# SITE-SPECIFIC OBSERVATION IN THE BREEDING SEASON IMPROVES THE ABILITY OF CHECKLIST DATA TO TRACK POPULATION TRENDS

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Abstract.—Checklist programs that compile birding observations are potentially useful for population monitoring. Previous analyses showed that trends in Quebec checklist data from migration seasons were significantly correlated with trends from the Breeding Bird Survey (BBS) in Quebec, although agreement of trend magnitudes for individual species was low. Here we analyze Quebec checklist data from the breeding season for comparison, using both the full data set and a subset of data collected at frequently visited ("standard") sites. Checklist trends from the breeding season for standard sites corresponded much more closely to magnitudes of BBS trends than checklist trends based on all sites, although in both cases, checklists accurately reflected direction of BBS trend in >80% of species. Checklist trends from migration seasons for all sites and for standard sites were similar to each other, and did not correspond as well to BBS trends, probably because different populations were sampled in the two seasons. Checklist programs can be improved for population monitoring purposes by encouraging frequent reporting from standard sites, and by collecting recommended ancillary data that allow analysts to select data most appropriate to their research questions.

### OBSERVAR EN LUGARES ESPECÍFICOS DURANTE LA TEMPORADA REPRODUCTIVA AUMENTA LA HABILIDAD DE DATOS EN LISTAS DE COTEJO PARA MONITOREAR TENDENCIAS POBLACIONALES

Sinopsis.-Los programas de listas de cotejo que compilan las observaciones de aves son potencialmente útiles para monitorear poblaciones. Análisis previos mostraron que la tendencia de los datos de migración provenientes de listas de cotejo en el área de Quebec fueron correlacionadas significativamente con tendencias de Monitoreo de Aves en Reproducción (BBS) en Quebec, aunque el acuerdo concordancia de las magnitudes en las tendencias de especies individuales fue poco. Analizamos aquí los datos de listas de cotejo para Quebec para compararlos, usando tanto los datos totals como segmento de datos colectados en lugares frecuentemente visitados (control). Tendencias en las listas de cotejo para la temporada reproductiva en los lugares control corresponden mucho más cercamente a las magnitudes de tendencias medidas por BBS que las tendencias de listas de campo reflejaron dirección hacia las tendencias medidas por el BBS en >80% de las especies. Las tendencias notadas en listas de cotejo en períodos migratorios para todas las áreas y para áreas control fueron similares entre sí y no correspondieron tan bien a las tendencias del BBS, probablemente porque se muestrearon diferentes poblaciones en las dos temporadas. Programas de listas de cotejo pueden mejorarse con el propósito de monitorear poblaciones al estimular los reportes frecuentes de lugares contro y al colectar datos ancilares recomendados que permita a los analistas seleccionar los datos más apropiados para contestar sus preguntas de investigación.

Checklist programs that compile birders' observations into a common database can provide information on long-term population trends (Cyr and Larivée 1993; Dunn et al. 1996). While no one suggests that they replace standardized programs such as the Breeding Bird Survey (BBS), checklist programs might provide useful trend data for comparative purposes. Moreover, checklist data can be gathered for species, regions and habitats that are poorly sampled by BBS, such as secretive or sparsely distributed species, arctic and boreal regions, or wetland habitats.

One criticism of using checklist data for trend analysis is that there are no restrictions on where birders go, and observations are probably biased towards productive birding areas. When habitat at a favorite site is lost, birders move to a better site, which could mask declines in total population size of some species. A possible means of reducing this kind of bias is to restrict analysis of data to a standard set of sites that are visited regularly by birders. The aim of this paper is to conduct such an analysis, using data from Quebec's Étude des Populations d'Oiseaux du Québec (ÉPOQ), North America's oldest and largest checklist program. We compare the resulting trends to those derived from the entire data set and also to trends from the BBS.

In addition, we compare ÉPOQ trends for three seasons: spring and fall migration and the breeding season. Migration season trends were previously shown to be correlated with Quebec BBS trends across a large number of species, but there were many discrepancies for individual species (Dunn et al. 1996). If discrepant trends are a result of migrants coming from different areas than are sampled by BBS (southern Quebec), then breeding season ÉPOQ trends should correspond more closely to BBS trends because both are certain to be sampling birds from the same areas.

## METHODS

Each ÉPOQ checklist reports the number of each species detected on a single day at a single locality, an area less than one minute of latitude and longitude (about 3.2 km<sup>2</sup>, Cyr and Larivée 1993, 1995). All lists are vetted by local bird clubs before submission to the data set, to ensure that unusual records are confirmed or corrected.

Data were analyzed for the 55 species listed in Table 1 for the period 1971–1992. For each season, analysis was restricted to species-specific time periods encompassing the appropriate range of dates for migration or breeding. For the breeding season, dates were chosen based on data in Cyr and Larivée (1995) and David (1996). Length of season varied among species, and mean daily sample size ranged from 22 checklists for the Yellow-bellied Flycatcher to 74 for the Song Sparrow, with an average of 42 per day for all species. For migration season date selection and sample sizes, see Dunn et al. (1996).

For each season, we identified localities that were regularly visited throughout the 22-yr study period and also had an annual average of at least 20 checklists. There were 32 such sites for the breeding season, 26 for spring migration and 16 for fall migration. Data from these sites were analyzed using the same methods used for analysis of data for all sites, as described below.

For all seasons, annual indices of abundance were derived from a multiple regression in which the dependent variable was the log(mean daily count + 1) where a single "daily count" was total birds reported on one checklist, and 1 was added to the mean of all checklist values for that day to allow transformation of zeros. (Tests with smaller additions showed that level of correspondence with BBS was not altered.) Each daily mean was weighted in the regression in proportion to the number of checklists used to calculate that mean.

Independent variables included date terms (see below) and dummy variables for each year. Day was set to 0 for a date near the center of the species-specific breeding or migration season. First- through third-order day terms were used in analysis of the breeding season (to model curvilinear relationships with date), while first- through sixth-order terms were used in analysis of migration seasons (to model the more complex pattern of abundance in those seasons). Dummy variables for each year were set to 0 or 1 (value = 1 if the observation was made in that year), and annual indices were calculated from the coefficients of the dummy variable for year that were estimated in the regression, as described in Dunn et al. (1996). Because day was set to 0 for a date near the center of the season, the index represents average abundance at that date.

Checklist trends were calculated from weighted regression of log annual indices on year, where weights were proportional to the number of checklists in the species-specific analysis period each year. Despite nonlinear trajectories in some species, all trends were calculated as linear regressions in order to compare them directly with the linear BBS trends (calculated for Quebec for 1971–1992 as per Erskine et al. 1992).

### RESULTS

Quebec checklist trends for spring and fall migrations and the breeding season were significantly correlated with BBS trends for the province, whether based on ÉPOQ data from all sites or from a standard set of sites  $(r_s = 0.49 \text{ to } 0.54, P < 0.001 \text{ in all cases}, n = 55 \text{ species except } n = 51 \text{ for fall})$ . For each season, trend values from standard sites were correlated with those based on the full data set (spring r = 0.83, fall r = 0.75, breeding season r = 0.65; P < 0.001 for all comparisons).

Correlation coefficients do not show whether the magnitude of trends correspond well or whether one set is biased relative to the other. Plots showed that breeding season trends based on all ÉPOQ sites differed markedly from BBS in the magnitude of trends for individual species. The checklist trends fell into a narrow range of values (both positive and negative) in comparison to the magnitude of BBS trends (Fig. 1, Table 2). By contrast, breeding season ÉPOQ trends from standard sites agreed much better in magnitude to BBS trends (Fig. 2, Table 2). However, the full and standard data sets agreed in direction of trend for 87% of the

TABLE 1 Species and	codes for figures	ÉPOO trends	for the	breeding	season	and	BBS
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Blue-headed Vireo (Vireo solitarius)       I $0.3^*$ $6.7^*$ $8.6+$ Warbling Vireo (V. gitvus)       b $0.1$ $1.4$ $1.7$ Red-eyed Vireo (V. gitvus)       c $0.1$ $0.4$ $2.3^*$ House Wren (Troglodytes aedon)       J $-0.3^*$ $-7.3^*$ $-3.8+$ Winter Wren (T. troglodytes)       d $0.2$ $0.8$ $3.5$ Golden-crowned Kinglet (Regulus satrapa)       K $1.1^*$ $10.0^*$ $-2.0$ Veery (Catharus fusceens)       e $-0.3$ $-0.7$ $-0.1$ Swainson's Thrush (C. ustulatus)       f $0.3^*$ $0.7$ $1.0$ Gray Catbird (Dumetella carolinensis)       N $-1.0^*$ $-5.1^*$ $-5.5^*$ Brown Thrasher (Toxostoma rufum)       O $-0.6^*$ $-2.6$ $-4.7$ Nashville Warbler (V ruficapilla)       i $0.1$ $-1.5$ $-4.2^*$ Northern Parula (Parula americana)       j $0.0$ $1.4^*$ $-0.3^*$ $-2.9 +$ Chestnut-sided Warbler (D. taggnolia)       k $0.3$ $-0.6^*$ $4.2^*$ $-6.5$ Mag	Great Crested Flycatcher (Myiarchus crinitus)	Н	-0.0	-2.0+	-2.5
Warbling Vireo (V. gilvus)b0.11.41.7Red-eyed Vireo (V. olivaceus)c0.10.42.3*House Wren (Troglodytes aedon)J $-0.3^*$ $-7.3^*$ $-3.8+$ Winter Wren (T. troglodytes)d0.20.8 $3.5$ Golden-crowned Kinglet (Regulus satrapa)K $1.1^*$ $10.0^*$ $-2.0$ Veery (Catharus fuscescens)e $-0.3^*$ $-4.2^*$ $-2.3^*$ Bermit Thrush (C. guttatus)I $-0.8^*$ $-7.9^*$ $-3.5$ American Robin (Turdus migratorius)g $-0.3^*$ $-0.7$ $1.0$ Gray Catbird (Dumetella carolinensis)N $-1.0^*$ $-5.1^*$ $-5.5^*$ Brown Thrasher (Toxostoma rufum)O $-0.6^*$ $-5.7^*$ $-4.6^*$ Tennessee Warbler (Vermivora peregrina)h $-0.4$ $-2.6$ $-4.7$ Nashville Warbler (D. rufapilla)i $0.1$ $-1.5$ $-4.2^*$ Vellow Warbler (Dendroica ptetchia)P $-0.7^*$ $-6.7^*$ $2.9+$ Chestnut-sided Warbler (D. magnolia)k $0.3^*$ $-0.4$ $-4.1$ $-0.2$ Yellow-tumped Warbler (D. fusca)m $0.1$ $1.0$ $2.8+$ Black-droated Green Warbler (D. virens)n $0.1$ $-0.3$ $-3.7^*$ Black-droated Green Warbler (D. virens)n $0.1$ $-0.2$ $0.5$ Mourning Warbler (D. fusca)g $0.2^*$ $2.2^*$ $3.7$ Black-droated Green Warbler (D. virens)n $0.1$ $-0.2$ $0.5$ </td <td>Blue-headed Vireo (Vireo solitarius)</td> <td>Ι</td> <td>0.3*</td> <td>6.7*</td> <td><math>8.6 \pm</math></td>	Blue-headed Vireo (Vireo solitarius)	Ι	0.3*	6.7*	$8.6 \pm$
Red-eyed Vireo (V. olivaaceus)c0.10.42.3*House Wren (Troglodytes aedon)J $-0.3^*$ $-7.3^*$ $-3.8+$ Winter Wren (T. troglodytes)d0.20.83.5Golden-crowned Kinglet (Regulus satrapa)k1.1*10.0* $-2.0$ Veery (Catharus fuscescens)e $-0.3$ $-0.7$ $-0.1$ Swainson's Thrush (C. ustulatus)L $-0.8+$ $-4.2^*$ $-2.3^*$ Hermit Thrush (C. guttatus)f $0.3^*$ $0.4$ $-0.7$ Wood Thrush (Hylocichla mustelina)M $-0.8^*$ $-7.9^*$ $-3.5$ American Robin (Turdus migratorius)g $-0.3$ $-0.7$ $1.0$ Gray Catbird (Dumetella carolinensis)N $-1.0^*$ $-5.1^*$ $-5.5^*$ Brown Thrasher (Toxostoma rufum)O $-0.6^*$ $-5.7^*$ $-4.6^*$ Tennessee Warbler (Vermivora peregrina)h $-0.4$ $-2.6$ $-4.7$ Nashville Warbler (D. pensylvanica)Q $-0.6^*$ $-4.2^*$ $-6.5$ Magnolia Warbler (D. magnolia)k $0.3$ $-0.6$ $5.8$ Cape May Warbler (D. tigrina)1 $-0.4$ $-4.1$ $-0.2$ Vellow-rumped Warbler (D. tigrina)n $0.1$ $1.2^*$ $0.0$ Black-und-white Warbler (D. tigrica)n $0.1$ $1.2^*$ $0.0$ Black-and-white Warbler (D. tigrica)n $0.1$ $0.2^*$ $2.2^*$ Ovenbird (Seiurus aurocapillus)q $0.1$ $-0.2^*$ $0.4^*$ Northern Wat	Warbling Vireo (V. gilgus)	b	0.1	1.4	1.7
House Wren (Troglodytes aedon)J $-0.3^*$ $-7.3^*$ $-3.8+$ Winter Wren (T. troglodytes)d $0.2$ $0.8$ $3.5$ Golden-crowned Kinglet (Regulus satrapa)K $1.1^*$ $10.0^*$ $-2.0$ Weery (Catharus fuscescens)e $-0.3$ $-0.7$ $-0.1$ Swainson's Thrush (C. ustulatus)L $-0.8+$ $-4.2^*$ $-2.3^*$ Hermit Thrush (C. guttatus)f $0.3^*$ $0.4$ $-0.7$ Wood Thrush (Hylocichla mustelina)M $-0.8^*$ $-7.9^*$ $-3.5$ American Robin (Turdus migratorius)g $-0.3$ $-0.7$ $1.0$ Gray Catbird (Dumetella carolinensis)N $-1.0^*$ $-5.1^*$ $-5.5^*$ Brown Thrasher (Toxostoma rufum)O $-0.6^*$ $-5.7^*$ $-4.6^*$ Nashville Warbler (V ruficapilla)i $0.1$ $-1.5$ $-4.2$ Northern Parula (Parula americana)j $0.0$ $1.4$ $-0.3$ Yellow Warbler (D. magnolia)k $0.3$ $-0.6$ $5.8$ Cape May Warbler (D. tigrina)1 $-0.4$ $-4.1$ $-0.2$ Yellow-rumped Warbler (D. fusca)o $0.2$ $2.2$ $3.7$ Black-undwhite Warbler (Mniotilla varia)R $0.4^*$ $3.3^*$ $4.7+$ American Redstart (Setophaga ruticilla)p $-0.2^*$ $-0.5^*$ Ovenbird (Seiurus aurocapillus)q $0.1$ $-0.2$ $-0.5$ Mourning Warbler (Dorornis philadelphia)S $-0.5^*$ $-0.2$ Common Yellowthroat	Red-eved Vireo (V olivaceus)	ĉ	0.1	0.4	2.3*
Winter Wren (T. troglodyts)d0.20.83.5Golden-crowned Kinglet (Regulus satrapa)K1.1* $10.0^*$ $-2.0$ Veery (Catharus fuscescens)e $-0.3$ $-0.7$ $-0.1$ Swainson's Thrush (C. ustulatus)L $-0.8+$ $-4.2^*$ $-2.3^*$ Hermit Thrush (C. guttatus)f $0.3^*$ $0.4$ $-0.7$ Wood Thrush (Hylocichla mustelina)M $-0.8^*$ $-7.9^*$ $-3.5$ American Robin (Turdus migratorius)g $-0.3$ $-0.7$ $1.0$ Gray Catbird (Dumetella carolinensis)N $-1.0^*$ $-5.7^*$ $-4.6^*$ Brown Thrasher (Toxostoma rufum)O $-0.6^*$ $-5.7^*$ $-4.6^*$ Tennessee Warbler (Vermivora peregrina)h $-0.4$ $-2.6$ $-4.7$ Nashville Warbler (Dendroica petechia)p $0.1$ $-1.5$ $-4.2$ Vellow Warbler (Dendroica petechia)p $-0.7^*$ $-6.7^*$ $2.9+$ Chestnut-sided Warbler (D. tigrina)1 $-0.4$ $-4.1$ $-0.2$ Yellow-rumped Warbler (D. tigrina)1 $-0.4$ $-4.1$ $-0.2$ Black-throated Green Warbler (D. virens)n $0.1$ $1.0$ $2.8+$ Black-throated Green Warbler (D. tisca)o $0.2$ $2.2$ $3.7$ Black-and-white Warbler (D. fusca)q $0.1$ $-0.9$ $-0.4$ Ovenbird (Seiurus aurocapillus)q $0.1$ $-0.2$ $-0.5$ Mourning Warbler (Oporornis philadelphia)S $-0.5^*$ $-6.2^*$ <t< td=""><td>House Wren (Troolodytes aedon)</td><td>Ĩ</td><td><math>-0.3^{*}</math></td><td>-7.3*</td><td>-3.8+</td></t<>	House Wren (Troolodytes aedon)	Ĩ	$-0.3^{*}$	-7.3*	-3.8+
NumerNumerNumerNumerNumerNumerNumerGolden-crowned Kinglet (Regulus satrapa)k1.1*10.0*-2.0Veery (Catharus fuscescens)e $-0.3$ $-0.7$ $-0.1$ Swainson's Thrush (C. ustulatus)f $0.3*$ $0.4$ $-0.7$ Wood Thrush (Hylocichla mustelina)M $-0.8*$ $-7.9*$ $-3.5$ American Robin (Turdus migratorius)g $-0.3$ $-0.7$ $1.0$ Gray Catbird (Dumetella carolinensis)N $-1.0*$ $-5.1*$ $-5.5*$ Brown Thrasher (Toxostoma rufum)O $-0.6*$ $-5.7*$ $-4.6*$ Tennessee Warbler (Vermivora peregrina)h $-0.4$ $-2.6$ $-4.7$ Nashville Warbler (V. ruficapilla)i $0.1$ $-1.5$ $-4.2$ Northern Parula (Parula americana)j $0.0$ $1.4$ $-0.3$ Yellow Warbler (Dendroica petechia)P $-0.7*$ $-6.7*$ $2.9+$ Chestnut-sided Warbler (D. ingrina)1 $-0.4$ $-4.1$ $-0.2$ Yellow-rumped Warbler (D. coronata)m $0.1$ $1.2$ $0.0$ Black-throated Green Warbler (D. virens)n $0.1$ $1.2$ $0.0$ Black-du-white Warbler (D. fusca) $0$ $0.2$ $2.2$ $3.7$ Black-and-white Warbler (D. fusca) $q$ $0.1$ $-0.2$ $-0.5$ Mourning Warbler (D. fusca) $q$ $0.1$ $-0.2$ $-0.5$ Mourning Warbler (Difficat varia)R $0.4*$ $3.3*$ $4.7+$ <	Winter Wren ( <i>T tragladytes</i> )	J d	0.2	0.8	3.5
ConstructionConstructionConstructionConstructionWeery (Catharus fuscescens)e $-0.3$ $-0.7$ $-0.1$ Swainson's Thrush (C. ustulatus)L $-0.8 + -4.2^*$ $-2.3^*$ Hermit Thrush (C. guttatus)f $0.3^*$ $0.4$ $-0.7$ Wood Thrush (Hylocichla mustelina)M $-0.8^*$ $-7.9^*$ $-3.5$ American Robin (Turdus migratorius)g $-0.3$ $-0.7$ $1.0$ Gray Catbird (Dumetella carolinensis)N $-1.0^*$ $-5.1^*$ $-5.5^*$ Brown Thrasher (Toxostoma rufum)O $-0.6^*$ $-5.7^*$ $-4.6^*$ Tennessee Warbler (Vermizora peregrina)h $-0.4$ $-2.6$ $-4.7$ Nashville Warbler (V. ruficapilla)i $0.1$ $-1.5$ $-4.2$ Northern Parula (Parula americana)j $0.0$ $1.4$ $-0.3$ Yellow Warbler (D. magnolia)k $0.3$ $-0.6$ $5.8$ Cape May Warbler (D. tigrina)1 $-0.4$ $-4.1$ $-0.2$ Yellow-rumped Warbler (D. tigrina)n $0.1$ $1.0$ $2.8+$ Black-throated Green Warbler (D. virens)n $0.1$ $1.0$ $2.8+$ American Redstart (Setophaga ruticilla)p $-0.2^*$ $-0.4$ Northern Waterthrush (S. noveboracensis)r $0.1$ $-0.2$ $-0.4$ Common Yellowthroat (Geothlypis trichas)T $-0.3$ $-1.2^*$ $-2.2^*$ Common Yellowthroat (Geothlypis trichas)T $-0.3$ $-1.2^*$ $-2.2^*$ Commo	Golden-crowned Kinglet ( <i>Regulus satraba</i> )	ĸ	11*	10.0*	-2.0
Next (Constraints)C0.30.40.4Swainson's Thrush (C. ustulatus)L $-0.8 + -4.2^*$ $-2.3^*$ Hermit Thrush (C. guttatus)f $0.3^*$ $0.4$ $-0.7$ Wood Thrush (Hylocichla mustelina)M $-0.8^*$ $-7.9^*$ $-3.5$ American Robin (Turdus migratorius)g $-0.3$ $-0.7$ $1.0$ Gray Catbird (Dumetella carolinensis)N $-1.0^*$ $-5.1^*$ $-5.5^*$ Brown Thrasher (Toxostoma rufum)O $-0.6^*$ $-5.7^*$ $-4.6^*$ Tennessee Warbler (V ruficapilla)i $0.1$ $-1.5$ $-4.2$ Northern Parula (Parula americana)j $0.0$ $1.4$ $-0.3$ Yellow Warbler (Dendroica petechia)P $-0.7^*$ $-6.7^*$ $2.9 +$ Chestnut-sided Warbler (D. magnolia)k $0.3$ $-0.6$ $5.8$ Cape May Warbler (D. tigrina)1 $-0.4$ $-4.1$ $-0.2$ Yellow-rumped Warbler (D. coronata)m $0.1$ $1.0$ $2.8 +$ Black-throated Green Warbler (D. virens)n $0.1$ $1.0$ $2.8 +$ Black-throated Green Warbler (Mniotilla varia)R $0.4^*$ $3.3^*$ $4.7 +$ American Redstart (Setophaga ruticilla)p $-0.2^*$ $-0.4$ $-2.0$ Ovenbird (Seiurus aurocapillus)q $0.1$ $-0.9$ $-0.4$ Northern Waterthrush (S. noveboracensis)r $0.1$ $-0.2$ $-0.5^*$ Mourning Warbler (Wilsonia canadensis)s $-0.1^*$ $-0.2$ $-0.6$ </td <td>Veery (Catharus fuscescens)</td> <td>e</td> <td>-0.3</td> <td>-0.7</td> <td>-0.1</td>	Veery (Catharus fuscescens)	e	-0.3	-0.7	-0.1
Smallson 3 Thusin (C. guttatus)I. $0.31$ $1.2$ $2.3$ Hermit Thrush (C. guttatus)f $0.3^*$ $0.4$ $-0.7$ Wood Thrush (Hylocichla mustelina)M $-0.8^*$ $-7.9^*$ $-3.5$ American Robin (Turdus migratorius)g $-0.3$ $-0.7$ $1.0$ Gray Catbird (Dumetella carolinensis)N $-1.0^*$ $-5.1^*$ $-5.5^*$ Brown Thrasher (Toxostoma rufum)O $-0.6^*$ $-5.7^*$ $-4.6^*$ Fennessee Warbler (Vernivora peregrina)h $-0.4$ $-2.6$ $-4.7$ Nashville Warbler (V. ruficapilla)i $0.1$ $-1.5$ $-4.2$ Northern Parula (Parula americana)j $0.0$ $1.4$ $-0.3$ Yellow Warbler (D. magnolia)k $0.3$ $-0.6$ $5.8$ Cape May Warbler (D. magnolia)k $0.3$ $-0.6$ $5.8$ Cape May Warbler (D. tigrina)1 $-0.4$ $-4.1$ $-0.2$ Yellow-rumped Warbler (D. tigrina)n $0.1$ $1.0$ $2.8+$ Black-throated Green Warbler (D. virens)n $0.1$ $1.2^*$ $0.2$ Black-throated Green Warbler (Mniotilta varia)R $0.4^*$ $3.3^*$ $4.7+$ American Redstart (Setophaga ruticilla)p $-0.2^*$ $-0.4$ $-2.0$ Ovenbird (Seiurus aurocapillus)q $0.1$ $-0.2^*$ $0.2^*$ Ovenbird (Seiurus aurocapillus)f $0.3^*$ $-1.2^*$ $-2.2 +$ Common Yellowthroat (Geothypis trichas)T $-0.3$ $-1.2^*$ <td< td=""><td>Swainson's Thrush (C ustulatus)</td><td>T</td><td>-0.8+</td><td>-4.9*</td><td>-9.3*</td></td<>	Swainson's Thrush (C ustulatus)	T	-0.8+	-4.9*	-9.3*
Internet Inte	Hermit Thrush (C. autatus)	f	0.81	0.4	-0.7
Wood Thin Usin (Tryacitation mastering)M0.31.3American Robin (Turdus migratorius)g $-0.3$ $-0.7$ 1.0Gray Catbird (Dumetella carolinensis)N $-1.0^*$ $-5.1^*$ $-5.5^*$ Brown Thrasher (Toxostoma rufum)O $-0.6^*$ $-5.7^*$ $-4.6^*$ Tennessee Warbler (Vermivora peregrina)h $-0.4$ $-2.6$ $-4.7$ Nashville Warbler (V. ruficapilla)i $0.1$ $-1.5$ $-4.2$ Northern Parula (Parula americana)j $0.0$ $1.4$ $-0.3$ Yellow Warbler (Dendroica petechia)P $-0.7^*$ $-6.7^*$ $2.9+$ Chestnut-sided Warbler (D. magnolia)k $0.3$ $-0.6$ $5.8$ Cape May Warbler (D. magnolia)k $0.3$ $-0.6$ $5.8$ Cape May Warbler (D. tigrina)1 $-0.4$ $-4.1$ $-0.2$ Yellow-rumped Warbler (D. fusca)o $0.2$ $2.2$ $3.7$ Black-throated Green Warbler (D. virens)n $0.1$ $1.2$ $0.0$ Black-and-white Warbler (Minoilita varia)R $0.4^*$ $3.3^*$ $4.7+$ American Redstart (Setophaga ruticilla)p $-0.2$ $-0.4$ $-2.0$ Ovenbird (Seiurus aurocapillus)q $0.1$ $-0.9$ $-0.4$ Northern Waterthrush (S. noveboracensis)r $0.1$ $-0.2$ $0.2$ Common Yellowthroat (Geothlypis trichas)T $-0.3$ $-1.2^*$ $-2.2+$ Canada Warbler (Wilsonia canadensis)s $-0.1$ $-0.6$ $1.4$ <	Wood Thrush (Hylocichla musteling)	M	-0.8*	-7.0*	-35
American Robin ( <i>Parlias migraturas</i> )g0.30.71.0Gray Catbird (Dumetella carolinensis)N $-1.0^*$ $-5.1^*$ $-5.5^*$ Brown Thrasher (Toxostoma rufum)O $-0.6^*$ $-5.7^*$ $-4.6^*$ Tennessee Warbler (Vermivora peregrina)h $-0.4$ $-2.6$ $-4.7$ Nashville Warbler (V. ruficapilla)i $0.1$ $-1.5$ $-4.2$ Northern Parula (Parula americana)j $0.0$ $1.4$ $-0.3$ Yellow Warbler (Dendroica petechia)P $-0.7^*$ $-6.7^*$ $2.9+$ Chestnut-sided Warbler (D. magnolia)k $0.3$ $-0.6$ $5.8$ Cape May Warbler (D. magnolia)k $0.3$ $-0.6$ $5.8$ Cape May Warbler (D. tigrina)1 $-0.4$ $-4.1$ $-0.2$ Yellow-rumped Warbler (D. fusca)o $0.2$ $2.2$ $3.7$ Black-throated Green Warbler (D. virens)n $0.1$ $1.2$ $0.0$ Black-and-white Warbler (Mniotilta varia)R $0.4^*$ $3.3^*$ $4.7+$ American Redstart (Setophaga ruticilla)p $-0.2$ $-0.4$ $-2.0$ Ovenbird (Seiurus aurocapillus)q $0.1$ $-0.9$ $-0.4$ Northern Waterthrush (S. noveboracensis)r $0.1$ $-0.2$ $-0.5^*$ Mourning Warbler (Wilsonia canadensis)s $-0.5^*$ $-6.2^*$ $0.2$ Common Yellowthroat (Geothlypis trichas)T $-0.3$ $-1.2^*$ $-2.2+$ Canada Warbler (Wilsonia canadensis)s $-0.1$ <td< td=""><td>American Pohin (Turdus migratorius)</td><td>a a a a a a a a a a a a a a a a a a a</td><td>-0.3</td><td>-0.7</td><td>1.0</td></td<>	American Pohin (Turdus migratorius)	a a a a a a a a a a a a a a a a a a a	-0.3	-0.7	1.0
Bin StrateInterfact (Dimension)InterfactoryInterfactoryBrown Thrasher (Toxostoma rufum)O $-0.6^{\circ}$ $-5.7^{\circ}$ $-4.6^{\circ}$ Brown Thrasher (Vernizora peregrina)h $-0.4$ $-2.6$ $-4.7$ Nashville Warbler (Veruficapilla)i $0.1$ $-1.5$ $-4.2$ Northern Parula (Parula americana)j $0.0$ $1.4$ $-0.3$ Yellow Warbler (Dendroica petechia)P $-0.7^{\circ}$ $-6.7^{\circ}$ $2.9^{+}$ Chestnut-sided Warbler (D. pensylvanica)Q $-0.6^{\circ}$ $-4.2^{\circ}$ $-6.5^{\circ}$ Magnolia Warbler (D. magnolia)k $0.3$ $-0.6$ $5.8$ Cape May Warbler (D. tigrina)1 $-0.4$ $-4.1$ $-0.2$ Vellow-rumped Warbler (D. coronata)m $0.1$ $1.0$ $2.8^{+}$ Black-throated Green Warbler (D. virens)n $0.1$ $1.2^{\circ}$ $0.0^{\circ}$ Black-and-white Warbler (Mniotilta varia)R $0.4^{*}$ $3.3^{*}$ $4.7^{+}$ American Redstart (Setophaga ruticilla)p $-0.2$ $-0.4$ $-2.0^{\circ}$ Ovenbird (Seiurus aurocapillus)q $0.1$ $-0.2$ $-0.5^{\circ}$ $-6.2^{\circ}$ $0.2^{\circ}$ Common Yellowthroat (Geothlypis trichas)T $-0.3$ $-1.2^{\circ}$ $-2.2^{+}$ $-2.2^{+}$ Canada Warbler (Wilsonia canadensis)s $-0.1^{\circ}$ $-0.6^{\circ}$ $-2.2^{\circ}$ $-2.2^{\circ}$ Common Yellowthroat (Geothlypis trichas)T $-0.3$ $-1.2^{\circ}$ $-2.2^{\circ}$ $-1.8^{\circ}$ Chipping Sparrow	Gray Cathird (Dumatalla carolinansis)	g N	-1.0*	-5.1*	-5.5*
Billowin Infrastier (Poststonia rajum)O0.00.00.00.0Tennessee Warbler (Vermivora peregrina)h $-0.4$ $-2.6$ $-4.7$ Nashville Warbler (V. ruficapilla)i $0.1$ $-1.5$ $-4.2$ Northern Parula (Parula americana)j $0.0$ $1.4$ $-0.3$ Yellow Warbler (Dendroica petechia)P $-0.7^*$ $-6.7^*$ $2.9+$ Chestnut-sided Warbler (D. inagnolia)k $0.3$ $-0.6$ $5.8$ Cape May Warbler (D. inagnolia)k $0.3$ $-0.6$ $5.8$ Cape May Warbler (D. inagnolia)m $0.1$ $1.0$ $2.8+$ Black-throated Green Warbler (D. virens)n $0.1$ $1.2$ $0.0$ Black-throated Green Warbler (D. inagnolia)R $0.4^*$ $3.3^*$ $4.7+$ American Redstart (Setophaga ruticilla)p $-0.2$ $-0.4$ $-2.0$ Ovenbird (Seiurus aurocapillus)q $0.1$ $-0.9$ $-0.4$ Northern Waterthrush (S. noveboracensis)r $0.1$ $-0.2$ $-0.5^*$ Mourning Warbler (Disonia canadensis)s $-0.5^*$ $-6.2^*$ $0.2$ Common Yellowthroat (Geothlypis trichas)T $-0.3$ $-1.2^*$ $-2.2+$ Canada Warbler (Wilsonia canadensis)s $-0.1$ $-1.6$ $-0.6$ Scarlet Tanager (Piranga olivacea)t $-0.2$ $2.5$ $-1.8$ Chipping Sparrow (Poocetes gramineus)v $-0.0$ $-1.6$ $-6.8^*$ Song Sparrow (Melospiza melodia)V $-0.$	Brown Thrasher (Torostoma mufum)	n O	-0.6*	-5.7*	-4.6*
Termessee wabber (Vermitoria perigrina)In $-0.4$ $-2.6$ $-4.7$ Nashville Warbler (V. ruficapilla)i $0.1$ $-1.5$ $-4.2$ Northern Parula (Parula americana)j $0.0$ $1.4$ $-0.3$ Yellow Warbler (Dendroica petechia)P $-0.7^*$ $-6.7^*$ $2.9^+$ Chestnut-sided Warbler (D. inagnolia)k $0.3$ $-0.6$ $5.8$ Magnolia Warbler (D. inagnolia)k $0.3$ $-0.6$ $5.8$ Cape May Warbler (D. tigrina)1 $-0.4$ $-4.1$ $-0.2$ Yellow-rumped Warbler (D. coronata)m $0.1$ $1.2$ $0.0$ Black-throated Green Warbler (D. virens)n $0.1$ $1.2$ $0.0$ Black-throated Green Warbler (Mniotilta varia)R $0.4^*$ $3.3^*$ $4.7^+$ American Redstart (Setophaga ruticilla)p $-0.2$ $-0.4$ $-2.0$ Ovenbird (Seiurus aurocapillus)q $0.1$ $-0.9$ $-0.4$ Northern Waterthrush (S. noveboracensis)r $0.1$ $-0.2$ $-0.5^*$ Mourning Warbler (Oporornis philadelphia)S $-0.5^*$ $-6.2^*$ $0.2$ Common Yellowthroat (Geothlypis trichas)T $-0.3$ $-1.2^*$ $-2.2^+$ Canada Warbler (Wilsonia canadensis)s $0.1$ $-0.6$ $1.4$ Vesper Sparrow (Poacetes gramineus)v $-0.0$ $-1.6$ $-6.8^*$ Savannah Sparrow (Passerculus sandwichensis)U $-0.4+$ $-1.2+$ $-2.3^*$ Song Sparrow (M. lincolnii)W	Topp occoo Worklor (Varminorg baraming)	h	-0.4	-9.6	-4.7
Naminie Warbier (V. rajacaphia)10.1 $-1.3$ $-4.2$ Northern Parula (Parula americana)j0.01.4 $-0.3$ Yellow Warbler (Dendroica petechia)P $-0.7^*$ $-6.7^*$ $2.9+$ Chestnut-sided Warbler (D. magnolia)k $0.3$ $-0.6^*$ $-4.2^*$ $-6.5$ Magnolia Warbler (D. tigrina)1 $-0.4$ $-4.1$ $-0.2$ Yellow-rumped Warbler (D. tigrina)1 $-0.4$ $-4.1$ $-0.2$ Yellow-rumped Warbler (D. coronata)m0.11.0 $2.8+$ Black-throated Green Warbler (D. virens)n0.11.20.0Blackburnian Warbler (D. fusca)o $0.2$ $2.2$ $3.7$ Black-and-white Warbler (Mniotilta varia)R $0.4^*$ $3.3^*$ $4.7+$ American Redstart (Setophaga ruticilla)p $-0.2$ $-0.4$ $-2.0$ Ovenbird (Seiurus aurocapillus)q $0.1$ $-0.9$ $-0.4$ Northern Waterthrush (S. noveboracensis)r $0.1$ $-0.2$ $-0.5$ Mourning Warbler (Oporornis philadelphia)S $-0.5^*$ $-6.2^*$ $0.2$ Common Yellowthroat (Geothlypis trichas)T $-0.3$ $-1.2^*$ $-2.2+$ Canada Warbler (Wilsonia canadensis)s $0.1$ $-0.6$ $1.4$ Vesper Sparrow (Poacetes gramineus)v $-0.0$ $-1.6$ $-6.8^*$ Savannah Sparrow (Passerculus sandwichensis)U $-0.4+$ $-1.2+$ $-2.3^*$ Song Sparrow (Melospiza melodia)V $-0.8^*$	Nochville Worklor (V. muf.gatilla)	;	0.4	-1.5	-4.9
Nothern Patha (Parula americana)J0.01.4-0.5Yellow Warbler (Dendroica petechia)P $-0.7^*$ $-6.7^*$ $2.9+$ Chestnut-sided Warbler (D. magnolia)k $0.3$ $-0.6$ $-4.2^*$ $-6.5$ Magnolia Warbler (D. magnolia)k $0.3$ $-0.6$ $5.8$ Cape May Warbler (D. tigrina)1 $-0.4$ $-4.1$ $-0.2$ Yellow-rumped Warbler (D. coronata)m $0.1$ $1.0$ $2.8+$ Black-throated Green Warbler (D. tirens)n $0.1$ $1.2$ $0.0$ Black-throated Green Warbler (D. fusca)o $0.2$ $2.2$ $3.7$ Black-and-white Warbler (Mniotilta varia)R $0.4^*$ $3.3^*$ $4.7+$ American Redstart (Setophaga ruticilla)p $-0.2$ $-0.4$ $-2.0$ Ovenbird (Seiurus aurocapillus)q $0.1$ $-0.9$ $-0.4$ Northern Waterthrush (S. noveboracensis)r $0.1$ $-0.2$ $-0.5$ Mourning Warbler (Oporornis philadelphia)S $-0.5^*$ $-6.2^*$ $0.2$ Common Yellowthroat (Geothlypis trichas)T $-0.3$ $-1.2^*$ $-2.2+$ Canada Warbler (Wilsonia canadensis)s $-0.1$ $-1.6$ $-0.6$ Scarlet Tanager (Piranga olivacea)t $-0.2$ $2.5$ $-1.8$ Chipping Sparrow (Poecetes gramineus)v $-0.0$ $-1.6$ $-6.8^*$ Savannah Sparrow (Metospiza melodia)W $0.1$ $-3.9^*$ $-4.0^*$	Nastivine warder (v. rujicapita)	1	0.1	-1.5	-4.2
Renow Warbler (Denatorica peternia)P $-0.7^*$ $-0.7^*$ $2.9^+$ Chestnut-sided Warbler (D. magnolia)Q $-0.6^*$ $-4.2^*$ $-6.5$ Magnolia Warbler (D. magnolia)k $0.3$ $-0.6$ $5.8$ Cape May Warbler (D. tigrina)1 $-0.4$ $-4.1$ $-0.2$ Yellow-rumped Warbler (D. coronata)m $0.1$ $1.0$ $2.8^+$ Black-throated Green Warbler (D. tisca)o $0.2$ $2.2$ $3.7$ Black-and-white Warbler (Mniotilta varia)R $0.4^*$ $3.3^*$ $4.7^+$ American Redstart (Setophaga ruticilla)p $-0.2$ $-0.4$ $-2.0$ Ovenbird (Seiurus aurocapillus)q $0.1$ $-0.9$ $-0.4$ Northern Waterthrush (S. noveboracensis)r $0.1$ $-0.2$ $-0.5$ Mourning Warbler (Wilsonia canadensis)s $-0.5^*$ $-6.2^*$ $0.2$ Common Yellowthroat (Geothlypis trichas)T $-0.3$ $-1.2^*$ $-2.2+$ Canada Warbler (Wilsonia canadensis)s $-0.1$ $-0.6$ $-1.6$ Scarlet Tanager (Piranga olivacea)t $-0.2$ $2.5$ $-1.8$ Chipping Sparrow (Poocetes gramineus)v $-0.0$ $-1.6$ $-6.8^*$ Savannah Sparrow (Melospiza melodia)W $0.1$ $-3.9^*$ $-4.0^*$	Northern Parula (Parula americana)	J	0.0	1.4 6.7*	-0.5
Cheshnutsided warbier (D. persylvanica)Q $-0.0^{\circ}$ $-4.2^{\circ}$ $-0.3^{\circ}$ Magnolia Warbier (D. magnolia)k $0.3$ $-0.6$ $5.8$ Cape May Warbier (D. tigrina)1 $-0.4$ $-4.1$ $-0.2$ Yellow-rumped Warbier (D. coronata)m $0.1$ $1.0$ $2.8+$ Black-throated Green Warbier (D. tisca)o $0.2$ $2.2$ $3.7$ Black-and-white Warbler (Mniotilta varia)R $0.4*$ $3.3^{\circ}$ $4.7+$ American Redstart (Setophaga ruticilla)p $-0.2$ $-0.4$ $-2.0$ Ovenbird (Seiurus aurocapillus)q $0.1$ $-0.9$ $-0.4$ Northern Waterthrush (S. noveboracensis)r $0.1$ $-0.2$ $-0.5$ Mourning Warbler (Oporonis philadelphia)S $-0.5^{\circ}$ $-6.2^{\circ}$ $0.2$ Common Yellowthroat (Geothlypis trichas)T $-0.3$ $-1.2^{\circ}$ $-2.2^{+}$ Canada Warbler (Wilsonia canadensis)s $-0.1$ $-0.6$ $1.4$ Vesper Sparrow (Spizella passerina)u $0.1$ $-0.6$ $1.4$ Vesper Sparrow (Poocetes gramineus)v $-0.0$ $-1.6$ $-6.8^{*}$ Savannah Sparrow (Melospiza melodia)V $-0.8^{*}$ $-1.7^{*}$ $-0.2$ Lincoln's Sparrow (M. lincolnii)W $0.1$ $-3.9^{\circ}$ $-4.0^{*}$	Chasteret sided Worklan (D. terrenteration)	r	-0.7*	-0.7*	2.9+
Magnona Warbler (D. magnona)k $0.5$ $-0.6$ $5.8$ Cape May Warbler (D. tigrina)1 $-0.4$ $-4.1$ $-0.2$ Yellow-rumped Warbler (D. coronata)m $0.1$ $1.0$ $2.8+$ Black-throated Green Warbler (D. tirens)n $0.1$ $1.2$ $0.0$ Black-throated Green Warbler (D. fusca)o $0.2$ $2.2$ $3.7$ Black-and-white Warbler (Mniotilta varia)R $0.4^*$ $3.3^*$ $4.7+$ American Redstart (Setophaga ruticilla)p $-0.2$ $-0.4$ $-2.0$ Ovenbird (Seiurus aurocapillus)q $0.1$ $-0.9$ $-0.4$ Northern Waterthrush (S. noveboracensis)r $0.1$ $-0.2$ $-0.5$ Mourning Warbler (Oporornis philadelphia)S $-0.5^*$ $-6.2^*$ $0.2$ Common Yellowthroat (Geothlypis trichas)T $-0.3$ $-1.2^*$ $-2.2+$ Canada Warbler (Wilsonia canadensis)s $-0.1$ $-1.6$ $-0.6$ Scarlet Tanager (Piranga olivacea)t $-0.2$ $2.5$ $-1.8$ Chipping Sparrow (Poocetes gramineus)v $-0.0$ $-1.6$ $-6.8^*$ Savannah Sparrow (Melospiza melodia)V $-0.8^*$ $-1.7^*$ $-0.2$ Lincoln's Sparrow (M. lincolnii)W $0.1$ $-3.9^*$ $-4.0^*$	Mamalia Machler (D. pensylvanica)	ų L	-0.0*	-4.2*	-0.5
Cape May Warbler (D. tagrina)1 $-0.4$ $-4.1$ $-0.2$ Yellow-rumped Warbler (D. coronata)m $0.1$ $1.0$ $2.8+$ Black-throated Green Warbler (D. twiens)n $0.1$ $1.2$ $0.0$ Black-und-white Warbler (D. fusca)o $0.2$ $2.2$ $3.7$ Black-and-white Warbler (Mniotilta varia)R $0.4*$ $3.3*$ $4.7+$ American Redstart (Setophaga ruticilla)p $-0.2$ $-0.4$ $-2.0$ Ovenbird (Seiurus aurocapillus)q $0.1$ $-0.9$ $-0.4$ Northern Waterthrush (S. noveboracensis)r $0.1$ $-0.2$ $-0.5$ Mourning Warbler (Oporornis philadelphia)S $-0.5*$ $-6.2*$ $0.2$ Common Yellowthroat (Geothlypis trichas)T $-0.3$ $-1.2*$ $-2.2+$ Canada Warbler (Wilsonia canadensis)s $-0.1$ $-1.6$ $-0.6$ Scarlet Tanager (Piranga olivacea)t $-0.2$ $2.5$ $-1.8$ Chipping Sparrow (Poocetes gramineus)v $-0.0$ $-1.6$ $-6.8*$ Savannah Sparrow (Melospiza melodia)V $-0.8*$ $-1.7*$ $-0.2$ Lincoln's Sparrow (M. lincolnii)W $0.1$ $-3.9*$ $-4.0*$	Gause Marchier (D. diagnoud)	K 1	0.5	-0.0	5.6
Yellow-rumped Warbler (D. coronata)m $0.1$ $1.0$ $2.8+$ Black-throated Green Warbler (D. virens)n $0.1$ $1.2$ $0.0$ Blackburnian Warbler (D. fusca)o $0.2$ $2.2$ $3.7$ Black-and-white Warbler (Mniotilta varia)R $0.4^*$ $3.3^*$ $4.7+$ American Redstart (Setophaga ruticilla)p $-0.2$ $-0.4$ $-2.0$ Ovenbird (Seiurus aurocapillus)q $0.1$ $-0.9$ $-0.4$ Northern Waterthrush (S. noveboracensis)r $0.1$ $-0.2$ $-0.5$ Mourning Warbler (Oporornis philadelphia)S $-0.5^*$ $-6.2^*$ $0.2$ Common Yellowthroat (Geothlypis trichas)T $-0.3$ $-1.2^*$ $-2.2+$ Canada Warbler (Wilsonia canadensis)s $-0.1$ $-1.6$ $-0.6$ Scarlet Tanager (Piranga olivacea)t $-0.2$ $2.5$ $-1.8$ Chipping Sparrow (Spizella passerina)u $0.1$ $-0.6$ $1.4$ Vesper Sparrow (Passeculus sandwichensis)U $-0.4+$ $-1.2+$ $-2.3^*$ Song Sparrow (Melospiza melodia)V $-0.8^*$ $-1.7^*$ $-0.2$ Lincoln's Sparrow (M. lincolnii)W $0.1$ $-3.9^*$ $-4.0^*$	Cape May warbier (D. ngrina)	I	-0.4	-4.1	-0.2
Black-throated Green Warbler (D. virens)n $0.1$ $1.2$ $0.0$ Blackburnian Warbler (D. fusca)o $0.2$ $2.2$ $3.7$ Blackburnian Warbler (D. fusca)R $0.4^*$ $3.3^*$ $4.7+$ Black-and-white Warbler (Mniotilta varia)R $0.4^*$ $3.3^*$ $4.7+$ American Redstart (Setophaga ruticilla)p $-0.2$ $-0.4$ $-2.0$ Ovenbird (Seiurus aurocapillus)q $0.1$ $-0.9$ $-0.4$ Northern Waterthrush (S. noveboracensis)r $0.1$ $-0.2$ $-0.5$ Mourning Warbler (Oporornis philadelphia)S $-0.5^*$ $-6.2^*$ $0.2$ Common Yellowthroat (Geothlypis trichas)T $-0.3$ $-1.2^*$ $-2.2+$ Canada Warbler (Wilsonia canadensis)s $-0.1$ $-1.6$ $-0.6$ Scarlet Tanager (Piranga olivacea)t $-0.2$ $2.5$ $-1.8$ Chipping Sparrow (Spizella passerina)u $0.1$ $-0.6$ $1.4$ Vesper Sparrow (Poosecetes gramineus)v $-0.0$ $-1.6$ $-6.8^*$ Savannah Sparrow (Melospiza melodia)V $-0.8^*$ $-1.7^*$ $-0.2$ Lincoln's Sparrow (M. lincolnii)W $0.1$ $-3.9^*$ $-4.0^*$	reliow-rumped warbier ( <i>D. coronata</i> )	m	0.1	1.0	2.8+
Blackburnian Warbler (D. Jusca)o $0.2$ $2.2$ $3.7$ Black-and-white Warbler (Mniotilta varia)R $0.4^*$ $3.3^*$ $4.7^+$ American Redstart (Setophaga ruticilla)p $-0.2$ $-0.4$ $-2.0$ Ovenbird (Seiurus aurocapillus)q $0.1$ $-0.9$ $-0.4$ Northern Waterthrush (S. noveboracensis)r $0.1$ $-0.2$ $-0.5$ Mourning Warbler (Oporornis philadelphia)S $-0.5^*$ $-6.2^*$ $0.2$ Common Yellowthroat (Geothlypis trichas)T $-0.3$ $-1.2^*$ $-2.2+$ Canada Warbler (Wilsonia canadensis)s $-0.1$ $-1.6$ $-0.6$ Scarlet Tanager (Piranga olivacea)t $-0.2$ $2.5$ $-1.8$ Chipping Sparrow (Spizella passerina)u $0.1$ $-0.6$ $1.4$ Vesper Sparrow (Posecetes gramineus)v $-0.0$ $-1.6$ $-6.8^*$ Savannah Sparrow (Melospiza melodia)V $-0.8^*$ $-1.7^*$ $-0.2$ Lincoln's Sparrow (M. lincolnii)W $0.1$ $-3.9^*$ $-4.0^*$	Black-throated Green wardler (D. virens)	n	0.1	1.2	0.0
Black-and-while Warbler (Miniolita varia)R $0.4^*$ $3.3^*$ $4.7+$ American Redstart (Setophaga ruticilla)p $-0.2$ $-0.4$ $-2.0$ Ovenbird (Seiurus aurocapillus)q $0.1$ $-0.9$ $-0.4$ Northern Waterthrush (S. noveboracensis)r $0.1$ $-0.2$ $-0.5$ Mourning Warbler (Oporornis philadelphia)S $-0.5^*$ $-6.2^*$ $0.2$ Common Yellowthroat (Geothlypis trichas)T $-0.3$ $-1.2^*$ $-2.2+$ Canada Warbler (Wilsonia canadensis)s $-0.1$ $-1.6$ $-0.6$ Scarlet Tanager (Piranga olivacea)t $-0.2$ $2.5$ $-1.8$ Chipping Sparrow (Spizella passerina)u $0.1$ $-0.6$ $1.4$ Vesper Sparrow (Poocetes gramineus)v $-0.0$ $-1.6$ $-6.8^*$ Savannah Sparrow (Melospiza melodia)V $-0.8^*$ $-1.7^*$ $-0.2$ Lincoln's Sparrow (M. lincolnii)W $0.1$ $-3.9^*$ $-4.0^*$	Blackburnian Warbler ( <i>D. fusca</i> )	0	0.2	2.2	3.7
American Redstart (Setophaga ruticilla)p $-0.2$ $-0.4$ $-2.0$ Ovenbird (Seiurus aurocapillus)q0.1 $-0.9$ $-0.4$ Northern Waterthrush (S. noveboracensis)r $0.1$ $-0.2$ $-0.5$ Mourning Warbler (Oporornis philadelphia)S $-0.5^*$ $-6.2^*$ $0.2$ Common Yellowthroat (Geothlypis trichas)T $-0.3$ $-1.2^*$ $-2.2+$ Canada Warbler (Wilsonia canadensis)s $-0.1$ $-1.6$ $-0.6$ Scarlet Tanager (Piranga olivacea)t $-0.2$ $2.5$ $-1.8$ Chipping Sparrow (Spizella passerina)u $0.1$ $-0.6$ $1.4$ Vesper Sparrow (Poocetes gramineus)v $-0.0$ $-1.6$ $-6.8^*$ Savannah Sparrow (Melospiza melodia)V $-0.8^*$ $-1.7^*$ $-0.2$ Lincoln's Sparrow (M. lincolnii)W $0.1$ $-3.9^*$ $-4.0^*$	Black-and-white Warbler (Mniotilta varia)	K	0.4*	3.3*	4.7+
Ovenbird (Seurus aurocapillus)q $0.1$ $-0.9$ $-0.4$ Northern Waterthrush (S. noveboracensis)r $0.1$ $-0.2$ $-0.5$ Mourning Warbler (Oporornis philadelphia)S $-0.5^*$ $-6.2^*$ $0.2$ Common Yellowthroat (Geothlypis trichas)T $-0.3$ $-1.2^*$ $-2.2+$ Canada Warbler (Wilsonia canadensis)s $-0.1$ $-1.6$ $-0.6$ Scarlet Tanager (Piranga olivacea)t $-0.2$ $2.5$ $-1.8$ Chipping Sparrow (Spizella passerina)u $0.1$ $-0.6$ $1.4$ Vesper Sparrow (Poocetes gramineus)v $-0.0$ $-1.6$ $-6.8^*$ Savannah Sparrow (Melospiza melodia)V $-0.8^*$ $-1.7^*$ $-0.2$ Lincoln's Sparrow (M. lincolnii)W $0.1$ $-3.9^*$ $-4.0^*$	American Redstart (Setophaga ruticilla)	р	-0.2	-0.4	-2.0
Northern Waterthrush (S. noveboracensis)r $0.1$ $-0.2$ $-0.5$ Mourning Warbler (Oporornis philadelphia)S $-0.5^*$ $-6.2^*$ $0.2$ Common Yellowthroat (Geothlypis trichas)T $-0.3$ $-1.2^*$ $-2.2+$ Canada Warbler (Wilsonia canadensis)s $-0.1$ $-1.6$ $-0.6$ Scarlet Tanager (Piranga olivacea)t $-0.2$ $2.5$ $-1.8$ Chipping Sparrow (Spizella passerina)u $0.1$ $-0.6$ $1.4$ Vesper Sparrow (Poocetes gramineus)v $-0.0$ $-1.6$ $-6.8^*$ Savannah Sparrow (Melospiza melodia)V $-0.8^*$ $-1.7^*$ $-0.2$ Lincoln's Sparrow (M. lincolnii)W $0.1$ $-3.9^*$ $-4.0^*$	Ovenbird (Seiurus aurocapillus)	q	0.1	-0.9	-0.4
Mourning Warbler (Oporornis philadelphia)S $-0.5^*$ $-6.2^*$ $0.2$ Common Yellowthroat (Geothlypis trichas)T $-0.3$ $-1.2^*$ $-2.2+$ Canada Warbler (Wilsonia canadensis)s $-0.1$ $-1.6$ $-0.6$ Scarlet Tanager (Piranga olivacea)t $-0.2$ $2.5$ $-1.8$ Chipping Sparrow (Spizella passerina)u $0.1$ $-0.6$ $1.4$ Vesper Sparrow (Poocetes gramineus)v $-0.0$ $-1.6$ $-6.8^*$ Savannah Sparrow (Melospiza melodia)V $-0.8^*$ $-1.7^*$ $-0.2$ Lincoln's Sparrow (M. lincolnii)W $0.1$ $-3.9^*$ $-4.0^*$	Northern Waterthrush (S. noveboracensis)	r	0.1	-0.2	-0.5
Common Yellowthroat (Geothlypis trichas)T $-0.3$ $-1.2^*$ $-2.2+$ Canada Warbler (Wilsonia canadensis)s $-0.1$ $-1.6$ $-0.6$ Scarlet Tanager (Piranga olivacea)t $-0.2$ $2.5$ $-1.8$ Chipping Sparrow (Spizella passerina)u $0.1$ $-0.6$ $1.4$ Vesper Sparrow (Poocetes gramineus)v $-0.0$ $-1.6$ $-6.8^*$ Savannah Sparrow (Melospiza melodia)V $-0.4+$ $-1.2+$ $-2.3^*$ Song Sparrow (M. lincolnii)W $0.1$ $-3.9^*$ $-4.0^*$	Mourning Warbler ( <i>Oporornis philadelphia</i> )	S	-0.5*	-6.2*	0.2
Canada Warbler (Wilsonia canadensis)s $-0.1$ $-1.6$ $-0.6$ Scarlet Tanager (Piranga olivacea)t $-0.2$ $2.5$ $-1.8$ Chipping Sparrow (Spizella passerina)u $0.1$ $-0.6$ $1.4$ Vesper Sparrow (Poocetes gramineus)v $-0.0$ $-1.6$ $-6.8$ *Savannah Sparrow (Melospiza melodia)U $-0.4+$ $-1.2+$ $-2.3*$ Song Sparrow (Melospiza melodia)V $-0.8$ * $-1.7$ * $-0.2$ Lincoln's Sparrow (M. lincolnii)W $0.1$ $-3.9$ * $-4.0$ *	Common Yellowthroat (Geothlypis trichas)	Т	-0.3	-1.2*	-2.2+
Scarlet Tanager (Piranga olivacea)t $-0.2$ $2.5$ $-1.8$ Chipping Sparrow (Spizella passerina)u $0.1$ $-0.6$ $1.4$ Vesper Sparrow (Poocetes gramineus)v $-0.0$ $-1.6$ $-6.8^*$ Savannah Sparrow (Passerculus sandwichensis)U $-0.4+$ $-1.2+$ $-2.3^*$ Song Sparrow (Melospiza melodia)V $-0.8^*$ $-1.7^*$ $-0.2$ Lincoln's Sparrow (M. lincolnii)W $0.1$ $-3.9^*$ $-4.0^*$	Canada Warbler (Wilsonia canadensis)	s	-0.1	-1.6	-0.6
Chipping Sparrow (Spizella passerina)u $0.1$ $-0.6$ $1.4$ Vesper Sparrow (Pooecetes gramineus)v $-0.0$ $-1.6$ $-6.8^*$ Savannah Sparrow (Passerculus sandwichensis)U $-0.4+$ $-1.2+$ $-2.3^*$ Song Sparrow (Melospiza melodia)V $-0.8^*$ $-1.7^*$ $-0.2$ Lincoln's Sparrow (M. lincolnii)W $0.1$ $-3.9^*$ $-4.0^*$	Scarlet Tanager (Piranga olivacea)	t	-0.2	2.5	-1.8
Vesper Sparrow (Poocetes gramineus)v $-0.0$ $-1.6$ $-6.8^*$ Savannah Sparrow (Passerculus sandwichensis)U $-0.4+$ $-1.2+$ $-2.3^*$ Song Sparrow (Melospiza melodia)V $-0.8^*$ $-1.7^*$ $-0.2$ Lincoln's Sparrow (M. lincolnii)W $0.1$ $-3.9^*$ $-4.0^*$	Chipping Sparrow (Spizella passerina)	u	0.1	-0.6	1.4
Savannah Sparrow (Passerculus sandwichensis)U $-0.4+$ $-1.2+$ $-2.3*$ Song Sparrow (Melospiza melodia)V $-0.8*$ $-1.7*$ $-0.2$ Lincoln's Sparrow (M. lincolnii)W $0.1$ $-3.9*$ $-4.0*$	Vesper Sparrow (Pooecetes gramineus)	v	-0.0	-1.6	-6.8*
Song Sparrow (Melospiza melodia)         V         -0.8*         -1.7*         -0.2           Lincoln's Sparrow (M. lincolnii)         W         0.1         -3.9*         -4.0*	Savannah Sparrow (Passerculus sandwichensis)	U	-0.4+	-1.2+	-2.3*
Lincoln's Sparrow ( <i>M. lincolnii</i> ) W 0.1 -3.9* -4.0*	Song Sparrow (Melospiza melodia)	V	-0.8*	-1.7*	-0.2
	Lincoln's Sparrow (M. lincolnii)	W	0.1	-3.9*	-4.0*
Swamp Sparrow ( <i>M. georgiana</i> ) w $0.2+$ $0.9$ $-5.0$	Swamp Sparrow (M. georgiana)	W	0.2+	0.9	-5.0

	Key to sym- bols in	ÉPOQ	, trend <sup>a</sup>	
Species	fig- ures	All sites	Standard sites	BBS trend
White-throated Sparrow (Zonotrichia albicollis)	Х	-1.1*	-1.6+	-1.9*
Dark-eyed Junco (Junco hyemalis)	х	-0.3	-1.6	-3.7
Rose-breasted Grosbeak (Pheucticus ludovicianus)	y	-0.5	-1.3	-4.8*
Bobolink (Dolichonyx oryzivorus)	Ý	-1.8*	-5.4*	-6.2*
Red-winged Blackbird (Agelaius phoeniceus)	Z	-0.9*	-1.1	-3.5*
Eastern Meadowlark (Sturnella magna)	Ζ	-0.7*	-5.3*	-5.3*
Common Grackle (Quiscalus quiscula)	z'	-0.6	-1.3	0.0
Brown-headed Cowbird (Molothrus ater)	%	-3.2*	-4.5*	-7.2*
Baltimore Oriole (Icterus galbula)	\$	-0.6*	-3.5*	-2.1

TABLE 1	1.	Continued.
		Optipiloa
TUDDE		communaca.

<sup>a</sup> Significance of trends: + = 0.05 < P < 0.10, \* = P < 0.05.

55 species. Moreover, significant ÉPOQ trends (n = 16) showed the same direction of trend as BBS (whether significant or not) in 81% and 85% of species for the full and standard data sets, respectively. In both analyses, ÉPOQ showed a significant decline for the Yellow Warbler while BBS showed a significant increase. There was no evidence of a positive bias in ÉPOQ trends from the breeding season relative to BBS trends (in either data set), as there was in the migration-season counts (Dunn et al. 1996).

ÉPOQ trends from migration seasons (all sites) also had a narrower range of trend magnitudes than BBS (Dunn et al. 1996), but analysis of data from standard sites did not improve correspondence to BBS (Table 2).

Data set	Min	Max	Interquartile range	Range	
Breeding Bird Survey	-7.2	8.6	4.6	15.8	
ÉPOQ Summer					
All sites Standard sites	$-3.2 \\ -7.9$	$\begin{array}{c} 1.1 \\ 10.0 \end{array}$	$0.8 \\ 5.0$	$4.3 \\ 17.9$	
ÉPOQ Spring					
All sites Standard sites	-4.3 -4.2	2.2 0.8	2.2 0.8	$6.5 \\ 5.0$	
ÉPOQ Fall					
All sites Standard sites	-4.9 -2.4	$4.5 \\ 3.1$	2.8 2.0	$9.4 \\ 5.4$	

TABLE 2. Range of trend magnitudes from ÉPOQ and BBS.



FIGURE 1. ÉPOQ trends for summer (full data set), plotted against BBS trends (1971–92). See Table 1 for key to symbols. Trends are expressed as annual percent change in abundance. Dashed line indicates one-to-one correspondence.

### DISCUSSION

The checklist program detected population change most similar to that of BBS when observation conditions were also the most similar to BBS, i.e., when checklist data were from the breeding season and from a set of standard sites that were visited annually. Breeding-season ÉPOQ trends based on all sites were quite different in magnitude than those from standard sites (compare Figs. 1 and 2), indicating that unrestricted inclusion of all birding sites did bias the data. However, the bias was in numbers of birds counted, and not in direction of trend. Birders evidently tend to favor sites where bird populations are relatively stable, but even unrestricted birding can detect the same directional trends as found in BBS.

For the migration seasons, checklist trends based on standard sites were similar in direction and magnitude to trends based on the complete data



FIGURE 2. ÉPOQ trends for summer, from a standard set of 32 sites, plotted against BBS trends (1971–92). Symbols for species (Table 1) indicate whether ÉPOQ trend shown here was statistically significant (capital letter or symbol), or nonsignificant (lower case letter). Other details as for Figure 1.

set. Migrants are more evenly distributed across the landscape than are breeding birds (with less habitat selection), so migration season counts may vary less among birding locations than would numbers of locally breeding birds, making it less important to restrict analysis to standard sites. Neither the restricted nor the full data set, however, showed signs of one-to-one correspondence of trend magnitudes between migrationseason ÉPOQ trends and BBS (Dunn et al. 1996, Table 2). This probably reflects the fact that many migrants counted in southern Quebec on migration breed in northern Quebec or in other provinces, where population trends could differ from those in southern Quebec. (BBS covers only the southern part of the province.) Trends in daily migration counts from a single site have been shown to agree more closely with BBS trends when birds originate from areas sampled by both surveys (Hussell 1997).

Even in the strongest comparison between checklist and BBS trends, that involving breeding season checklist trends from standard sites, there were discrepancies for individual species (Fig. 2). Differences could result from some of the known biases in checklist programs (Dunn et al. 1996) or in BBS (e.g., road-side bias; Sauer et al. 1994). In other cases, trends might genuinely differ among the sites sampled by the two programs. Although BBS provides a useful vardstick for determining whether checklist programs detect population change, it does not necessarily represent the more accurate of the two surveys for every species. For example, ÉPOQ shows large increases in Golden-crowned Kinglets in all seasons, while BBS shows a nonsignificant decline. However, slightly different analysis methods (Sauer et al. 2000) produce a large (nonsignificant) positive trend for kinglets in Quebec for the study period, with extremely high variance. The high variance and instability of trend estimates indicate that the species is poorly sampled by BBS in Quebec, and in this case EPOQ may more accurately reflect true population change. In other cases, such as the open-country species that show notably larger and more significant changes in BBS than in EPOQ (Vesper Sparrow, Red-winged Blackbird, Brown-headed Cowbird), the discrepancies may indicate that EPOQ participants undersample open agricultural habitats. The most important discrepancy between the surveys is the Yellow Warbler, shown to be significantly increasing in BBS, but significantly declining according to EPOO. Further investigation is needed to explain this particular disagreement.

Results presented here indicate that the value of checklist programs for population monitoring purposes is increased when analysis is restricted to a standard set of regularly visited sites, for data collected during the breeding season. However, we do not advocate restricting checklist programs to standard sites alone, as programs with broad participation are valuable for a wide variety of additional purposes, not only scientific (as in documenting range changes or timing of migration) but also recreational and educational (Droege et al. 1998). Moreover, unrestricted birding appears able to detect direction of trend in most species, even if not the magnitude of change. Nonetheless, checklist program organizers might consider selecting a set of standard sites and promoting regular visits to them in order to increase the value of their program for population monitoring. Program organizers can also enhance the usefulness of their data by adhering to recommended data collection protocols (Droege et al. 1998; http://www.rsl.psw.fs.fed.us/pif/ext\_prot.html). These include requiring separate lists for each day and birding locality ( $\leq 2-3$ km<sup>2</sup>), and routine recording of latitude and longitude of birding location, hours of active birding, numbers of birds seen (as opposed to presence/ absence) and a simple rating of observer skill and quality of viewing conditions. Recording these data makes it possible for analysts to select portions of the database that are appropriate for their particular analyses,

and widens the scope for checklist data to be used as a resource for answering research and conservation questions.

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