A Checklist Approach for Monitoring Neotropical Migrant Birds: Twenty-year Trends in Birds of Québec Using ÉPOQ

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Abstract — ÉPOQ (Studies of Bird Populations in Québec) is a data base on birds of Québec containing more than 2.2 million records of observations recorded on 158,000 checklists from 3,600 observation sites since 1950. Trends were measured for each of four subsets of ÉPOQ data between 1970 and 1989 (all year, spring (April-May), summer (June-July), and fall (August-October) as well as for BBS (Breeding Bird Survey of U.S. Fish Wildl. Serv.) data for Québec (1969 to 1989). Species were then separated into neotropical and temperate migrants, and trends compared between ÉPOQ subsets and data bases. The all year-ÉPOQ subset reflects very well the dominantly decreasing trends of many neotropical and temperate migrant species that are also decreasing in the other data subsets (spring, summer and fall). In the summer-ÉPOQ subset and in BBS, there are more increasing trends when no trend was recorded in the all year-ÉPOQ subset. Most trends are similar for both ÉPOQ and BBS, except for nine of 74 species studied. General trends indicate significant decreases for 25 neotropical and 17 temperate migrants, and significant increases for 10 neotropical and 8 temperate migrants. Significantly decreasing species in all year-ÉPOQ belong to bird assemblages from maple forests, agricultural habitats, insectivorous in flight, and edge species, whereas non-significant trends in all year ÉPOQ or significantly increasing trends mainly in the summer-ÉPOQ or in BBS reveal more species belonging to boreal forest ecosystems.

INTRODUCTION

Several methods have been used to monitor bird populations on broad scales (Kendeigh 1944, Anonymous 1970, Berthold 1976, Källander *et al.* 1977, Ralph and Scott 1981, Verner 1985). In North America, long term trend studies have been possible mainly through the Breeding Bird Survey (BBS) (Robbins *et al.* 1986).

Temple and Cary (1990) provide evidence that checklists relate well to other data sets, including the Christmas Bird Count. In Québec, Victor Gaboriault (David 1978) started in 1948 a program of collecting sightings of birds recorded on field checklists. In 1975, a computer coding of all data was undertaken, and expanded to the present. The data base, called ÉPOQ (*Étude des Populations d'Oiseaux du Québec* or Studies of Bird Populations in Québec) currently includes over 2.2 million data from 158,000 checklists, and 3,600 localities. Since 1970, between 2,000 and 10,000 checklists have been completed per year. These sample sizes fulfill one criteria for using EFP (Gradual Frequency Sampling) of Blondel *et al.* (1981) which have proven useful to generate estimates of richness and abundance as long as sample size was large.

Cyr and Larivée (1980) and Larivée (1989) presented preliminary studies of ÉPOQ data. Otherwise, there has been no attempt to analyse in some detail the value of these data, nor to compare trends derived from them with other data sets, except for a very brief mention in Droege (1990), and Dunn (1991). In this paper we present ÉPOQ, and evaluate trends in neotropical and temperate migrant birds of Québec, comparing

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data and trends from different subsets of ÉPOQ and BBS over a 20 year period. From these results we expect to provide managers with a new tool to evaluate trends in migrant birds that would help to understand, and manage properly all species for which there is definite concern in regard to their decline.

METHODS

ÉPOQ contains information from checklists. A standard one contains all species regularly seen or heard in Québec. Volunteer observers report in field checklists the number (or its closest estimate) of all bird species seen or heard at any one observation site (locality or area coded to the nearest 00°01' of latitude and longitude) on any single day. The most important criteria for filling a checklist are one observation site and one date per checklist, whatever the season, duration of field trip, habitats covered, and number of observers. Observers also report date, time of beginning and end of the field trip (for coding of duration), name of site (or distance and direction to nearest locality or geographical feature), and names of observers. Each species is given a coding number on the checklist.

Data extracted for the present study, south of 52°N latitude in Québec, cover 1970 to 1989. Data were further separated into subsets: all year, spring (April-May), summer (June-July), and fall (August-October). Species reported on 100 or more checklists were considered for this study. Total sample size considered was all year (four seasons): 125,713, spring: 39,157, summer: 61,150, and fall: 26,302 checklists.As data were still being entered in ÉPOQ between the data extraction process for each sample, sample size for all year data set is smaller than the samples per season.

From ÉPOQ, given the total number of checklists (S) for any time period or area considered, and number of checklists (or sample size per species) on which each species was encountered (N), frequency (in %) of checklists that contain a species (C=N*100/S) was calculated for each species for each subset. The slope of the regression over years for frequency (C) was used as a measure of trend for each species.

BBS data used are from Québec routes only. Refer to Robbins and Van Velzen (1967) and Robbins *et al.* (1986) for a technique description. Data represent bird numbers per route of 50 stops censused during three minutes each, once during the breeding season between a half hour before to about 4 1/2 hours after sunrise. Species reported on 10 or more BBS routes were considered for this study. Median estimate percent of change in population size was calculated according to a procedure currently used at the U.S. Fish and Wildlife Service (Sam Droege kindly provided the analysed data for Québec). See Robbins *et al.* (1986) for other trend analyses.

Seventy four (74) species were selected and separated into neotropical and temperate migrants after Droege and Sauer (1988), Hussell *et al.* (1992), and Witham and Hunter (1992). Comparisons were then made between different subsets of ÉPOQ, and between ÉPOQ and BBS data.

RESULTS

Of 74 species considered, 46 were neotropical and 28 temperate migrants, all breeding in Québec (Table 1). Species sample sizes from total checklist number (all year-ÉPOQ) varied between 1,195 (Olive-sided Flycatcher, *Contopus borealis*) to 47,000 for European Starling (*Sturnus vulgaris*). Samples were smaller for any one season ranging from 122 (Indigo Bunting, *Passerina cyanea*, in fall) to 20,854 (American Robin, *Turdus migratorius*, in spring).

Since number of species showing a significant trend in any ÉPOQ subset was larger in all year subset, the neotropical and temperate migrants were separated into two groups each, one in which all species showed a significant trend, positive or negative, in the all year subset and one in which no species showed a significant trend. In Table 2, species were grouped according to statistical significance in combinations of ÉPOQ subsets or BBS data.

All year-ÉPOQ showed the highest number of significant trends for neotropical (25, all declining) and temperate (18, 17 of which were declining) migrants (Table 2A). Species showing a significant trend were not always the same between subsets, but all year-ÉPOQ decreasing trends were often reflected by similar trends in more than one season. Increasing trends were more often obvious in summer-ÉPOQ and BBS (Table 2B and 3). Compared to ÉPOQ subsets, BBS showed fewer species with a significant trend (Table 2A,B).

More trends followed the same direction between ÉPOQ and BBS, except for six of 74 species studied (see also Dunn 1991). Red-eyed Vireo (*Vireo olivaceus*), American Redstart (*Setophaga ruticilla*), American Robin, American Crow (*Corvus brachyrhynchos*), Olive-sided Flycatcher (*Contopus borealis*), and Cedar Waxwing (*Bombycilla cedrorum*) were noteworthy for contradictory trends between the two methods (Table 2A), the contradictory trends never exceeding 2,7% for any one data set. For both neotropical and temperate migrants for which BBS results showed a significant negative trend, ÉPOQ results were also significantly decreasing for all species in all subsets except for one season for Bobolink (*Dolichonyx oryzivorus*)(summer, n.s.).

For species showing a positive significant trend in BBS, the trend analysis from ÉPOQ revealed mixed trends for all subsets for both neotropical and temperate migrants, but summer-ÉPOQ follow the same positive significant trend as BBS more often than results from other seasons (Table 2B and 3), and more so for neotropical migrants with almost 70% showing consistency (Table 3).

All species were assigned a general habitat type or guild to which each belonged and the total number of species presenting a significant trend, either positive or negative in ÉPOQ subsets or BBS were then calculated per habitat type or guild. Guilds and bird assemblages were quite different for species showing a significant decreasing or increasing trend.

Table 1. — Number of checklists containing each species (N), slope of the frequency distribution (C), and significance level (P) for ÉPOQ-all year, spring, summer and fall bird data (1970-89), and BBS median estimate of trend and significance level (1969-89). Significance levels are * = P < 0.05, ** = P < 0.01, *** = P < 0.001; n.s. = non significant. See appendix for scientific names.

Species	DATA BASE ÉPOQ ALL YEAR N	C	P	SPRING N	C	P	SUMMER N	C	P	FALL N	C	P	BBS Median	P
NEOTROPICAL MIGRANTS														
Broad-winged Hawk	3742	-0,01	n.s.	1771	0,01	n.s.	1215	0,13	n.s.	708	-0,02	n.s.	4,5	
Common Nighthawk	1997	-0,1	***	279	-0,05	***	1097	-0,33	***	619	-0,10	**	-3,1	**
Chimney Swift	3807	-0,28	***	1397	-0,30	***	1830	-0,68	***	580	-0,20	***	-1,1	
Ruby-throated Hummingbird	5231	-0,07	*	1240	-0,05	n.s.	2264	0,02	n.s.	1727	-0,14	n.s.	-1,5	
Olive-sided Flycatcher	1611	-0,03	n.s.	291	0,01	n.s.	1125	-0,02	n.s.	193	-0,07	***	4,3	*
Eastern Wood-Pewee	4996	-0,16	***	794	-0,06	*	2935	-0,27	*	1265	-0,31	**	0,7	
Yellow-bellied Flycatcher	1195	0,01	n.s.	181	0,00	n.s.	811	0,19	*	200	-0,04	**	12,6	
Alder Flycatcher	5370	0,06	n.s.	652	0,04	*	3885	0,5	**	832	0,02	n.s.	9,9	***
Least Flycatcher	7162	-0,15	***	2682	-0,15	**	3900	-0,18	n.s.	579	-0,05	n.s.	0,4	
Great crested Flycatcher	3478	-0,04	n.s.	1544	0,02	n.s.	1622	-0,03	n.s.	308	-0,05	n.s.	0,9	
Eastern Kingbird	9300	-0,06	n.s.	2537	0,04	n.s.	4967	0,09	n.s.	1794	-0,11	n.s.	2,1	
Purple Martin	2386	-0,15	**	1043	-0,19	**	819	-0,23	*	523	-0,18	**	-3,5	
Bank Swallow	7497	-0,24	***	2061	-0,28	***	4168	-0,21	n.s.	1266	-0,29	***	0,9	
Cliff Swallow	3344	-0,03	n.s.	1229	-0,02	n.s.	1724	0,07	n.s.	388	-0,04	n.s.	2,8	
Barn Swallow	16130	-0,65	***	5964	-0,68	***	7138	-1	***	3007	-0,77	***	-1,7	*
Veery	8741	-0,16	***	2864	-0,25	***	5083	0,04	n.s.	789	-0,06	n.s.	-1,5	
Swainson's Thrush	7788	-0,12	n.s.	1526	-0,11	*	4576	-0,03	n.s.	1669	-0,15	n.s.	2,7	
Wood Thrush	2941	-0,18	***	1340	-0,20	**	1381	-0,41	***	220	-0,14	***	-2,5	
Gray Catbird	7197	-0,33	***	2090	-0,35	***	2988	-0,56	**	2108	-0,42	***	-2,2	*
Solitary Vireo	2321	0,01	n.s.	1003	0,00	n.s.	833	0,17	**	484	-0,02	n.s.	13,3	***
Warbling Vireo	2433	0,02	n.s.	972	0,02	n.s.	1151	0,19	n.s.	310	0,01	n.s.	2,6	*
Philadelphia Vireo	3066	0,01	n.s.	784	0,05	n.s.	1622	0,12	n.s.	658	-0,01	n.s.	2,7	
Red-eyed Vireo	8564	-0,1	*	1276	0,02	n.s.	5600	-0,18	n.s.	1684	-0,12	n.s.	5,4	***
Nashville Warbler	7193	-0,15	*	2819	-0,24	*	2674	0,11	n.s.	1698	-0,16	n.s.	10,9	
Parula Warbler	2247	-0,05	n.s.	1013	-0,10	*	811	0,01	n.s.	423	-0,02	n.s.	-2,2	
Yellow Warbler	8420	-0,14	**	3065	-0,04	n.s.	4322	-0,02	n.s.	1030	-0,25	***	2,2	
Chestnut-sided Warbler	5106	-0,12	*	1731	-0,12	n.s.	2900	-0,16	n.s.	474	-0,04	n.s.	-1,6	
Magnolia Warbler	6965	-0,03	n.s.	2029	-0,10	n.s.	3434	0,38	*	1501	-0,05	n.s.	6,8	**
Cape May Warbler	3304	-0,04	n.s.	1884	-0,08	n.s.	859	0,07	n.s.	560	-0,05	n.s.	2,4	
Black-throated blue Warbler	3608	-0,11	**	1788	-0,19	*	1341	-0,03	n.s.	475	-0,06	n.s.	0,8	
Black-throated green Warbler	5978	-0,11	*	2274	-0,14	*	2356	0,05	n.s.	1342	-0,10	n.s.	-3,1	
Brown-headed Cowbird	21776	-0,67	***	13967	-0,79	***	4674	-0,95	***	1565	-0,54	***	-3,6	***
Purple Finch	17480	0,03	n.s.	7094	-0,10	n.s.	4816	0,03	n.s.	3227	0,42	**	3,6	*
American Goldfinch	22685	-0,18	n.s.	5735	-0,06	n.s.	7467	-0,37	n.s.	6500	-0,48	*	-1	
Neotropical migrants														
Number of species with P < 0.05			25			19			17			18		12
Number of species with P n.s.			21			27			29			28		34
Temperate migrants														
Number of species with P < 0.05			18			17			13			17		12
Number of species with P n.s.			10			11			15			11		16

Species showing a decreasing trend preferred maple forests, preferred agricultural habitats, were insectivorous in flight, or lived in edges (significant trends in all year-ÉPOQ);(Table 2A). Many icterids were also decreasing. No declining temperate migrants were found in maple forests, compared to eight neotropical species. More temperate (seven) than neotropical migrants (five) were from agricultural areas. Insectivorous and edge species were more numerous among declining neotropical species.

The pattern was very different for the group of species which showed no significant trend in all year-ÉPOQ (Table 2B). Most were increasing if anything in both summer-ÉPOQ and BBS, the trend being sometimes reversed for a different season (either spring or fall). Trends that were more consistent included species with similar significant trends from different subsets or data base. There were four such neotropical and three temperate migrants. Three neotropical and two temperate migrants showed reverse trends but not in the same season (Table 2B). Most birds showing a general significant increase belonged to boreal forest ecosystems (non-significant trends in all year-ÉPOQ) (Table 2B).

DISCUSSION

Using a checklist approach to census birds by volunteers allow the gathering of information on all species of any area, or any season, whether the bird is common or uncommon, or even only localized. Thus, any species falling into the category of neotropical migrant can be assessed to some degree with this method, because, even if it less common, the calculation involved in evaluation of long term trends is based on the ratio of total number of checklists containing this species over the total number of checklist reported. From a total sample size of

Table 2A. — Neotropical and temperate migrant birds grouped by data sets showing a significant trend in ÉPOQ-all year. Negative (-) or positive (+) trends are shown whenever they were significant in Table 1. Total number of species per habitat or guild and per data set are also given.

NEOTROPICAL MIGRANTS

Species	Habitat* or guild	ÉPOQ data sets: All year	Summer: Spring	Summer: Fall	BBS
Significants in ÉPOQ- all year					
Red-eyed Vireo	M	-			+
Ruby-throated Hummingbird	O	-			
Chestnut-sided Warbler	E	-			
Ovenbird	M	-			
Common Yellowthroat	O	-			
Significants in ÉPOQ-all year & fall					
Yellow Warbler	A-E	-		-	
Wilson's Warbler	E	-		-	
American Redstart	In	-		-	+
Significants in ÉPOQ-all year, summer & fall					
Indigo Bunting	E	-	-	-	
Significants in ÉPOQ-all year & spring					
Veery	M	-	-		
Least Flycatcher	M	-	-		
Black-throated blue Warbler	M	-	-		
Nashville Warbler	A-E	-	-		
Black-throated green Warbler	BF	-	-		
Significants in ÉPOQ-all year, spring & fall					
Bank Swallow	In	-	-	-	
Bobolink	A-Ict	-	-	-	-
Scarlet Tanager	M	-	-	-	
Significants in all ÉPOQ subsets					
Common Nighthawk	In	-	-	-	-
Barn Swallow	A-In	-	-	-	-
Gray Catbird	A-E	-	-	-	-
Chimney Swift	In	-	-	-	
Wood Thrush	M	-	-	-	
Purple Martin	In	-	-	-	
Eastern Wood-Pewee	M-In	-	-	-	
Northern Oriole	Ict	-	-	-	
TOTAL (negative trend)		25	16	9	15	3
TOTAL (positive trend)						2

TEMPERATE MIGRANTS

Species	Habitat*	ÉPOQ data sets: All year	Summer: Spring	Summer: Fall	BBS
American Robin	O	-		-	+
Winter Wren	BF	-		-	
Significants in ÉPOQ-all year, spring & summer					
Eastern Phoebe	In	-	-	-	
White-throated Sparrow	BF	-	-	-	
Ruby-crowned Kinglet	BF	-	-		
Chipping Sparrow	O	-	-		
American Crow	O	-	-		+
Yellow-bellied Sapsucker	O	-	-	-	
Savannah Sparrow	A	-	-	-	
European Starling	O	-	-	-	
Brown-headed Cowbird	Ict	-	-	-	-	-
Mourning Dove	O	+	+	+	+	+
Northern Flicker	A-E	-	-	-	-	
Brown Thrasher	A	-	-	-	-	
Song Sparrow	A	-	-	-	-	
Common Grackle	A-Ict	-	-	-	-	
Eastern Meadowlark	A-Ict	-	-	-	-	-
Vesper Sparrow	A	-	-	-	-	-
TOTAL (negative trend)		17	15	9	12	3
TOTAL (positive trend)		1	1	1	1	3

SUMMARY PER GUILD AND HABITAT

NEOTROPICAL MIGRANTS

Guild or habitat	Number of species per habitat	ÉPOQ data sets: Number species significantly decreasing (or increasing +) per habitat or guild: All year	Summer: Spring	Summer: Fall	BBS
Agricultural (A)	5	5	2	4	3
Boreal Forest (BF)	1	1	1		
Edge (E)	6	6	2	2	4	1
Icterid (Ict)	2	2	2	1	2	1
Insectivorous (In)	7	7	6	3	7	2(1+)
Maple forest (M)	8	8	6	1	3	(1+)
Regrowth (Rgr)						
Other (O)	2	2				

TEMPERATE MIGRANTS

Guild or habitat	Number of species per habitat	ÉPOQ data sets: Number species significantly decreasing (or increasing +) per habitat or guild: All year	Summer: Spring	Summer: Fall	BBS
Agricultural (A)	7	7	7	6	7	2
Boreal Forest (BF)	3	3	2		1	
Edge (E)	1	1	1	1	1	
Icterid (Ict)	3	3	3	3	3	2
Insectivorous(In)	1	1	1	1		
Maple forest (M)						
Regrowth (Rgr)						
Other (O)	5	5(1+)	4(1+)		3(1+)	(3+)

Table 2B. — Neotropical and temperate migrant birds grouped by data sets showing a non significant trend in ÉPOQ-all year. Negative (-) or positive (+) trends are shown whenever they were significant in Table 1. Total number of species per habitat or guild and per data set are also given.

NEOTROPICAL MIGRANTS

Species	Habitat* or guild	ÉPOQ data sets All year	Spring	Summer	Fall	BBS
Non-significant in ÉPOQ- all year nor in other seasons						
Warbling Vireo	O					+
Broad-winged Hawk	O					
Great crested Flycatcher	In					
Eastern Kingbird	In					
Cliff Swallow	In					
Philadelphia Vireo	BF					
Cape May Warbler	BF					
Blackpoll Warbler	BF					
Mourning Warbler	O					
Rose-breasted Grosbeak	O					
Non-significant in ÉPOQ- all year but so in summer						
Blackburnian Warbler	BF			+		
Solitary Vireo	BF			+		+
Black-and-white Warbler	BF			+		+
Magnolia Warbler	BF			+		+
Lincoln Sparrow	Rgr			+		
Non-significant in ÉPOQ- all year but so in fall						
Olive-sided Flycatcher	BF				-	+
Non-significant in ÉPOQ- all year but so in summer & fall						
Yellow-bellied Flycatcher	BF			+	-	
Northern Waterthrush	BF			+	-	
Non-significant in ÉPOQ- all year but so in spring						
Swainson's Thrush	BF		-			
Parula Warbler	BF		-			
Non-significant in ÉPOQ- all year but so in spring & summer						
Alder Flycatcher	Rgr		+	+		+
TOTAL (negative trend)			2		3	
TOTAL (positive trend)			1	8		6

TEMPERATE MIGRANTS

Species	Habitat*	ÉPOQ data sets All year	Spring	Summer	Fall	BBS
Hermit Thrush	BF					+
Dark-eyed Junco	BF					+
Blue Jay	O					
House Wren	O					
Fox Sparrow	BF			+		+
Purple Finch	BF				+	+
Cedar Waxwing	O				-	+
American Goldfinch	O				-	
Golden-crowned Kinglet	BF			+	+	+
Yellow-rumped Warbler	BF		-	+		
TOTAL (negative trend)			1		2	
TOTAL (positive trend)				3	2	6

SUMMARY PER GUILD AND HABITAT

NEOTROPICAL MIGRANTS

Guild or habitat	Number of species per habitat	ÉPOQ data sets Number species significantly increasing (or decreasing -) per habitat or guild All year	Spring	Summer	Fall	BBS
Agricultural (A)						
Boreal Forest (BF)	12	(2-)	6	(3-)	4	
Edge (E)						
Icterid (Ict)						
Insectivorous (In)	3					
Maple forest (M)						
Regrowth (Rgr)	2			2		
Other (O)	4					1

TEMPERATE MIGRANTS

Guild or habitat	Number of species per habitat	ÉPOQ data sets Number species significantly increasing (or decreasing -) per habitat or guild All year	Spring	Summer	Fall	BBS
Agricultural (A)						
Boreal Forest (BF)	6	(1-)	3	2	5	
Edge (E)						
Icterid (Ict)						
Insectivorous (In)						
Maple forest (M)						
Regrowth (Rgr)						
Other (O)	4			(2-)	1	

* A=Agricultural, BF=Boreal Forest, Edge=E, Ict=Icterid, In=Insectivorous, M=Maple forest, Rgr=Regrowth, O=Other.

about 10,000 new checklists per year, any probability of finding any species can be calculated, and should be comparable between years or localities.

BBS could not be compared with other data bases up to now in Québec and very seldom elsewhere (Droege 1990 and references therein, Dunn 1991). Because most trends followed the same direction both in EPOQ and BBS, the value of both methods are reciprocally enhanced, even though very different methods were used.

General trends of many neotropical migrants showed many species might have suffered from management practices over the last 20 years, that affected at the same time many other

Table 3. — Consistency between BBS and the various ÉPOQ data sets. Trends are expressed in number of species of neotropical and temperate migrant birds per category. Highly consistent: trends are the same in both data sets. Relatively consistent: trends are in the same direction, but significance level differ. Inconsistent: trends are not in the same direction but one may be significant. Contradictory: trends are significant in opposite directions.

		Neotropical mibrants				Temperate migrants			
BBS versus ÉPOQ		All year	Spring	Summer	Fall	All year	Spring	Summer	Fall
Highly consistent									
*+ *+		-	-	-	-	1	1	3	3
*- *-		4	5	8	4	3	3	3	3
+ +		4	6	9	1	-	-	1	1
- -		1	3	2	4	1	1	3	-
0 0									
	Total	9	14	19	9	5	5	10	7
Relatively consistent									
*+ +		3	3	5	4	3	4	4	3
*- -		9	6	4	4	5	5	3	5
+ 0		7	6	4	7	1	1	-	3
- 0		-	1	-	2	-	-	-	-
	Total	19	16	13	17	9	10	7	11
Inconsistent									
*+ 0		3	1	2	1	1	-	-	1
*- 0		-	-	-	-	-	-	-	
+ -		3	4	9	8	2	2	5	1
*+ -			3	1	2	2	3	3	-
*- +		10	8	2	7	7	7	3	6
	Total	16	16	14	18	12	12	11	8
Contradictory									
*+ *-		2	-	-	2	2	1	-	2
	Total	2	-	-	2	2	1	-	2
Consistent total		28	30	32	26	14	15	17	18
	Percent	60,87	65,22	69,57	56,52	50	53,57	60,71	64,29
Inconsistent total		18	16	14	20	14	13	11	10
	Percent	39,13	34,78	30,43	43,48	50	46,43	39,29	35,71

Total all migrants		All year	Spring	Summer	Fall
Consistent		42	45	49	44
	Percent	56,76	60,81	66,22	59,46
Inconsistent		32	29	25	30
	Percent	43,24	39,19	33,78	40,54

* = Statistically significant
*+ = Significantly positive
*- = Significantly negative
\+ = Positive, but not significant
\- = Negative, but not significant
0 = No trend

* A=Agricultural, BF=Boreal Forest, Edge=E, Ict=Icterid, In=Insectivorous, M=Maple forest, Rgr=Regrowth, O=Other.

temperate species. It is already known from trends derived from BBS that some populations of a species do not react the same way to the environment in different parts of its whole range or throughout the continent (Robbins *et al.* 1986). This might apply as well in the Québec region. When trends were not the same between ÉPOQ and BBS or between any ÉPOQ subsets, it often involved species reaching their northern distributional limit in Québec (for example Yellow-rumped Warbler, *Dendroica coronata*). Understanding these differences will require further field studies.

Obviously, species showing significant declining trend in more than one data base, and in more than one data set in ÉPOQ, should receive special attention (eight neotropical and seven temperate migrants in Table 2A).

In agricultural habitats, long term effects of pesticides on bird populations are still poorly documented. Reduction in amount of edges and hedgerows can affect many species that depend upon these for cover and feeding. Overuse of the land and reduced habitat diversity is also a problem that is more obvious in some parts of the southern portion of the Saint-Lawrence valley agricultural area. Many icterids also belong to this habitat type, and all are declining, whether neotropical or temperate migrants. Bollinger and Gavin (1992) mention that many factors contribute simultaneously to declines, especially loss of old hayfields for nesting Bobolink. Edge species are also affected by a mixture of disturbances applying both to agricultural landscapes and forest fragmentation (Freemark and Collins 1992).

Although evidence is still lacking at this point, many factors might affect the insectivorous species in flight: availability of nesting places (Chimney Swift, *Chaetura pelagica*), insect spraying with pesticides in agricultural areas, drainage in lakes and waterway, exploitation of sand banks and harassment by four wheel bikers (Bank Swallows, *Riparia riparia*), warming of climate, reduced insect diversity in agricultural landscapes, lack or reduction of natural ponds and streams for insect reproduction, and overuse of the land for agriculture without refuge area for insects to reproduce.

Boreal forest ecosystems have spread in previously forested areas of different types as a result of conversion to coniferous monocultures. This has had a positive impact on many species.

Spring-ÉPOQ or fall subsets also provide data on species that differ between seasons due to different migration routes each species follows in both seasons. With large sample sizes, trends during migration can be detected and be meaningful, especially if there are no other means to assess populations during other seasons (Dunn 1992). Our checklist program to evaluate trends during migration corroborates many trends shown by BBS and ÉPOQ during other seasons. It provides strong evidence that less standardized methods can yield very significant results for analysis of neotropical migrant bird trends on a regional or national scale during migration.

For a census program to be successful, information on all species in all habitats and seasons should be sought, because some seasons yield special information on many birds that might not otherwise be determined. One reason ÉPOQ is valuable is the huge amount of data available, with checklists being gathered at a rate of 10,000 per year containing 150,000 records gathered by volunteers. This smooths out biases related to the less standardized methods of ÉPOQ, even when different seasons are considered. Large ÉPOQ sample sizes bring further confidence in values of trends for many other species not dealt with by BBS.

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