Breeding Bird Inventory at Bear Pond Natural Area in Canaan New Hampshire: 20 Year Update

Prepared for:
Upper Valley Land Trust

Prepared by:
Leonard Reitsma, Ph.D.
Professor Emeritus of Ecology
Department of Biological Sciences
Plymouth State University
Plymouth, NH

INTRODUCTION

Between 2003 and 2005 a comprehensive biological inventory was conducted within the Bear Pond Natural Area (BPNA) and submitted to the Mascoma Watershed Conservation Council. This inventory included a wide variety of taxa with special attention to plants, amphibians, butterflies, mammals and birds. The breeding bird survey spanned the entire property with 46 fixed sampling stations at 300 meter intervals. These 46 point count sites encompass the various forest types found within BPNA including areas dominated by a quaking bog and mixed upland forest previously harvested in 1985. As part of the monitoring recommendations consistent with "forever wild" status stipulated in the BPNA conservation easement, the 46 point count sites were surveyed again in 2014 and 2024. Bird species detected were recorded using the same methods in all three years in order to compare changes over two decades.

Long-term datasets hold special value in discerning how species diversity and abundance of individuals may change. As such, BPNA offers an opportunity to continue to monitor community-level changes that may result from a number of factors. Significant declines in the diversity and overall abundance of birds have been reported in the last several decades, and especially within the last forty years (Rosenberg et al. 2019). As well, the diversity and abundance of the dominant food source for most breeding birds in New England, insects, have declined precipitously (Wagner 2020). The purpose of this study was to determine how avian species composition and total abundance of individuals may have changed at BPNA since the original census in 2003-2005 (for this report 2004 was used). This was accomplished through the use of point counts, which provide a standardized profile of the avian community at BPNA.

A species of special conservation need in the bioregion within which BPNA is located is the Canada warbler, *Cardellina canadensis* (CAWA). Canada warblers are a small Neotropical migrant species that winter in South America and breed in northeastern United States and across Canada. They are currently declining at 2% per year across their breeding range and 6% per year within New Hampshire (Sauer et al. 2014). Their breeding success at BPNA and the abutting Canaan Town Forest to the south was intensively studied from 2003-2020 in the southern section of BPNA north and south of Bear Pond. Because of their preference for red maple swamps and disturbed habitats with dense shrub and understory layers, this species serves as a representative of other species that prefer these habitat types.

The hope is that these surveys will persist each decade. With a burgeoning human population, unprecedented loss and alteration of habitat and documented rapid decline in biodiversity, these long-term data take on added significance locally, regionally and arguably even globally.

METHODS

Point counts are standardized protocols for documenting avian diversity and abundance. They were conducted at each of the 46 stations/points during the bird breeding season beginning as early as May 11 and ending no later than June 25 (Figure 1). Each point was visited a total of 3 times during each year. At each visit, we recorded all species seen or heard over a ten-minute sampling period. Species were listed on datasheets according to estimated distance and direction from the sampling point and distance was noted as to whether each detection was within or outside a 150 meter radius to avoid double-counting the same individual at adjacent points. Only species with large home ranges may have been double-counted but most detections of such individuals were beyond 150 meters. All field technicians are skilled at sound and sight identification of the species listed in the results of this report.

To quantify the bird community using these data, the maximum number of individuals of each species across all three sampling dates within each season detected at each of the 46 sampling stations was tallied. For example, at H-0 (one of the 46 grid points), if no Canada warblers were detected within 150 meters on the first date, two on the second date and three on the third date, then the total for that species at that grid point was three. After tallying totals for each species, two analyses were conducted. An Analysis of Variance (or ANOVA) is used to test whether the averages across years are statistically significantly different from each other given the variation in values within a given year. This analysis was done for both species richness (number of species detected at each grid point across all 46 points hereafter referred to as diversity) and for

abundance (number of individual birds detected). This analysis is robust given the three sampling dates each season.

In addition, these data allow for rankings of species by most to least abundant. Comparing these three years at decade intervals thus allows for a profile of changes in numbers of species detected (diversity), changes in numbers of individual birds detected (abundance) and how species have changed from most to least abundant (rank abundance).

RESULTS and DISCUSSION

A clear pattern emerges from the data and analyses when restricting detections to within 150 meters of each point. Bird species diversity declined significantly from 2004 to 2014 and remained low in 2024. The average number of species detected per point count was significantly greater in 2004 compared to either subsequent year ($df = 2$, $F = 33.89$, $p < 0.0001$) (Figure 2). Total number of species detected was notably higher in 2004 than in both subsequent years (75 in 2004, 64 in 2014 and 56 in 2024). Although total species detected was higher in 2014 than in 2024, the average number of species detected per point count did not differ significantly between the two years because more uncommon species were detected in 2014 (19 species detected once or twice in 2014 v. 9 in 2024). The average number of individual birds detected per point count was significantly higher in 2004 than in both subsequent years ($df = 2$, $F = 47.09$, $p < 0.0001$). These averages were not significantly different between 2014 and 2024 but both these years differed significantly from 2004. Total number of individual birds detected was far greater in 2004 (1275 in 2004, 818 in 2014 and 851 in 2024).

Taken together, these patterns clearly indicate significant declines in diversity and abundance over the ten year period from 2004 to 2014, and that decline persisted over the following ten years to 2024. BPNA was formerly owned by Mr. Roger Remacle who oversaw an extensive harvest between 1980 and 1985. The subsequent forest succession attracted many disturbance-dependent species like veery, chestnut-sided warbler and Canada warbler to name a few (see changes in ranking below). While this may partly explain higher diversity in 2004 when the forest was in early to mid-succession, time since harvest is likely not a factor in the 36% reduction in total individual birds detected between 2004 and 2014. Both the analyses by Rosenberg et al. (2019) and the patterns in the Breeding Bird Survey across North America (Sauer et al. 2014) provide evidence for wide-scale declines in both diversity and abundance of songbirds, corroborated by these data from BPNA.

Significant shifts in species abundance rankings occurred, and this is consistent with expectations in the years after a heavy harvest of timber in the early 1980s (Table 1). That said, the top five abundant species shifted little. These are generalists in terms of forest habitat types. Ranking first in two years is the ovenbird (first in two years and second in the third). Second is the blue jay ranking second in two years and third in the third). The third ranked is the red-eyed vireo ranking fourth in two years and third in the third and hermit thrush ranking fourth in two years and third in the third. These species represent resilience, the ability to select a wide array of habitat types for breeding purposes, but still forested, not human-dominated. A few species are noteworthy in rankings, such as, the chestnut-sided warbler which had 28 detects in 2004 down to 1 in 2014 and 4 in 2024, and Canada warblers went from 30 in 2004 to 29 in 2014 and down to 14 in 2024 (more later on CAWAs). A similar pattern, and for a species with similar habitat preferences to the CAWA is the magnolia warbler with 27 detects in 2004, 26 in 2014 and only 5 in 2024. A second tier of common species in order of abundance are black-capped chickadee, veery, black-throated blue warbler, black-throated green warbler, winter wren and black-and-white warbler. Among these six species, changes in ranking and total detections were not consistent. The Canada warbler population in the southern portion of BPNA (Figure 3) was intensively studied from 2005 to 2020 with less intensive monitoring through 2023. Over that period, several neighborhoods disappeared or declined significantly. The current population on what is referred to as the “upper plot” in Figure 3 is < 10% of what it was at its peak from 2005 through 2008.

RECOMMENDATIONS

Models of climate change predict increases in frequency and severity of weather that creates disturbance in forests. This was evident when surveying in the southern part of BPNA in 2024, where the intensive Canada warbler work was conducted. Blow-down from high winds made for tough conditions walking from one

attracts disturbance-dependent species. Minus a disturbance on the scale of the 1938 hurricane, the type of disturbance at the scale of the timber harvest in the early 1980s is unlikely. An intermediate approach that is currently prohibited by the conservation easement would be to create openings in the canopy in the form of small patch cuts. In another couple or three centuries, the oldest cohort of trees may accomplish the same as patch cuts when these large trees fall (tree-fall gaps). This is not a recommendation for a harvest for profit, but rather, harvest as a mimic of old-growth forest dynamics that creates a mosaic of forested habitats, essentially fast-forwarding “forever wild” into the old-growth future of BPNA. Again, I acknowledge restrictions prohibit this at present.

The second and final recommendation is to prioritize repeating this standardized bird survey in 2034 and at decadal intervals thereafter. Such data would be a local treasure, but the scope of their influence and impact may well extend beyond the Upper Valley.

ACKNOWLEGEMENTS

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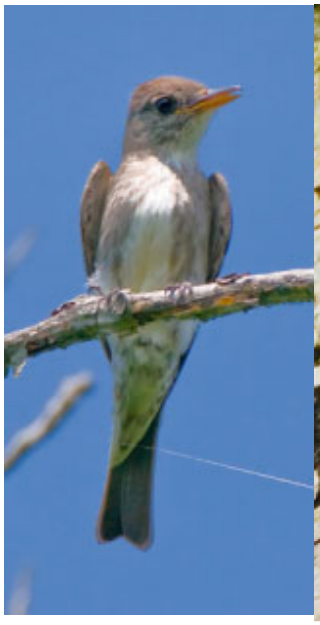


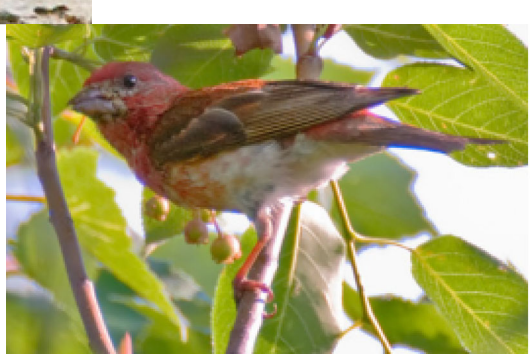


Table 1. Lists of all species detected in each of three years from most abundant to least abundant. Noteworthy species are discussed in the Results and Discussion section of this report.

2004		2014		2024	
Ovenbird	75	Ovenbird	83	Black-capped chickadee	65
Blue jay	66	Blue jay	59	Ovenbird	61
Yellow-bellied sapsucker	63	Red-eyed vireo	48	Blue jay	58
Red-eyed vireo	61	Hermit thrush	37	Red-eyed vireo	50
Hermit thrush	55	Nashville warbler	35	Hermit thrush	43
Black-capped chickadee	51	Black-capped chickadee	35	Yellow-bellied sapsucker	37
American crow	50	Veery	34	Veery	35
White-throated sparrow	47	Yellow-bellied sapsucker	33	Black-throated blue warbler	32
Nashville warbler	46	Black-throated blue warbler	32	Winter wren	25
Veery	40	Magnolia warbler	26	Tufted titmouse	23
Black-throated blue warbler	35	Black-throated green warbler	23	Brown creeper	23
Black-throated green warbler	34	Black and white warbler	22	Red-breasted nuthatch	22
Winter wren	31	White-breasted nuthatch	21	Black-throated green warbler	21
Canada warbler	30	Blackburnian warbler	21	Northern parula	20
Purple finch	29	Canada warbler	20	Black and white warbler	19
Chestnut-sided warbler	28	Winter wren	17	White-breasted nuthatch	17
Magnolia warbler	27	Scarlet tanager	17	Scarlet tanager	17
Black and white warbler	26	Hairy woodpecker	17	American crow	17
Mourning dove	26	Northern waterthrush	16	Pileated woodpecker	16
Common yellowthroat	24	Golden-crowned kinglet	16	Blackburnian warbler	16
Yellow-rumped warbler	24	White-throated sparrow	14	Eastern wood-pewee	15
Cedar waxwing	23	Northern parula	14	Canada warbler	14
Scarlet tanager	22	Swamp sparrow	13	White-throated sparrow	13
Hairy woodpecker	19	Common yellowthroat	13	Swamp sparrow	13
American robin	18	Tree swallow	11	Hairy woodpecker	13
Red-breasted nuthatch	18	Ruffed grouse	11	Nashville warbler	12
Red-winged blackbird	16	Wood thrush	10	Mourning dove	12
Alder flycatcher	15	Mourning dove	9	Common yellowthroat	12
Brown creeper	14	Blue-headed vireo	8	Song sparrow	11
Northern parula	14	Yellow-rumped warbler	7	Purple finch	10
Olive-sided flycatcher	14	Purple finch	7	Pine warbler	10
Rose-breasted grosbeak	14	Cedar waxwing	7	Cedar waxwing	8
White-breasted nuthatch	14	Song sparrow	5	Blue-headed vireo	8
Eastern wood-pewee	13	Red-winged blackbird	5	Northern waterthrush	7
Evening grosbeak	12	Rose-breasted grosbeak	5	Great-crested flycatcher	7
Swamp sparrow	12	Common grackle	5	Ruffed grouse	6
American goldfinch	11	American robin	5	Golden-crowned kinglet	6
Blackburnian warbler	10	Alder flycatcher	5	Yellow-rumped warbler	5
Common grackle	10	Pileated woodpecker	4	Wood thrush	5
Downy woodpecker	10	Downy woodpecker	4	Northern flicker	5
Northern waterthrush	9	Red-breasted nuthatch	3	Magnolia warbler	5
Song sparrow	9	Broad-winged hawk	3	Broad-winged hawk	5
Northern flicker	8	Brown creeper	3	Gray catbird	4
Blue-headed vireo	7	Belted kingfisher	3	Chestnut-sided warbler	4
Great-crested flycatcher	7	American crow	3	Common raven	4
Golden-crowned kinglet	6	Tufted titmouse	2	Barred owl	4
Tree swallow	6	Rusty blackbird	2	American robin	3
Yellow-bellied flycatcher	6	Ruby-throated hummingbird	2	Red-winged blackbird	2
Broad-winged hawk	5	Wood thrush	2	Common grackle	2
Common loon	5	Gray catbird	2	Canada goose	2
Gray catbird	5	Eastern kingbird	2	Alder flycatcher	2
Indigo bunting	5	Common raven	2	Red-shouldered hawk	1
Pileated woodpecker	5	Canada goose	2	Northern cardinal	1
Ruby-throated hummingbird	5	Baltimore oriole	2	Downy woodpecker	1
Wood thrush	5	American goldfinch	2	Belted kingfisher	1

Common raven	4
Barn swallow	3
Black-billed cuckoo	2
Chipping sparrow	2
Chimney swift	2
Eastern kingbird	2
Mourning warbler	2
Ruffed grouse	2
Wild turkey	2
Barred owl	1
Dark-eyed junco	1
Killdeer	1
Least flycatcher	1
Sharp-shinned hawk	1
Tufted titmouse	1
Wilson’s snipe	1
Wood duck	1
Yellow-billed cuckoo	1
Yellow warbler	1
individuals	**1275**
species	**75**

Swainson’s thrush	1
Palm warbler	1
Olive-sided flycatcher	1
Mallard	1
Great blue heron	1
Chestnut-sided warbler	1
Barn swallow	1
American redstart	1
individuals	**818**
species	**64**

individuals	**851**
species	**56**

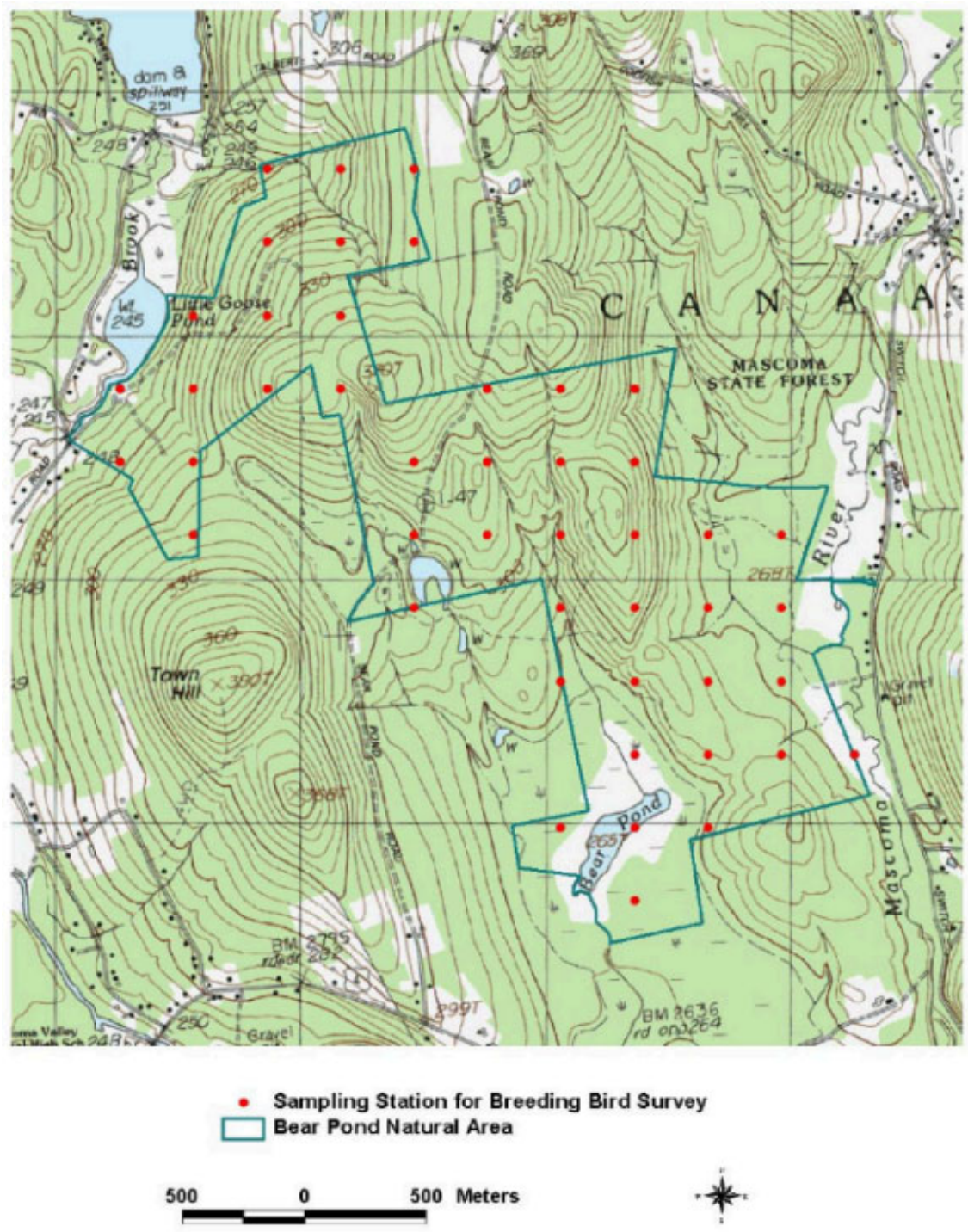


Figure 1. Topographic map of the Bear Pond Natural Area (BPNA) with point count stations for the breeding bird survey conducted in 2004, 2014 and 2024. Each station is 300 meters apart and only those birds detected within 150 meters of each point were used in determining species diversity and total number of birds detected.

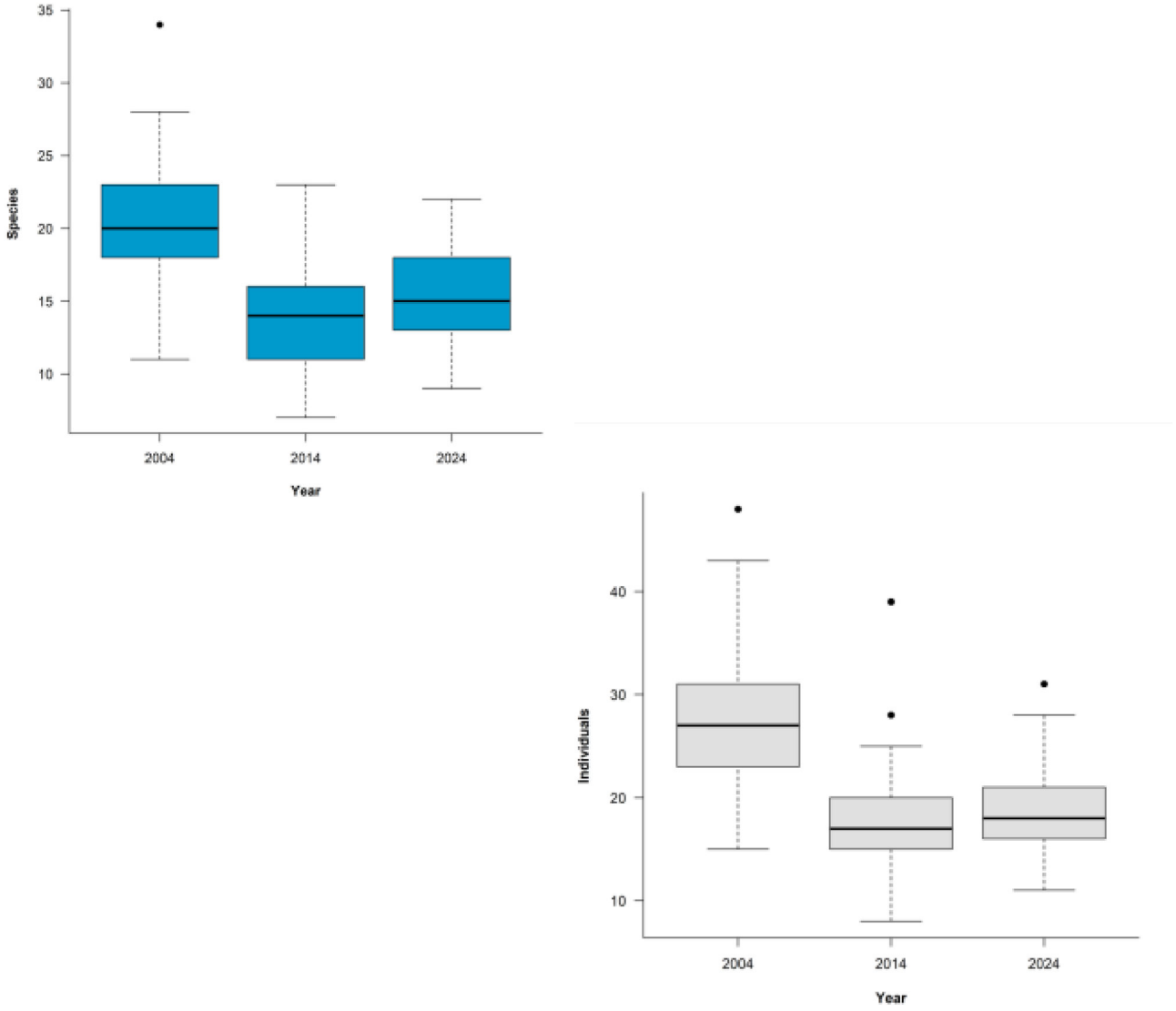
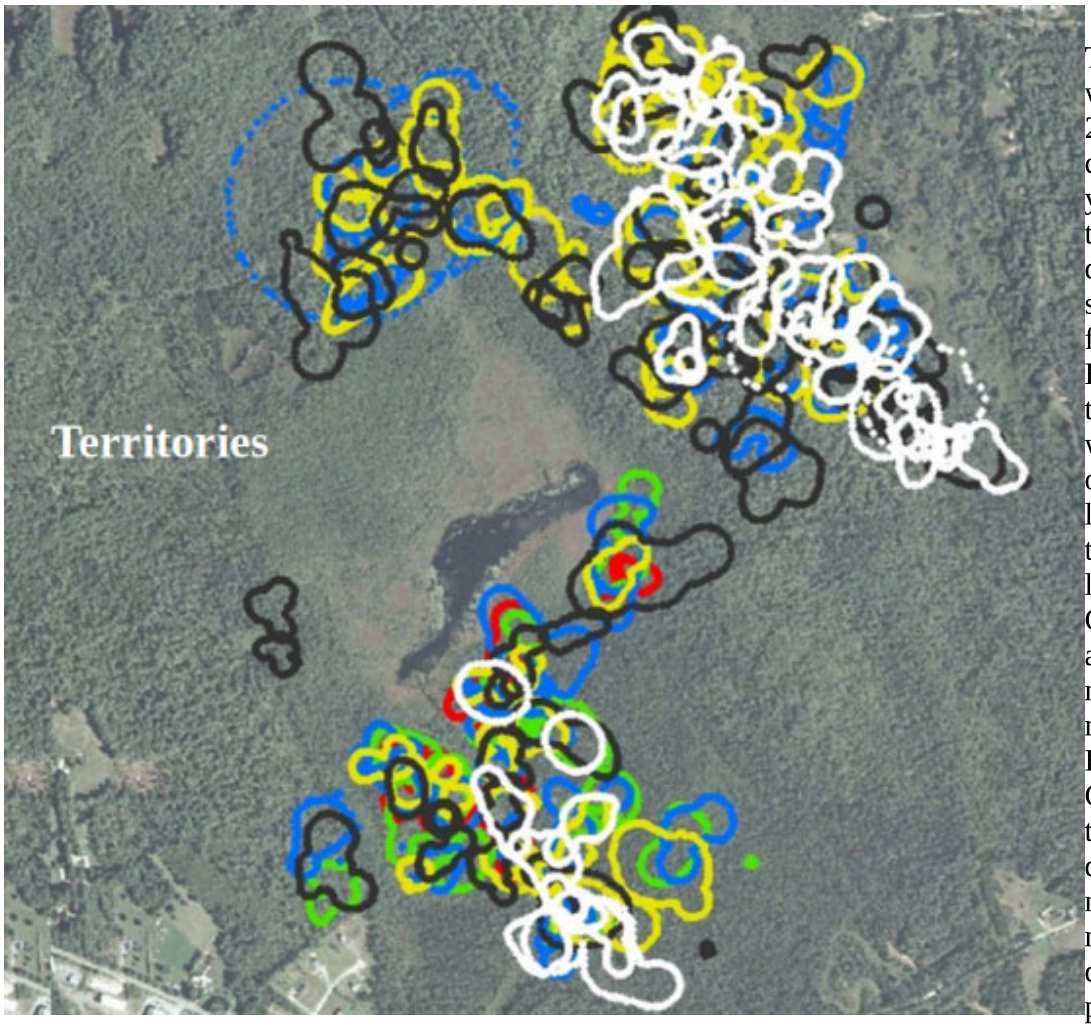


Figure 2. Top: average number of species detected at each point count (with range of variation) for each of the three years surveys were conducted (2004, 2014 and 2024). See methods for how numbers of species were tallied over three survey dates at each point in each year. Bottom: average number of individuals detected at each point count. Both diversity and abundance were statistically significantly greater in 2004 compared to 2014 and 2024 and the latter two years did not significantly differ.



Territories of Canada warblers in the years 2003 – 2008. Each color is a different year. The density of this species has decreased significantly due to forest succession. Bear Pond separates the upper plot, entirely within the boundaries of BPNA, from the lower plot. Roughly three quarters of the lower plot is on the Canaan Town Forest and the rest to the north is the southern most section of BPNA. The density of Canada warblers on the lower plot has decreased less because much of it is red maple swamp where dense undergrowth persists.