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# WORKING PAPER

## ANALYSIS AND LIAISON

POSTCENSAL POPULATION ESTIMATES,

1976-81

#82-02



Government  
of Canada

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Regional  
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Expansion

Expansion  
Économique  
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POSTCENSAL POPULATION ESTIMATES,

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## Post-Censal Population Estimates, 1976-81

### Introduction

The most recent 1981 Census figures show that Statistics Canada's postcensal population estimates have been less accurate than in previous years. These inaccurate figures have important consequences on a number of economic and fiscal issues, not the least of which has been the overpayment of equalization to some Atlantic provinces.

### Background

Statistics Canada prepares estimates of population by province on a quarterly basis. These estimates, known as postcensal estimates, are based on the preceding census adjusted by changes in the components of population growth. To this end, separate estimates are made of births, deaths, immigration, emigration, in-migration and out-migration during each quarter, and the population figures for the last period are adjusted accordingly. Since the census provides actual population counts only once every five years, these estimates are used to provide more timely information for decision making in both the private and public sector.

There are two major sources of error in the postcensal estimates: those associated with the preceding census, on which the estimates are based, and those originating from the method of estimating the components of change.

Errors from census can be broadly classified into two classes, undercoverage and processing. The overall undercoverage rate for Canada in both the 1971 and 1976 census is about 2% (Table 1). It is, however, distributed unevenly among the provinces and ranges from 3.13% for British Columbia to 0.38% for Prince Edward Island. Processing errors include both response and imputation errors, and the standard errors associated with these can usually be determined.

Unfortunately, very little accurate information is available on the magnitude of errors resulting from estimates of the components of population change. While the estimates of natural increase, based on vital statistics (i.e. births and deaths) are very accurate, the estimates of net migration, both international and internal, are less reliable.

Table 1. Estimated Population Undercoverage Rates, by Province, 1976 Census

<u>Province</u>	<u>Estimated Rate per cent</u>
Newfoundland	1.10
Prince Edward Island	0.38
Nova Scotia	0.86
New Brunswick	2.16
Quebec	2.95
Ontario	1.52
Manitoba	1.07
Saskatchewan	1.33
Alberta	1.49
British Columbia	3.13
Total, 10 Provinces	2.04

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Source: Statistics Canada, Estimates of Population for  
Canada and the Provinces, June 1, 1981  
Cat. No. 91-201 (Ottawa: Minister of Supply and  
Services, Canada) January 1982, Table 3.

In terms of international migration, the number of legal immigrants can be reasonably estimated based on records maintained by the Canadian Employment and Immigration Commission. On the other hand, since no accurate and consistent information is available for the number of people who leave the country, the estimation of emigrants is more difficult.

Similarly, there are many problems associated with the estimation of inter-provincial migration. The number of children who move in or out of a given province can be determined from information on the changes of address in the Family Allowance accounts. The number of adults who experience similar movements can then be estimated by applying an adjustment factor to the number of children. This adjustment factor is derived on the basis of the relationship of migration patterns of adults with those of children during the last inter-censal period. Therefore, in addition to other factors, the estimated number of migrants would not be reliable if the age composition of the migration stream during the last inter-censal period is different from that since the last census.

#### Accuracy of Postcensal Estimates, 1976-81

The reliability of the postcensal estimates series 1976-81 can be assessed by comparing the estimate for June 1, 1981, when the census was taken, with the corresponding 1981 census counts. It appears that the discrepancy, or the error of closure, is more significant than for the previous postcensal estimates for many provinces (Table 2).

Generally, the postcensal estimates 1976-81 have over-estimated the population of the slow growth provinces and under-estimated those of Alberta which has experienced rapid population increase during this period (Table 3). As a matter of fact, the error of over-estimation is well above 2% for Newfoundland and New Brunswick. This is similar to Saskatchewan where the error of over-estimation is about 1.2%. On the other hand, the error of under-estimation for Alberta reaches 3.5%.

These trends are further illustrated in Figure 1. Here the percentage changes in population during the inter-censal period are plotted separately for Canada and the provinces. It should be noted that these year-to-year changes are based on 1976 census and the population estimates on 1977 to 1980. Both the 1981 census and 1981 estimates

Table 2. Error of Post-censal Estimates, Canada and Provinces, 1966, 1971, 1976 and 1981<sup>1</sup>

Area	Errors in Post-Censal Estimates			
	1966 <sup>2</sup>	1971 <sup>2</sup>	1976 <sup>3</sup>	1981 <sup>4</sup>
Newfoundland	2.43	0.38	-0.18	-3.20
Prince Edward Island	0.00	-0.89	1.69	-0.81
Nova Scotia	0.53	-2.41	0.36	-1.18
New Brunswick	1.62	-0.47	1.62	-2.16
Quebec	-0.64	0.03	0.14	1.52
Ontario	-0.95	1.45	0.81	-0.00
Manitoba	-0.52	0.00	0.59	-0.49
Saskatchewan	-0.10	0.22	1.52	-1.24
Alberta	0.07	0.37	-0.65	3.49
British Columbia	-0.64	0.50	0.97	1.20
Yukon	7.14	-5.56	-4.55	4.36
Northwest Territories	-10.34	2.86	- 11.63	6.52
Canada	-0.48	0.52	0.51	0.63

Note:

1. The error of post-censal estimates is the discrepancy between these estimates and the corresponding census figure expressed as a percentage of the census counts.
2. Statistics Canada, Estimates of Population for Canada and the Provinces, June 1, 1981 Cat. No. 91-201 (Ottawa: Minister of Supply and Services, Canada), November 1977, Table 2.
3. Statistics Canada, Estimates of Population for Canada and the Provinces, June 1, 1981 Cat. No. 91-201 (Ottawa: Minister of Supply and Services, Canada) January 1982, Table 3.
4. Data Coordination calculation.

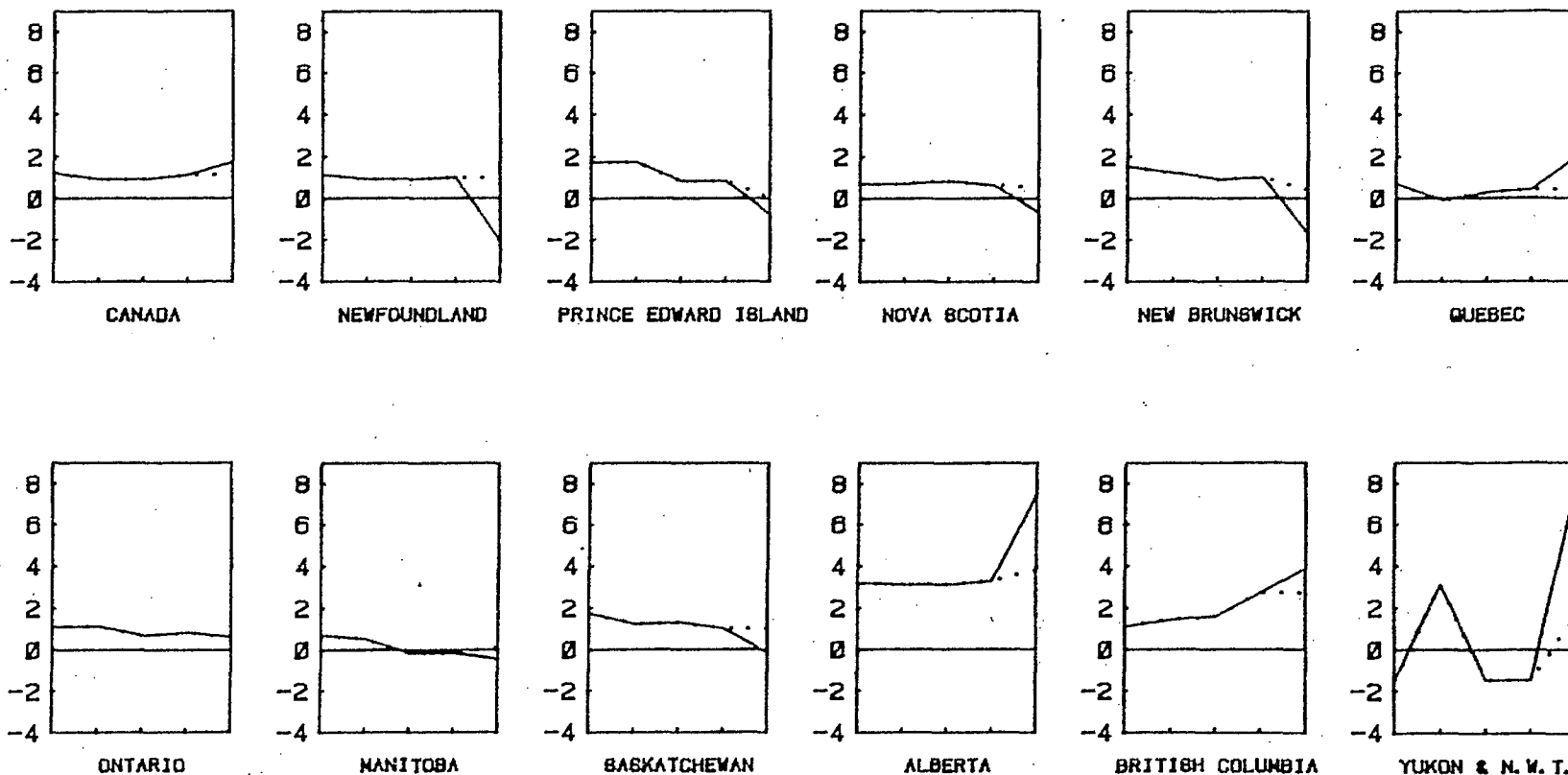
Table 3. Comparison Between Census Population Counts and Post-censal Estimates, Canada and Provinces, June 1, 1981

Area	Census <sup>1</sup> (1)	Post-Censal <sup>2</sup> estimates (2)	Deviation	
			(1)-(2) (3)	(3/1)x100 (4)
(in thousands)				
Newfoundland	568	586	-18	-3.20
Prince Edward Island	123	124	-1	-0.81
Nova Scotia	847	857	-10	-1.18
New Brunswick	696	711	-15	-2.16
Quebec	6 438	6 340	98	1.52
Ontario	8 625	8 625	0	0.00
Manitoba	1 026	1 031	-5	-0.49
Saskatchewan	968	980	-12	-1.24
Alberta	2 238	2 160	78	3.49
British Columbia	2 744	2 711	33	1.20
Yukon	23	22	1	4.36
Northwest Territories	46	43	3	6.52
Canada	24 343	24 189	154	0.63

Note:

1. Statistics Canada, Daily, March 30, 1982.
2. Statistics Canada, Estimates of Population for Canada and the Provinces, June 1, 1981 Cat. No. 91-201 (Ottawa: Minister of Supply and Services, Canada) January 1982, Table 3.

FIG. 1 POPULATION GROWTH FOR CANADA AND THE PROVINCES  
 PERCENTAGE CHANGES  
 1976-77, 1977-78, 1978-79, 1979-80, 1980-81



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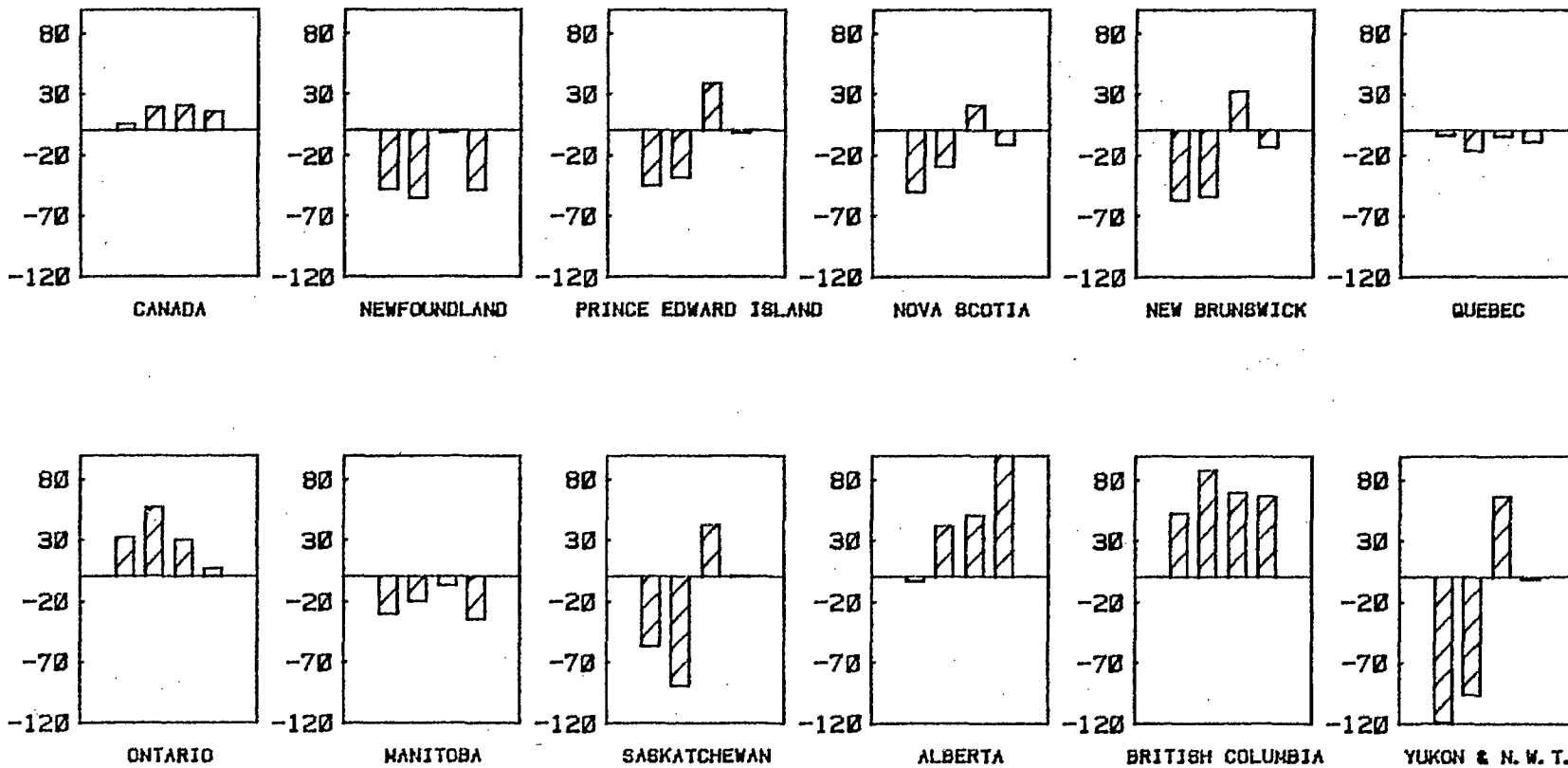
were used to calculate the changes for the period between 1980 and 1981. Therefore, the dotted line indicates what the population change would have been if 1981 population estimates were used while the solid line shows the rate of population growth if 1981 census were used together with the 1980 estimates. It is apparent that the gap between the two lines is quite large with over-estimation in the Atlantic provinces and under-estimation in Alberta readily discernible. Since the population estimates for 1981 are based on preceding quarterly estimates, it is quite clear that the population of these provinces may have been over- or under-estimated since 1976.

As discussed earlier, these errors of estimation can usually be attributed to problems in determining the number of emigrants and inter-provincial migrants. While the estimation of emigrants may contribute to some extent to these discrepancies, the errors caused by inter-provincial migrants estimation may have played a more critical role. This is clearly demonstrated by comparisons of the migration flow between the periods 1971-76 and 1976-81 for the Atlantic provinces and Alberta (Figure 2).

During the first half of the seventies the Atlantic provinces seem to have experienced an economic renaissance in relation to the rest of Canada, possibly because of government programs and the expansion of the service sector. As a result, migration was very different from the previous inter-censal periods. Instead of being a net exporter of people, Nova Scotia, Prince Edward Island and New Brunswick registered a substantial net gain of population while the net loss was considerably reduced in Newfoundland. On the other hand, the westward shift in Canadian population continued and Alberta registered net migration at a rate consistent with that of 1966-71. It should be noted that the boom in Alberta started to take place in 1973 when the energy crisis occurred.

The economic hope of the Atlantic provinces seems to have been dashed in the second half of the seventies. The country has been suffering from inflation and economic downturn and these regions suffered the most. As a consequence, net out-migration has resumed (Figure 2). On the contrary, Alberta is enjoying economic prosperity because of the rapid growth in the energy industry and in other sectors of the economy. As a result, in-migration to Alberta has accelerated (Figure 2).

FIG. 2 NET MIGRATION FOR CANADA AND THE PROVINCES  
 RATES PER THOUSAND POPULATION  
 1961-66, 1966-71, 1971-76, 1976-81



The reversal of and changes in migration flows may be responsible for the errors in estimation. Although this may be an over-simplified explanation, it is quite possible that the age composition of the migration streams in and out of both the Atlantic provinces and Alberta is very different between the first and the second half of the last decade. For example, in Atlantic Canada, there may have been more unattached individuals and childless couples who were attracted by economic opportunities in the West, in the second half, than in the first half of the decade, when the economy at home was better. On the other hand, because of the brightened economic picture in 1971-76, the proportion of these individuals in the in-migration stream, including return migrants to Atlantic Canada, may have been higher in the first half of the decade than in the second half.

As a result of the changes in the age composition of migration streams between 1971-76 and 1976-81, the estimation of inter-provincial migrants could be subject to error. This is due to the fact that the estimated number of adults who moved is based on the movement of children according to Family Allowance records, and also the assumption that the migration pattern of adults and those of children is the same in both the previous and the present inter-censal period. Therefore, if there are more small families or unattached individuals who left the Atlantic provinces in the last half of the decade than in the first half, the total number of out-migrants would be underestimated based on the ratio of adult/children relationship which was established in the period 1971-76 (Table 4). Similarly, the number of children who moved into Alberta during 1976-81 may lead to an under-estimation of adult in-migrants if the adjustment factor does not reflect the changing age structure of the migration stream.

#### Implications

Inaccurate population estimates have significant consequences. Many programs and projects require a long lead time, and in many instances, these decisions have to be made on the basis of postcensal estimates. The implication is particularly serious for the Atlantic provinces because of the reliance of provincial governments on equalization payments calculated on a per capita basis. It has been estimated by the Atlantic Provinces Economic Council that revised population counts may result in a \$41 million reduction for Newfoundland or about 10% of expected entitlement from equalization payments and Establishment

Table 4. Estimation of Number of Adult Migrants Based  
Number of on Child Migrants.

<u>Region</u>	<u>Migration Stream</u>	<u>Hypothetical Composition of Stream Adult/Child Ratio</u>		<u>Consequence of Estimation of Migration</u>
		<u>71-76</u>	<u>76-81</u>	<u>76-81</u>
Atlantic Provinces	In-Migration	High	Low	Over
	Out-Migration	Low	High	Under
Alberta	In-Migration	Low	High	Under
	Out-Migration	High	Low	Over

Program Funding. In Prince Edward Island, the loss may be about 4% of entitlements, or \$4 million. Furthermore, the provincial governments would have to repay the over-payment from previous years. It will therefore, be necessary to raise taxes or borrow additional funds in order to maintain similar levels of service.



*Myra, Please  
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Mr. David C. Rothwell  
Acting Director  
Economic Development Analysis Div.

FROM  
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YOUR FILE/VOTRE RÉFÉRENCE
DATE September 27, 1982

SUBJECT  
OBJET

Quarterly Postcensal  
Population Estimates

Estimations trimestrielles  
postcensales de la population

Attached please find a report on the nature and problems of the Quarterly Postcensal Population Estimates prepared by Statistics Canada, as a supplement to the Census conducted every five years. Due to their timeliness and frequency, these estimates provide important information for decision-making during the inter-censal period.

Vous trouverez ci-joint un rapport sur la nature et les problèmes des estimations trimestrielles postcensales de la population que prépare Statistique Canada et qui complète les recensements effectués tous les cinq ans. Ces estimations, parce qu'elles sont fréquentes et à jour, apportent aux personnes intéressées des renseignements importants pour les prises de décisions pendant les périodes intercensales.

The objective of this report is to outline the estimation procedure, review the underlying assumptions, identify potential problems, and describe the possible consequences of inaccurate results.

Le rapport donne les grandes lignes de la procédure d'estimation, examine les hypothèses sous-jacentes, détermine les problèmes éventuels et décrit les conséquences possibles de résultats inexacts.

Attach.

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A P P E N D I X

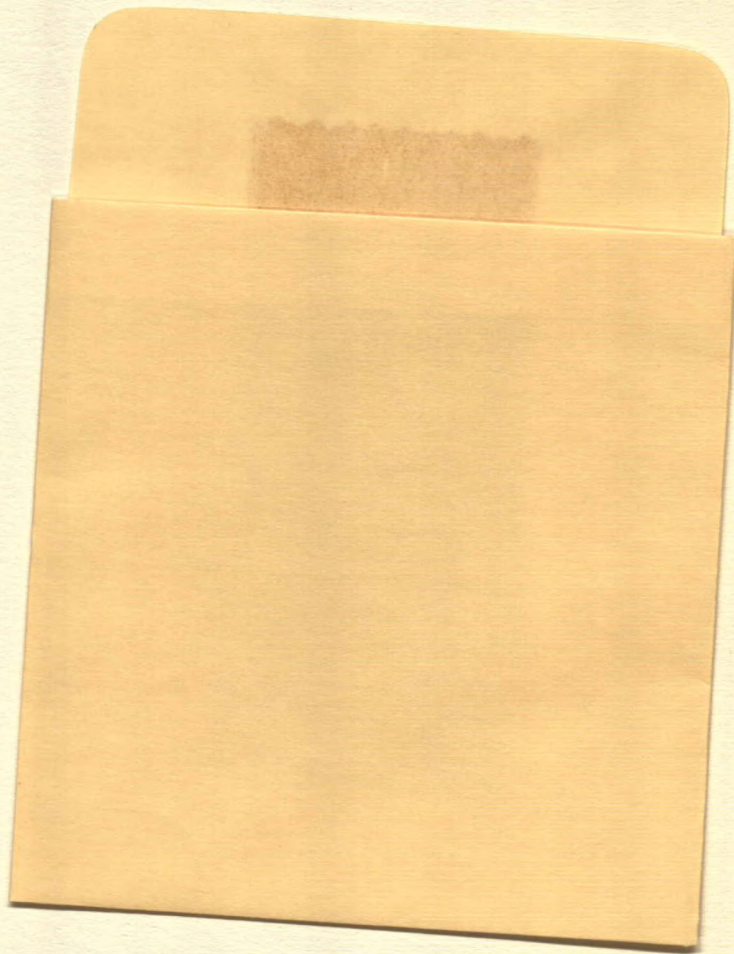
Appendix I. Components of Population Change, 1976-81

	Canada	Nfld.	PEI	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Yukon	NWT.
Population ('000)													
1976 (Census)	22 993	558	118	829	677	6 234	8 264	1 022	921	1 838	2 467	22	43
1977 (Estimate)	23 258	564	120	835	687	6 276	8 355	1 029	937	1 896	2 494	21	43
1978 (Estimate)	23 476	569	122	841	695	6 273	8 444	1 034	948	1 954	2 530	22	44
1979 (Estimate)	23 681	574	123	848	701	6 289	8 504	1 032	960	2 014	2 571	22	43
1980 (Estimate)	23 936	580	124	853	708	6 312	8 574	1 030	970	2 081	2 640	21	43
1981 (Estimate)	24 189	586	124	857	711	6 340	8 625	1 031	980	2 160	2 711	22	43
1981 (Census)	24 343	568	123	847	696	6 438	8 625	1 026	968	2 238	2 744	23	46
Population Change ('000)													
1976-1977	265	6	2	6	10	42	91	7	16	58	27	-1	0
1977-1978	218	5	2	6	8	-3	89	5	11	58	36	1	1
1978-1979	205	5	1	7	6	16	60	-2	12	60	41	0	-1
1979-1980	255	6	1	5	7	23	70	-2	10	67	69	-1	0
1980-1981 (Estimate)	253	6	0	4	3	28	51	1	10	79	71	1	0
1980-1981 (Census)	407	-12	-1	-6	-12	126	51	-4	-2	157	104	2	3
Population Change (%)													
1976-1977	1.2	1.1	1.7	0.7	1.5	0.7	1.1	0.7	1.7	3.2	1.1	-1.5	
1977-1978	0.9	0.9	1.7	0.7	1.2	-0.1	1.1	0.5	1.2	3.1	1.4	3.1	
1978-1979	0.9	0.9	0.8	0.8	0.9	0.3	0.7	-0.2	1.3	3.1	1.6	-1.5	
1979-1980	1.1	1.0	0.8	0.6	1.0	0.4	0.8	-0.2	1.0	3.3	2.7	-1.5	
1980-1981 (Estimate)	1.1	1.0	0	0.5	0.4	0.4	0.6	0.1	1.0	3.8	2.7	1.6	
1980-1981 (Census)	1.7	-2.1	-0.8	-0.7	-1.7	2.0	0.6	-0.5	-0.2	7.5	3.9	7.8	
Natural Increase ('000)													
1976-1977	193.9	8.0	0.9	5.4	6.3	52.2	61.3	8.5	9.0	22.8	18.1	0.3	1.0
1977-1978	190.7	7.4	1.0	5.7	5.6	51.3	59.8	8.1	8.8	23.5	18.2	0.4	1.0
1978-1979	197.9	7.0	0.9	5.6	5.7	55.3	60.2	8.0	9.6	24.9	19.2	0.4	1.1
1979-1980	199.2	7.0	0.9	5.4	5.3	53.9	60.6	7.6	9.4	27.0	20.7	0.3	1.1
1980-1981 (Preliminary)	199.4	8.2	1.0	5.6	5.6	52.3	59.8	8.0	10.0	27.6	20.3	0.3	1.0
Net Migration <sup>1</sup>													
1976-1977	71.1	-2.0	1.1	0.6	3.7	-10.2	29.7	-1.5	7.0	35.2	8.9	-1.3	-1.0
1977-1978	27.3	-2.4	1.0	0.3	2.4	-54.3	29.2	-3.1	2.2	34.5	17.8	0.6	0
1978-1979	7.1	-2.0	0.1	1.4	0.3	-39.3	-0.2	-10.0	2.4	35.1	21.8	-0.4	-2.1
1979-1980	55.8	-1.0	0.1	-0.4	1.7	-30.9	9.4	-9.6	0.6	40.0	48.3	-1.3	1.1
1980-1981 (Estimate)	53.6	-2.2	-1.0	-1.6	-2.6	-24.3	-8.8	-7.0	0	51.4	51.0	0.7	-1.0
1980-1981 (Census)	207.6	-20.2	-2.0	-11.6	-17.6	73.7	-8.8	-12.0	-12.0	129.4	84.0	0.7	2.0

Note 1 Net Migration is derived by subtracting natural increase from population change for the given year and geographic unit.

- Source: 1. For Natural Increase, see Statistics Canada, Vital Statistics, Volume I, Births and Deaths, Cat. No. 84-204 for the periods 1976 to 1980. Information on 1980 to 1981 was not published; obtained from Statistics Canada through personal communication.
2. For other information, see Statistics Canada, Estimates of Population for Canada and the Provinces, Cat. No. 91-201.





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