1994, illustrating the difficulty in sighting birds in the dense habitat.

Mist Netting : We captured 22 unbanded birds and 23 previously banded Bicknell's Thrushes on Mt. Mansfield in 1994, 24 unbanded and 11 recaptures in 1993, and 11 unbanded and none recaptured in 1992 (a pilot year) for a total of 57 banded thrushes in three years. Survivorship was calculated using capture-recapture data and observations of color banded birds from 1992-1994 (Table 1).

Nest Monitoring : Despite many hours of systematic searches on the Mt. Mansfield study area we found only two active nests, two recently fledged nests, and two nests from previous breeding seasons in 1994. In both 1992 and 1993 one active nest was found. Only one of the four active nests produced fledglings (Table 2). It remains unclear why the two 1994 nests were abandoned. Nests were found to be placed abutting the trunk of a tree or very close to the trunk. There was a tendency for nests to be placed on the southeastern side of trees.

Seven of 8 nest trees were balsam fir (*Abies balsamea*). One nest was located in a red spruce (*Picea rubens*). Nest trees were small (1.85-2.80 m tall and 2.8-7.9 cm DBH) with the nest located between 1 and 1.60 m high. Nests were supported by one to four small branches (0.3-1.5 cm diameter). The amount of vegetation obscuring the nest in each cardinal direction in a 25 cm radius circle centered at the nest was usually very high (+60% coverage) on at least two sides of the nest and low on two sides. Nests were invariably found in a live portion of the tree and usually in healthy trees.

We compared vegetation surrounding the eight nest sites with eight randomly selected non-use (no nest) sites. Five-meter radius plots examined the shrub stem densities (defined as woody plants with a DBH <8 cm and > 0.5 m high). Densities were significantly higher in the nest plots for both small stems ($\chi^2 = 25.2$, $P < 0.001$) and large stem densities ($\chi^2 = 18.06$, $P < 0.001$). Except for small mountain holly (*Nemopanthis mucronata*) stems and small dead stems, the relative densities of each species were similar on nest sites and non-use sites. Small mountain holly was nearly twice as dense in non-use sites and small dead stems were twice as prevalent in nest sites.

Tree densities were examined on 11.3 meter plots around the nests and in randomly chosen non-use sites. There were significantly more trees in the 8-23 cm DBH class on the non-use sites ($\chi^2 = 4.01$, $P < 0.05$). Balsam fir trees were the dominant species in this size class. There was no significant between-site difference in density in the >23 cm DBH tree class. However, there were a significantly greater number of dead than living trees in the non-use site in this class ($\chi^2 = 7.54$, $P < 0.01$). Relative densities were similar in the small DBH class. Balsam fir dominated the large tree class on nest sites, while dead trees dominated the large tree class on non-use sites.

Ocular estimates for nine categories of ground cover and vegetation were estimated within the 5 meter radius plots for both nest sites and non-use sites. The averages of three of these categories (ferns, moss, and leaf litter) differed considerably between the two types of site. Fern and moss average cover was lower and average leaf litter cover was higher in the nest sites.

Long-Term Habitat Monitoring Plots : 1994 was the first year of long-term monitoring of the vegetation in the study area on Mt. Mansfield. These data will yield more meaningful insights in 3 years when the same plots are resampled.

Monitoring Avian Productivity and Survivorship : Mist netting was completed for six consecutive morning hours in nine 10-day periods throughout the breeding season for a total of 329 net hours. Sixty-five birds of 15 species were captured during this time for a total of 4.7 birds captured per net hour (Table 3). Six individuals were recaptured. These results are not amenable to analysis after only one year of data collection. Several additional years of data collection will be necessary to make conclusions based on capture-recapture models.

Discussion

Spot mapping data since 1992 have shown an increase of four territories on the Mt. Mansfield study plot. We believe our spot mapping data, from which two independent observers calculated similar numbers of territories in 1992-1994, closely approximated actual Bicknell's Thrush densities on the study plot. On 11 July we observed a color banded bird counter calling five times with other birds. The locations of this bird coincided closely with a territory plotted from spot-mapping data. These observations appear to support the accuracy of our spot-mapping data. Some birds wandered over a large area. These individuals were almost always captured in mist nets and not observed singing or calling. Most nomadic behavior occurred early (territory establishment phase) and late (post-breeding dispersal) in the breeding season. This suggests that territorial boundaries "relax", or break down, outside the height of breeding activities.

Wallace (1939) reported that Bicknell's Thrush territories on Mt. Mansfield "may apparently cover an acre or more". Assuming densely packed territories of about 0.6 ha (1.5 ac) in size, Wallace's suggestion would yield density estimates of approximately 65 pairs/40 ha. This is similar to our maximum estimates and may reflect unusually high densities on Mt. Mansfield, which we believe supports 250+ pairs.

A significant, but still preliminary, finding is that the survivorship and return rates (site fidelity) of adult Bicknell's Thrushes appear to be very high. Survivorship calculations represent conservative estimates because of the difficulty in capturing birds and sighting color bands in the dense habitat. We have not documented the return of a juvenile, or hatch year (HY), bird in a successive year. Adult birds appear to have higher survivorship, based on their observed return rates. However, sample sizes of HY birds have been small (1992=2, 1993=2). We captured 13 HY birds in 1994 and hope to obtain data in 1995 on survivorship and site fidelity of young birds.

Similar breeding densities in 1992-1994, coupled with high adult site fidelity and survivorship, suggest that Mt. Mansfield's breeding population may be relatively stable. However, the demographics of this relatively large population may not reflect those on the many smaller, more isolated peaks occupied by this species. We are comparing Bicknell's Thrush demographics and population stability on peaks with both extensive and limited subalpine spruce-fir habitat as part of our overall research on the status of the species.

Nest monitoring was largely unsuccessful in 1994 because of the small number of nests found and the abandonment of the only two active nests during incubation. The nests may have been abandoned because of human disturbances from excessive traffic on nearby trails. Five Blackpoll Warbler (*Dendroica striata*) nests, one Myrtle Warbler (*Dendroica coronata*) nest, and a Purple Finch (*Carpodacus purpureus*) nest were discovered and monitored in a similar manner, yet all seven nests fledged young.

It is possible that either or both incubating females were predated. Both were color banded, but neither was captured or observed following its nest abandonment. Possible predators of adults and nests that were observed during the 1994 season included: Blue Jay (*Cyanocitta cristata*), numerous Northern Ravens (*Corvus corax*), one *Accipiter* species, red squirrel (*Tamiasciurus hudsonicus*), and raccoon (*Procyon lotor*; two sets of tracks noted on the Amherst Trail).

Nest site selection appeared to be based primarily on shrub stem densities. Areas that had high shrub densities were characterized by thick patches of young balsam fir trees and very few large, mature trees. Non-use sites generally had higher densities, although widely spaced, mature trees.

The long-term habitat monitoring plots on Mt. Mansfield may enable an understanding of changes that occur in the habitat over time. Several studies have documented severe declines of red spruce throughout the Northeast since the early 1960's (e.g., Siccama et al. 1982, Foster and Reiners 1983, Battles et al. 1992, Miller-Weeks and Smoronk 1993), as well as heavy mortality of balsam fir (Miller-Weeks and Smoronk 1993). Most of the hypotheses proposed to account for this decline involve the effects of atmospheric deposition and include: 1) soil acidification/aluminum toxicity; 2) spruce needle damage and disease; 3) general stress from reduced photosynthetic activity and secondary metabolite production; 4) excess nitrogen deposition; 5) complex high-elevation disease from the combined effects of high ozone concentrations, acid deposition and nutrient deficiencies; and 6) organic air pollutants (e.g., Krahl-Urban et al. 1989). The possible impacts of this habitat degradation on populations of Bicknell's Thrush and other subalpine bird species are unknown. Detection of such impacts will require long-term monitoring of both vegetation and avifauna.

Future Plans

Research will continue on the Mt. Mansfield study plot in 1995. We plan to use radio telemetry to monitor several individual thrushes on the study plot. Additionally, passerine migration will be monitored in the fall using mist nets, censusing, and examination of transmission tower strikes to assess the use of the subalpine forest by migrants during migration on Mt. Mansfield and one other site in Vermont to be determined.

In 1995 we plan to expand our monitoring of high-elevation bird populations to other study plots in the Green Mountains, Adirondacks and the Catskills using point counts, five MAPS stations, and two BBIRD stations. Bicknell's Thrushes will also be studied on the five new study plots using similar protocols as on Mt. Mansfield.

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Table 1. Survivorship estimates based on capture-recapture data and observations of color banded birds from 1992-1994 on Mt. Mansfield, VT.

Years	Total Banded	Total Recaptured	Percent Survivorship
Female			
1992-1993	3	2	66.7
1993-1994	5	3	60.0
1992-1994	8	4	50.0
Male			
1992-1993	6	2	33.3
1993-1994	5	3	52.9
1992-1994	23	11	47.8
Total			
1992-1993	11	4	36.3
1993-1994	28	15	53.6
1992-1994	35	15	42.8

Table 2. History of four active nests found on Mt. Mansfield, VT, 1992-1994.

Nest	Date	# Eggs	# Young	Notes
92A	6 July 92	1	2	Chicks approx. 6 days old. Banded nestlings (908, 909).
	13 July 92			Nest empty, intact. Assumed fledged two.
93A	24 June 93	4		Female flushed from nest.
	29 June 93	1	3	Approximately 1 day old.
	30 June 93		4	
	6 July 93		3	
	7 July 93			Nest empty. Presumed predated. Red squirrel seen in area at 0930. Nest checked at 1315.
94A	22 June 94	4		Flushed adult from nest. Silent
	23 June 94			Female went to nest while watched from trail 5 meters away.
	27 June 94	4		Female not seen. Watched for 20 minutes. Several males calling and singing nearby.
	29 June 94	4		Female not seen. Watched 5 minutes.
94B	30 June 94	4		Eggs cold. Estimated to be 7 days old. Female has abandoned.
	22 June 94	4		Flushed adult from nest. Silent. Later netted female (921).
	23 June 94	4		Female on nest.
	27 June 94	4		Observing from trail periodically female not seen all A.M. Checked nest. Eggs cold. Female abandoned.

Table 3. Number of individuals of each species of birds captured during MAPS banding periods.

Common Name	Scientific Name	Total Adults	Total Juveniles
Ruby-throated Hummingbird	<i>Archilochus colubris</i>	1	0
Yellow-bellied Flycatcher	<i>Empidonax flaviventris</i>	1	0
Ruby-crowned Kinglet	<i>Regulus calendula</i>	0	1
Bicknell's Thrush	<i>Catharus bicknelli</i>	2	0
Swainson's Thrush	<i>Catharus ustulatus</i>	0	1
American Robin	<i>Turdus migratorius</i>	1	0
Black-throated Blue Warbler	<i>Dendroica caerulescens</i>	0	4
Myrtle Warbler	<i>Dendroica coronata</i>	8	3
Blackpoll Warbler	<i>Dendroica striata</i>	11	8
American Redstart	<i>Setophaga ruticilla</i>	0	1
Canada Warbler	<i>Wilsonia canadensis</i>	1	0
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>	0	1
White-throated Sparrow	<i>Zonotrichia albicollis</i>	11	3
Slate-colored Junco	<i>Junco hyemalis</i>	2	4
Purple Finch	<i>Carpodacus purpureus</i>	1	0
Number of individuals		39	26
Number of species		10	9

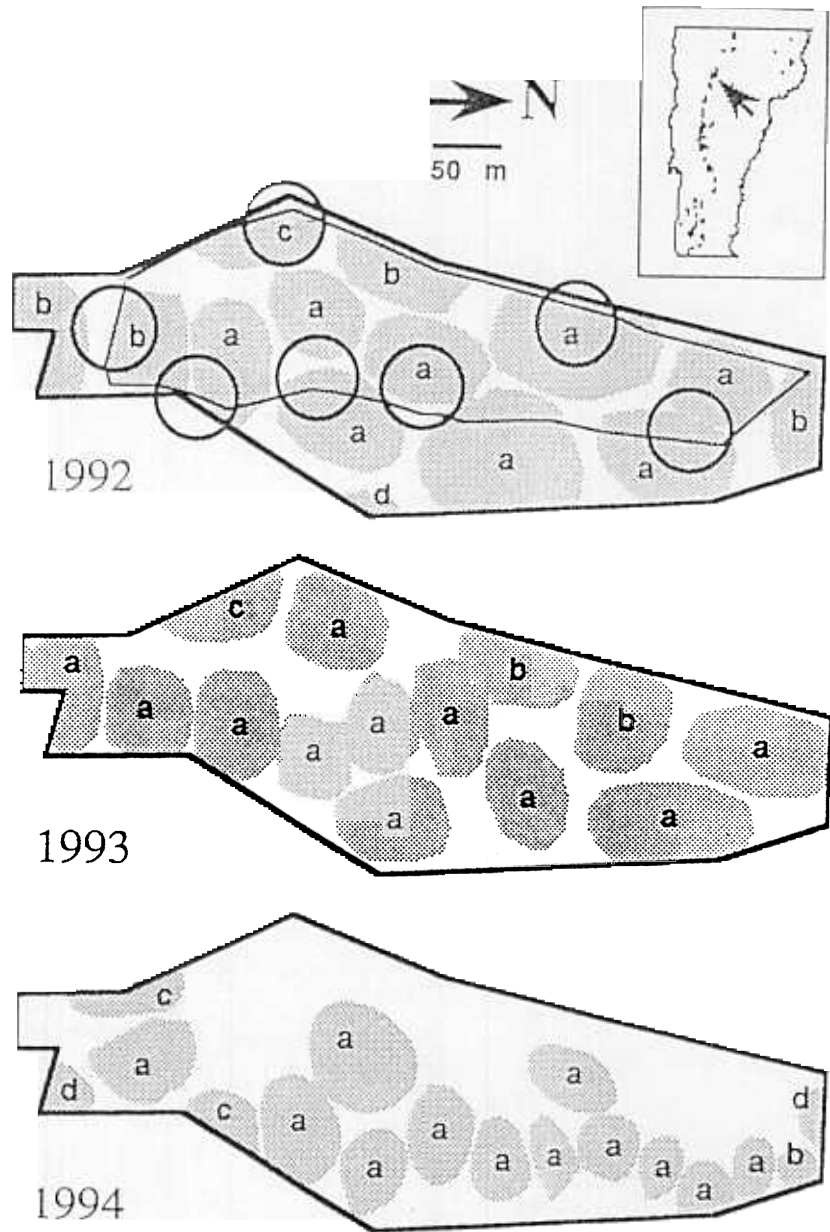


Figure 1. Locations of spot-mapped Bicknell's Thrush territories on Mt. Mansfield study plot. The 1992 map indicates point count locations (circles) and the transects used for spot-mapping. Inset map shows approximate location of high elevation (> 915 m) land in Vermont, and the arrow indicates location of Mt. Mansfield. Letters indicate percent of territory estimated to be located within the boundaries of the plot: a - 100%; b - 75%; c - 50%; d - 25%.