Seasonal Trends in Species Richness and Density Among Landbirds Wintering on Block Island, Rhode Island

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Abstract

We used CBC-style counts in November, December, and February to study seasonal trends in the species richness and density of 75 species of landbirds on Block Island, RI. Across five winters (1995-2000), December values of species richness and birds per foot-mile consistently exceeded February values but varied in parallel; in contrast, year-to-year fluctuations in the generally higher November values of species richness and density were discordant with year-to-year variation in the other counts. We interpret this pattern as implying that the December counts (CBCs) tended to track wintering populations and were little influenced by the vicissitudes of late fall migration. Declines in density from December to February were observed in the vast majority of species each year, were statistically significant overall in four of five years, and were qualitatively similar in two subsets comprising the most migratory species (generally wintering south of southern New England) and the winter resident species most numerous on Block Island in February. We discuss methods for distinguishing between mid-winter dispersal and mortality as the proximal causes of particular examples of December-February decline.

The Christmas Bird Count (CBC) has tracked early winter populations of North American birds for more than a century. Although contemporary observers have come to value and appreciate the resulting long-term database much more than CBC founder Frank Chapman could possibly have foreseen (LeBaron 2000), counting birds was undoubtedly one of Chapman's motives from the start. Ironically, the monitoring function of the CBC may have been compromised to some extent by another of Chapman's priorities—providing a conservation-minded alternative to the traditional Christmas Day "Side Hunt" (Chapman 1900). The latter consideration evidently tied the timing of the counts to the early winter season (mid-December–early January)—a period that witnesses considerable southbound migration in much of North America—and some observers have suggested that the official CBC Period significantly precedes the period when many bird populations over much of the continent reach their most stable mid-winter levels (Peterjohn 2000).

The most important consequence of this early winter timing is that CBC data are suspected to be more variable than they would be if they were collected later, closer to the nadir of seasonal movement. Another, more welcome consequence has been the regular presence of numerous "half-hardy" lingerers on counts throughout the continent—birds that provide much of the excitement drawing observers to the CBC Observations deemed unusual on CBCs have been interpreted variously as late migrants, birds likely to withdraw after the onset of severe weather, birds likely to perish after the onset of severe weather, or artifacts arising from intense CBC coverage in contrast to poor mid-winter coverage

Heretofore, all of these considerations have been speculative, as no systematic attempt has been made to evaluate CBC data directly in relation to late fall migration and mid-winter stasis. From the appearance of an Orange-crowned Warbler or a Sooty Shearwater on a New England CBC to a dramatic change in the number of Northern Cardinals or Lapland Longspurs on an Ohio CBC, observers still lack the means to

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distinguish among the various possible causes underlying variation in December populations. Veit and Petersen (1993) proposed replicating CBCs in late February as a means of clarifying *to what extent* particular species actually decline in late winter. Extending this logic, we propose that a third count in November might lend insight into *how and why* various populations change through the colder months. Here we present the results of a five-year (1995–2000) study on Block Island, RI, in which we bracketed the traditional late December count with CBC-style counts in early–mid-November and mid–late February. Our goals were two-fold: to quantify declines in landbird density over the majority of the winter season; and to identify, where possible, the proximal causes of these declines.

We considered three potential causes of population change: stereotyped migration, facultative dispersal, and mortality. In practice, we recognized changes due to stereotyped migration by a combination of *a priori* knowledge of a species' phenology and an empirical pattern of regular occurrence on November counts and absence on February counts. Mortality presumably affected all species encountered, regardless of the significance of the other two factors. Although mortality's quantitative effects might be expected to vary considerably from year to year and from species to species, qualitatively it must affect all winter populations in the same manner—diminishing them to varying extents in the absence of reproduction, immigration, and emigration. Thus the real challenge was to identify instances where facultative dispersal was likely an important cause of changes in density. We predicted that the effects of facultative dispersal should vary from year to year, and that unlike mortality, dispersal should result in increased densities, particularly from November to December, for some species in some years. By examining trends from November to December, we identified potentially dispersing species *a posteriori*, as those increasing in density in both years exhibiting overall increases, *and* decreasing in density in the one year exhibiting an overall decrease.

Study Area and Methods

Located twelve miles south of the Rhode Island mainland, Block Island extends approximately seven miles from north to south and three miles from east to west. The CBC circle is centered near the north end (Sandy Point) and encompasses the entire island and much of the ferry route from Point Judith.

Block Island's winter avifauna is particularly amenable to analysis for several reasons. Although some characteristic year-round residents of the nearby mainland, such as Barred Owl, Eastern Screech-Owl, Rock Dove, and Tufted Titmouse, are essentially absent from the island, several other "residents" (e.g., Red-bellied Woodpecker, Hairy Woodpecker, Downy Woodpecker, Blue Jay, Black-capped Chickadee, and White-breasted Nuthatch) breed locally in such small numbers that detection of their occasional—but sometimes dramatic—seasonal movements is greatly facilitated. Furthermore, Block Island's insular setting aids interpretation of winter counts of its most numerous year-round residents (e g , Carolina Wren, Northern Mockingbird, Northern Cardinal, and House Finch). Populations of such species, whose winter dispersal or aggregation at feeding stations raise troubling questions for mainland CBCs (Veit and Petersen 1993), are almost closed systems on Block Island, where the extensive water barrier presumably discourages mid-winter immigration and emigration. The absence of significant summer populations of many other, more migratory, species (e.g., Marsh Wren, Swamp Sparrow, Field Sparrow, Purple Finch) further simplifies interpretation of their late-fall/early-winter phenology.

The winter status of half-hardies on Block Island in relation to the mainland is complex. The maritime climate and exposed habitats of Block Island appear to aid winter survival for some species (Northern (Yellow-shafted) Flicker, Yellow-rumped (Myrtle) Warbler) and hinder it for others (Brown Creeper, Golden-crowned Kinglet). Likewise, Block Island could be a destination for some species and a source of others dispersing in mid-winter (R. Ferren in litt.).

A quick perusal of Block Island winter count data reveals exceedingly complex patterns of variation in the numbers of many waterbirds—particularly seabirds. Further complicating analysis of these species is variation in the amount and kinds of effort employed in their detection Ferry-based observations have been a staple of all modern winter-season counts on Block Island, but land-based effort directed at waterbirds has varied considerably among counts, depending on, among other factors, the employment of day-long stationary sea-watches on many (but not all) counts. For these reasons, the present analysis is restricted to a set of diurnal terrestrial species generally detected by birding on foot. This set, referred to below as "Landbirds," consists of Mourning Dove, woodpeckers, and passerines. For some analyses, these Landbirds were further divided into two mutually exclusive subsets based on their winter status

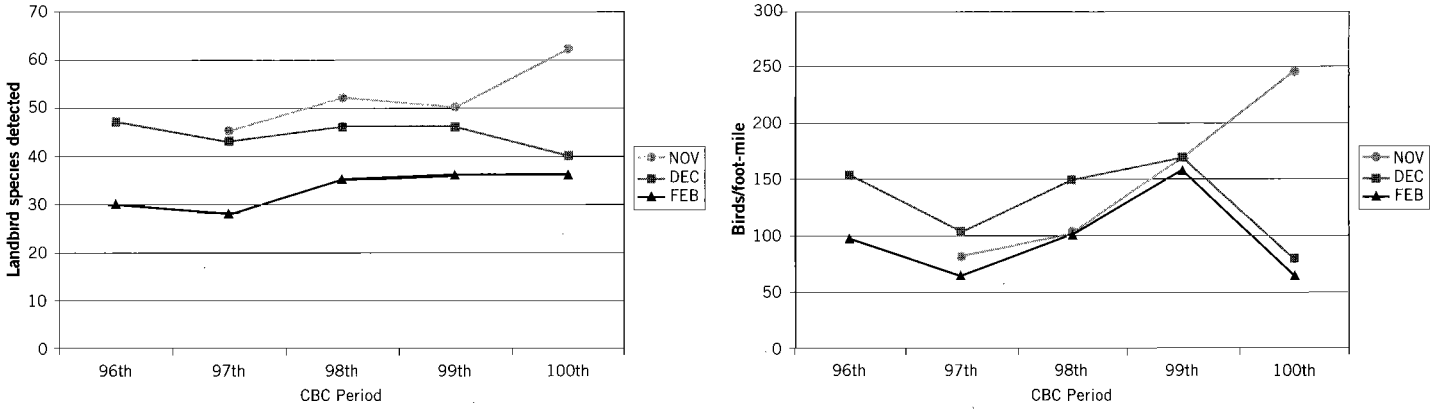

Figure 1. Trends in species richness (a) and density (b) among Landbirds on CBC-style counts conducted in November, December, and February (1995-2000) on Block Island, Rhode Island.

in the region: "Migrant" species were defined as those generally wintering south of southern New England (National Geographic Society 1999, Conway 1992, Veit and Petersen 1993, Levine 1998); and "Winter Residents" were defined as the fifteen species most numerous overall on the February counts. A complete list of the Landbirds encountered, along with the designation of some as Migrants or Winter Residents, is presented in Table 1.

We scheduled our November counts during the second week of the month, on or around Veterans' Day. Similarly, the February counts were clustered around Presidents' Day, during the third week of the month. In recent years the Block Island CBC has been conducted consistently around 20 December. CBC methodology was employed on all counts Variation in effort among counts was addressed by dividing all raw counts of Landbirds by the number of party-miles on foot (foot-miles) Changes in density from November to December or from December to February were tested by two-tailed Wilcoxon's Signed Ranks Tests for the full set of Landbird species and for the subsets of Migrant and Winter Resident species.

Results

A total of fourteen counts were conducted, beginning with the 96th CBC on 18 December 1995 and concluding—for the purposes of the present

Table 1. Records of Landbirds on winter counts on Block Island, RI (1995-2000)

Species	M[1]	WR[2]	#Counts Nov	Dec	Feb	Max	Max (Date[3])
Mourning Dove		1	4	5	5	145	NOVE
Red-bellied Woodpecker			4	4	1	3	NOVE
Downy Woodpecker			4	5	5	35	DECC
Hairy Woodpecker			2	3	2	4	NOVE
Northern Flicker		1	4	5	5	186	DECA
Eastern Phoebe	1		1	0	0	1	NOVE
Northern Shrike			1	3	1	15	DECA
Blue-headed Vireo	1		1	0	0	1	NOVD
Blue Jay			4	5	5	58	NOVE
American Crow		1	4	5	5	603	DECD
Fish Crow			3	4	3	10	DECC
Horned Lark			1	1	1	6	DECE
Tree Swallow	1		0	1	0	2	DECA
Black-capped Chickadee		1	4	5	5	218	FEBD
Red-breasted Nuthatch		1	4	5	5	137	DECA
White-breasted Nuthatch			3	3	2	5	DECA
Brown Creeper			3	2	0	6	NOVE
Carolina Wren		1	4	5	5	169	DECD
House Wren	1		1	2	1	1	NOV, DEC, FEB
Winter Wren			3	5	3	8	DECE
Marsh Wren	1		1	2	0	3	DECB
Golden-crowned Kinglet			4	4	1	101	NOVE
Ruby-crowned Kinglet	1		4	4	2	29	NOVE
Eastern Bluebird			2	2	2	69	NOVE
Hermit Thrush	1		4	5	5	38	DECD
American Robin		1	4	5	5	1188	NOVE
Gray Catbird	1		4	5	5	31	DECD
Northern Mockingbird			4	5	5	50	DECA
Brown Thrasher	1		2	4	2	4	FEBD
European Starling		1	4	5	5	1795	DECC
American Pipit	1		4	3	0	21	NOVC
Cedar Waxwing			4	4	2	221	NOVE
Orange-crowned Warbler	1		4	2	0	1	4 NOV, 2 DEC
Nashville Warbler	1		1	0	0	1	NOVC
Yellow-rumped Warbler		1	4	5	5	1814	DECD
Pine Warbler	1		1	1	0	5	NOVE
Prairie Warbler	1		0	1	0	1	DECC
Palm Warbler	1		3	2	0	10	NOVD
Blackpoll Warbler	1		1	0	0	5	NOVE
Common Yellowthroat	1		4	1	0	3	NOVC
Yellow-breasted Chat	1		0	0	1	1	FEBD
Eastern Towhee	1		4	5	5	21	DECB
American Tree Sparrow			3	5	5	60	DECD
Chipping Sparrow	1		2	1	0	3	NOVE
Field Sparrow			4	5	1	16	DECC
Lark Sparrow	1		1	0	0	1	NOVE
Ipswich Sparrow			0	3	1	2	DECB, DECE
Savannah Sparrow	1		4	4	3	7	NOVE
Sharp-tailed Sparrow Sp.	1		2	1	0	3	NOVD
Seaside Sparrow	1		1	0	0	1	NOVB
Fox Sparrow	1		3	3	3	6	NOVC
Song Sparrow		1	4	5	5	370	NOVE
Lincoln's Sparrow	1		1	0	0	1	NOVE
Swamp Sparrow	1		4	5	4	39	NOVE
White-throated Sparrow		1	4	5	5	525	DECD
White-crowned Sparrow	1		2	2	1	3	NOVE
Dark-eyed Junco		1	4	5	5	221	NOVE
Lapland Longspur			2	0	1	6	NOVE
Snow Bunting			4	5	3	511	NOVE
Northern Cardinal		1	4	5	5	96	DECA
Dickcissel	1		1	0	0	1	NOVD
Red-winged Blackbird			4	4	3	644	NOVE
Eastern Meadowlark	1		3	4	2	31	DECA
Rusty Blackbird	1		4	1	0	6	DECC
Common Grackle			4	2	1	19	NOVE
Brown-headed Cowbird			4	3	0	26	DECB
Baltimore Oriole	1		1	0	0	1	NOVC
Purple Finch			4	2	0	9	NOVB, NOVE
House Finch		1	4	5	5	124	DECD
Red Crossbill			1	3	2	40	NOVE
White-winged Crossbill			1	1	0	199	DECC
Common Redpoll			1	2	1	52	DECC
Pine Siskin			2	0	0	137	NOVE
American Goldfinch			4	5	5	799	NOVE
House Sparrow		1	4	5	5	169	FEBE

[1] *Migratory species wintering south of southern New England (see text).*
[2] *Winter resident species—the 15 most numerous species on February counts (see text).*
[3] *Letters A through E refer to the 96th through 100th CBC periods, respectively.*

Table 2. Summary of winter bird counts on Block Island, Rhode Island (1995-2000).

Count	Year	Julian Date	Miles on Foot	Landbirds[1]	
				Species	Density (inds./mi)
Veterans	1996	316	28.0	45	81.3
	1997	317	23.0	52	101.5
	1998	318	29.5	50	168.8
	1999	312	31.0	62	245.5
	Average	316	27.9	52.2 (71)	149.3
Christmas	1995	352	26.5	47	153.8
	1996	358	34.0	43	103.1
	1997	356	36.5	46	148.7
	1998	355	41.0	46	169.3
	1999	354	40.5	40	79.1
	Average	355	35.7	44.4 (63)	130.8
Presidents	1996	50	16.0	30	97.3
	1997	49	20.0	28	63.8
	1998	47	28.5	35	100.5
	1999	46	28.0	36	157.5
	2000	52	38.5	36	64.1
	Average	49	26.2	33.0 (50)	96.6

[1]Landbirds defined as Mourning Dove, woodpeckers, and passerines (see text).

analysis—with the fifth Presidents' Day Count (PDC) on 21 February 2000. Species totals averaged 98 in November (Range 91-115, n=4), 96.4 in December (Range 90-103, n=5), and 72.6 in February (Range 66-78, n=5). A grand total of 162 species were recorded across all of the counts. Considering Landbirds only, species totals averaged 52.2 in November (Range 45-62), 44.4 in December (Range 40-47), and 33.0 in February (Range 28-36). A grand total of 75 species of landbirds were recorded across all of the counts. Estimates of Landbird density (individuals per foot-mile) varied a great deal (two- to three-fold in each type of count), averaging 149.3 in November, 130.8 in December, and 96.6 in February.

Not surprisingly (in view of the average values just presented), species richness of Landbirds was consistently highest in November (Fig. 1a). Even so, November estimates of density were rather unpredictable, variously resembling the December value, the February value, or exceeding both, depending on the year (Fig. 1b). The December values of both species richness and density of landbirds were consistently higher than the February values in a given year, and year-to-year fluctuations in these counts varied in parallel (Fig. 1). Landbird species totals and densities for all fourteen counts are summarized in Table 2.

Twenty-five species of Landbirds present in November or December were never detected in February (Table 1). Eleven of these reflected unique occurrences of seasonally rare species—Eastern Phoebe, Blue-headed Vireo, Tree Swallow, Nashville Warbler, Prairie Warbler, Blackpoll Warbler, Lark Sparrow, Seaside Sparrow, Lincoln's Sparrow, Dickcissel, and Baltimore Oriole. In contrast, eight of the species absent in February were essentially annual in November (often in multiples and sometimes in double-digit numbers) and occurred at least once each in December—Brown Creeper, American Pipit, Orange-crowned Warbler, Palm Warbler, Common Yellowthroat, Rusty Blackbird, Brown-headed Cowbird, and Purple Finch. Six other species absent in February were of ambiguous or intermediate status in early winter, appearing on two–three November or December counts each: Marsh Wren, Pine Warbler, Chipping Sparrow, Sharp-tailed Sparrow sp., White-winged Crossbill, and Pine Siskin.

The proportion of Landbird species declining to those increasing, from November to December, varied from 23:29 in 1996 to 59:6 in 1999 (four year average 36.2:22.0). Across all Landbird species, no significant change in density from November to December was observed overall or in any year with the exception of 1999, when a dramatic decrease was evident ($P<0.001$). This overall pattern—or lack thereof—was also noted among the subset of 15 Winter Resident species, for which the only significant change from November to December was a decline noted in 1999 ($P<0.05$). Among the Migrant subset, a significant decrease in density was noted in 1997 ($P<0.05$) as well as in 1999 ($P<0.001$). The full results of tests contrasting November and December densities are presented in Table 3.

In contrast to the November–December interval, during which changes in landbird density tended to be variable and non-significant, a striking trend of diminishing density was observed between December and February, reflecting a consistent diminution for the vast majority of Landbird species encountered. From December to February, the proportion of Landbirds declining to those increasing varied only from 31:18 in 1998–99 to 44:5 in 1995–96 (five–year average, 35.4:11.6), and statistically significant decreases in density were detected in four out of five years. Furthermore, the trend in the exceptional year (1998–99), although not statistically significant, showed decreases for 63% of the species and an overall average decline of -16% per species (Range –100% to +605%, SD=113%, n=47). Comparisons restricted to Migrant species were qualitatively similar to the overall Landbird sample, as were comparisons restricted to Winter Residents. In other words, the trend of diminishing landbird density between December and February was comparable among species north of their "normal" winter ranges and among the core constituents of Block Island's winter avifauna. The percentage by which density changed between December and February (data pooled across years to reduce the number of zero counts) averaged –46% across all Landbirds (Range –100% to +177%, SD=53%, n=63), –67% for the Migrants (Range –100% to +42%, SD=41%, n=21), and –19% for the Winter Residents (Range –55% to +30%, SD=24%, n=15, see Fig. 2). The full results of

Table 3. Changes in Landbird densities (individuals per foot-mile) between November and December on Block Island, Rhode Island (1996-2000).

	97th	98th	99th	100th	Average
Landbirds					
Spp. Decr:Incr	23:28	35:24	26:29	59:5	47:27
Wilcoxon's Z	0.98	-1.01	1.10	-6.28***	-1.50
Average Δ in Density	0.29	0.63	0.01	-2.22	-0.25
Average % Δ in Density	26.0	38.0	7.4	-67.2	19.3
Migrants[1]					
Spp. Decr:Incr	7:9	14:7	11:8	21:1	24:7
Wilcoxon's Z	0.47	-2.32*	0.36	-3.92***	-2.78**
Average Δ in Density	0.02	-0.05	0.01	-0.15	-0.03
Average % Δ in Density	6.6	-40.2	-32.2	-77.7	-48.4
Winter Residents[1]					
Spp. Decr:Incr	5:10	8:7	4:11	14:1	5:10
Wilcoxon's Z	1.14	0.06	1.25	-3.29**	0.68
Average Δ in Density	1.70	3.22	0.11	-5.12	0.32
Average % Δ in Density	72.3	55.8	51.9	-42.2	14.9

**P<0.05*
***P<0.01*
****P<0.001*

[1]See text and Table 1 for definitions.

Table 4 Changes in Landbird densities (individuals per foot-mile) between December and February on Block Island, Rhode Island (1995-2000).

	CBC Period					
	96th	97th	98th	99th	100th	Average
Landbirds						
Spp. Decr:Incr	43:5	39:6	33:14	30:18	27:15	52: 12
Wilcoxon's Z	-4.81***	-4.45***	-2.72**	-0.78	-2.32*	-4.94***
Average in Density	-0.75	-0.52	-0.64	-0.16	-0.20	-0.46
Average % in Density	-56.9	-34.0	-40.3	-14.5	-14.8	-43.9
Migrants[1]						
Spp. Decr:Incr	10:0	11:1	10:4	10:4	6:4	19:3
Wilcoxon's Z	-2.82**	-2.75**	-2.29*	-1.48	-1.78	-3.43***
Average in Density	-0.06	-0.06	-0.03	-0.04	-0.01	-0.04
Average % in Density	-74.4	-89.1	-48.1	-30.8	-38.7	-66.9
Winter Residents[1]						
Spp. Decr:Incr	13:2	14:1	10:5	7:8	10:5	12:3
Wilcoxon's Z	-2.95**	-2.90**	-0.85	+0.51	-1.70	-2.90**
Average in Density	-3.37	-2.27	-2.65	-0.66	-0.94	- 1.98
Average % in Density	-30.9	-21.3	-14.2	-4.0	-0 5	-19.0

**P<0.05*

***P<0.01*

****P<0.001*

[1]See text and Table 1 for definitions.

comparisons between December and February are presented in Table 4.

As noted above, our results revealed two years (1996 and 1997) in which overall Landbird density increased over the November–December period, and one year (1999) in which it decreased (Fig. 1b). Thus, we defined our profile of candidates for facultative dispersal as those species that increased in density from November to December in both 1996 and 1997 and decreased over that period in 1999. Only nine species satisfied these criteria: Downy Woodpecker, Red-breasted Nuthatch, Gray Catbird, Northern Mockingbird, Yellow-rumped (Myrtle) Warbler, Field Sparrow, Northern Cardinal, Eastern Meadowlark, and House Finch.

Discussion

Our observation that year-to-year variation in species richness and density appeared congruent between the December and February counts—and discordant between the November and December counts—did not arise from systematic biases in our sampling efficiency. If anything, those birds still present tended to be easier to detect in February than in December as a consequence of a resurgence of singing behavior. Similarly, the weather did not pose consistent problems for bird detection in February relative to December, as one might have expected. One February blizzard was more than offset by several balmy, spring-like PDCs featuring choruses of Carolina Wrens, Song Sparrows, and Northern Cardinals and spring-migrant Killdeers and Red-winged Blackbirds. The congruence between December and February values of landbird species richness and density was real, and it implies that the CBC is actually an effective means of assessing winter populations—as opposed to late fall populations—on Block Island. This is an important result that lends support to an important premise—heretofore largely untested—underlying many applications of CBC data (reviewed by Peterjohn 2000 and Hochachka and Kelling 2000).

The eleven species whose only occurrence involved unique events on November or December counts might be regarded as seasonal vagrants, lagging far behind the vast majority of conspecifics, whose potential persistence into the southern New England winter would be fortuitous and dependent on favorable circumstances—most notably mild weather. Individuals of these species are hardly expected locally even in November, but if present then, might just as easily remain through the CBC period if weather permits their survival. Another species that might belong in this category is the Yellow-breasted Chat, which was detected on just a single February count.

In contrast, the eight species encountered regularly (and often in numbers) in November and December—but never in February—should be regarded as late-fall migrants. Their withdrawals between late fall and early winter are regular and predictable consequences of their migration phenology and appear not to be governed (at least proximally) by weather-induced dispersal or mortality. Despite the fact that they are not really authentic members of the local winter avifauna, a few of these birds should be expected annually on regional CBCs, regardless of late fall weather, at the tail end of their normal southbound migration. These species expose some bias arising from the CBCs early winter timing, but at least on Block Island, the overall impact of such non-wintering birds on CBC results appears quite limited.

Of eleven Migrant species detected during February, three (House Wren, Ruby-crowned Kinglet, and White-crowned Sparrow) were represented by only one or two individuals over the five February counts and cannot be regarded as regular members of the winter avifauna. Four others (Winter Wren, Brown Thrasher, Savannah Sparrow, and Fox

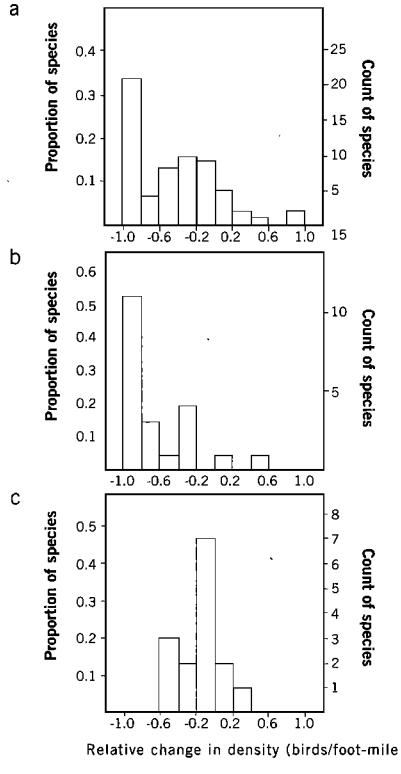

Figure 2. Relative changes in density from December to February among Landbirds (a), Migrants (b), and Winter Residents (c) on Block Island, RI (see text for definitions).

Sparrow) were represented by five–eleven total individuals on two–three PDCs, rendering their status ambiguous. In contrast, the remaining four Migrants (Hermit Thrush, Gray Catbird, Eastern Towhee, and Swamp Sparrow) clearly were perfectly regular winter residents on Block Island. In fact, the population trends of these species closely resembled those of the full Landbird sample: average change from December to February –38 6% for these four vs. –43.9% for all Landbirds. Although this resemblance could be construed as implying that these four species should have been classed with the Winter Residents from the start, it also underscores a more meaningful result: such characteristic and numerous Winter Residents as Northern Flicker, European Starling, and Dark-eyed Junco showed December–February declines >50%—even greater than the declines of the four half-hardy species.

The nine species identified as likely candidates for facultative dispersal form a diverse group. Several of these species—Downy Woodpecker, Red-breasted Nuthatch, Yellow-rumped (Myrtle) Warbler, and House Finch—have been suspected of undertaking mid-winter movements along coastal vantages by many observers in the region (R. Ferren in litt , S. Mitra unpubl. data, C. Raithel unpubl. data, R. Veit pers. comm.). Although such movements have not been reported for Gray Catbird, Field Sparrow, and Eastern Meadowlark, a perception exists that these birds sometimes appear in larger than expected numbers on regional CBCs when severe cold strikes just prior to the count period (S. Mitra pers obs.). This sort of corroboration, although admittedly tenuous, suggests that our methodology might prove to be a powerful tool in future prospective studies seeking to quantify the relative effects of dispersal and mortality as agents of winter population changes. The remaining two species—Northern Mockingbird and Northern Cardinal—are more enigmatic, as they are generally regarded as relatively sedentary species unlikely to undertake extensive over-water movements outside of their peak periods of dispersal/migration (late summer to early fall). We propose that application of our methods to other CBC circles might confirm heretofore unsuspected winter mobility in these species.

Variation from year to year in season-specific values of species richness and density of Landbirds might have arisen from several independent sources, including biasing effects of weather (especially wind) on detection rates; "real" effects of weather on patterns of migration, dispersal, and mortality; availability of berry, cone, and other food resources on Block Island; and extrinsic population changes attributable to factors, such as breeding success and boreal irruptions, affecting the populations far in time or space from Block Island. As discussed above, we endeavored to identify and minimize sources of bias affecting our data. We also depended, to a certain extent, on real differences between years in the numbers of several Landbird species dispersing to and from Block Island. Our goal of describing the basic patterns underlying the dynamics of winter bird populations on Block Island were achieved without explicitly identifying the underlying mechanisms. A thorough analysis of these mechanisms, particularly of the roles of temperature, snow cover, and food availability, must await an expanded data set

In conclusion, we found that bracketing a long-standing CBC with similar counts in November and February was an extremely gratifying exercise that clarified the winter status of many species on Block Island. In a coastal region replete with half-hardy species that are rare or unknown on CBCs just a few tens of miles inland, we were able to confirm that late December landbird counts were, in fact, robust indicators of mid-winter populations. Furthermore, we were able to quantify consistent mid-winter declines in density over a broad array of species ranging from those at the northern edges of their winter distributions to the most numerous and characteristic winter residents in the area Variation between years in population trends from November to December yielded some provocative insights into the relative roles of dispersal and mortality as the proximal causes of these declines. We urge participants in other CBCs to apply similar techniques to quantify seasonal trends in the species richness and density of other North American winter bird populations.

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