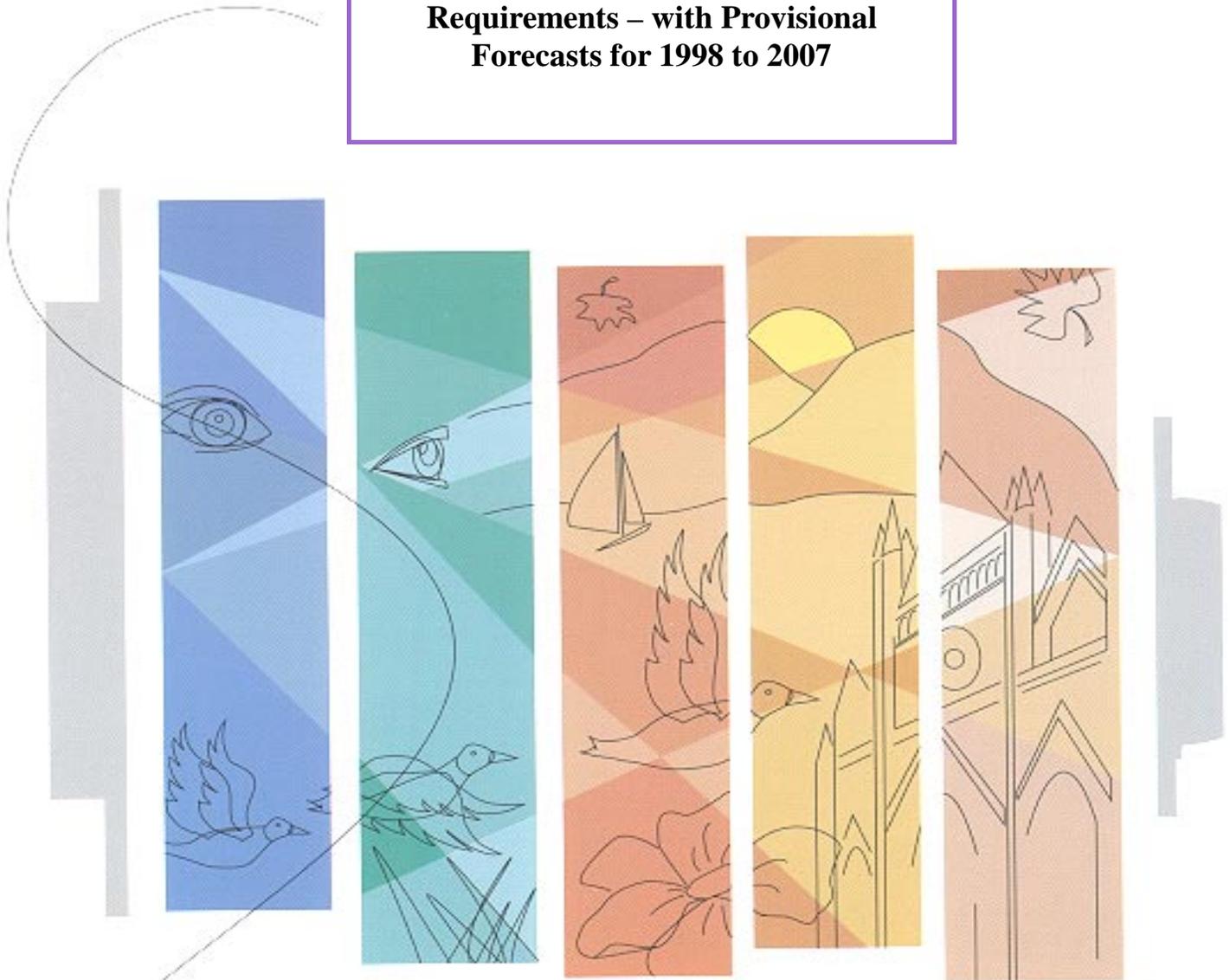Research Branch
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Review of the Offender Population Forecast: Models, Data and Requirements – with Provisional Forecasts for 1998 to 2007

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Review of the Offender Population Forecast :

Models, Data and Requirements - with

Provisional Forecasts for 1998 to 2007

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EXECUTIVE SUMMARY

The Research Branch has been tasked with developing a new offender population forecasting system for the Correctional Service of Canada (CSC). A previous forecasting system (Offender Population Forecast – OPF) employed a suite of comprehensive time-series models and historical offender data. Unfortunately, the OPF system became unserviceable with the arrival of the Offender Management System (OMS) in 1993. Since then, the Service has used simple trend extrapolations as an interim solution for the National Capital Accommodation and Operations Plan forecasts. Development of a new offender population forecasting system is currently underway. It will be called **OPPSIM** (the **Offender Population Profiling and Simulation System**).

Part I of this report provides a historical background of CSC forecasting procedures. While new information technology has provided many improvements, it has also disrupted the legacy of our forecasting system. Given that discontinuities were introduced into the historical population data sets used for forecasting, a major effort in the **OPPSIM** project will be re-building the historical time-series.

In Part II, an overview and workplan is provided for a new **OPPSIM**. Features will include a model for forecasting offender profiles and federal admissions. These models will be introduced in phases, as sufficient offender profile and admission data become available.

Traditional time-series models (and data) from the OPF forecasting suite are reviewed in Part III. While **OPPSIM** will incorporate the main time-series models, these must first be adapted to OMS data, and re-engineered to take full advantage of more powerful forecasting technology now available.

Finally, Part IV offers provisional population forecasts for male, female, and Aboriginal offenders as well as the total community supervision populations. These provisional projections serves as a bridge until new forecasts become available.

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PART I: <u>HISTORICAL BACKGROUND</u>

The Correctional Service of Canada (CSC) has employed several different forecasting methodologies and systems over the years. This reflects both the changing requirements of end users and improvements in the offender population forecast technology available. A review of this evolution helps to better understand the current situation and the directions being taken.

A. Population Forecasting in Correctional Service of Canada

In 1983, Carolyn Canfield commented on the number of different approaches to offender population forecasting that the CSC had used over the previous decade. These ranged from fairly simple extrapolations of recent trends in inmate population level, tempered by subjective judgment about regional variation from national growth, to an extensive population simulation system encompassing different techniques, sources of information, planning applications and monitoring activities.[1]

The next decade saw CSC's approach evolve further. First, the Service's commitment to an advanced population simulation approach was gradually withdrawn (a new Federal Corrections Simulation Model – FCSM – had been introduced in the late 1970s). However, the FCSM system proved too difficult to support with the technology and electronic database systems of the day, and the Service gradually lost confidence in that approach in favour of pure time-series methodologies. FCSM was gradually replaced with a suite of increasingly comprehensive time-series models. These models were frequently enhanced and eventually came to be known as the Offender Population Forecast (OPF). The Research Branch continued using OPF system use until as recently as August, 1992.

As development of an automated and more technologically advanced forecasting system was planned in 1986, it coincided with the new Offender Management System (OMS) project just being launched. The new forecasting system was to be called the Offender Population Forecasting System (OPFS), and was to be developed in parallel

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[1] Carolyn Canfield, **Forecasting Correctional Populations: The Correctional Service of Canada**. The Research Group, Toronto, December, 1983 (p.13).

with the new OMS. Although initial project definition and requirements were begun, development of the new OMS fell behind schedule and work on the OPFS project was unable to proceed.

When OMS arrived in 1993, the OPFS project had long been dormant and only the OPF time-series models were in use. Unfortunately, the arrival of OMS also interrupted most of the historical time-series used by OPF. Consequently, the models themselves were unable to read new OMS data without major re-programming. CSC had to quickly revert to simple trend extrapolations to meet immediate planning needs. These extrapolations were based on offender population counts from the old Inmate Movement System, as time-series data was not yet available from OMS.

In 1993, the statistical reporting and offender population forecasting functions were transferred from the Research Branch. However by 1997, the function of offender population forecasting returned to Research, along with it the task of developing a new forecasting system.

B. The Current Offender Population Forecasting System

Discontinuities were introduced into most of the historical time-series data when OMS arrived, and most of these series require some re-engineering. Specific data issues are examined in a later section of this report. Nevertheless, several modifications to the OPF models were on the agenda before the arrival of OMS, and these issues will be addressed in the new OPFS system. For example:

i)   OPFS should add a capacity for short-term forecasting (simulation) and impact analysis;

ii)   time-series models have proved inadequate for forecasting the community supervision population and a different kind of model will be developed; and

iii)   a capacity to forecast by offender security levels.

In addition, new issues are continuously arising that may require additional modifications to CSC's forecasting system. For example, new legislation can change the number or type of offenders who are entering federal corrections, or the sentences they are required to serve.

The CCRA (1992) changed the way the Service counts the Day Parole population, for example, which invalidated the previous admission and release time-series. As a result, the medium term (5-year) forecast, because it depends on

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admission and release data collected under the old definitions, is no longer functional. Such technical problems often arise, so a forecasting system must be sufficiently flexible to accommodate changing requirements.

The initial challenge for OPPSIM will be to re-establish continuity between the CSC's historical time series and the new OMS data. Fortunately, continuity problems between the "male on-register" population time-series and the new OMS data are relatively minor and an interim forecast for this key population group can be produced immediately. Unfortunately, other data series present more serious problems and we have had to develop estimating procedures in order to produce interim projections.

C. Building on the new OMS

Implemented in September 1993, the OMS has ushered in a new information era. OMS greatly expands the information that is available on federal offenders, particularly in the realm of offender risk/need assessments and population profiling. In addition to the expanded range of information, forecasting technology has also made major advances over the past decade that can now be reflected in the OPPSIM system.

The Research Branch will design a more advanced system than was originally planned by making extensive use of the new Offender Intake Assessment (OIA) information, the plan calls for a "pilot" of the new OPPSIM system by the end of this fiscal year.

The first release of **OPPSIM** is being called a "pilot" system although most of the models will be fully functional at that time. Unfortunately, the system itself will be ready before a significant number of the trend time-series that are needed for forecasting. It will take several additional years to acquire some of the data – for example; several of the Women's Institutions are new so we are looking at five more years to acquire a minimum set a historical data. Similarly, offender risk/needs data derived from OIAS, has been collected for just over three years (e.g., from November 1994) so this series will not have a minimum set until the end of 1999. Typically, it requires a minimum of 50 to 60 time periods to begin accurate forecasting (i.e., four to five years of consistent data), so estimates of population will serve data for an interim period to provide early projections.

PART II: <u>AN OVERVIEW AND WORKPLAN</u>

The new **OPPSIM** will have two major components: i) a forecasting and simulation system, and; ii) a database management system for collecting and storing special research data files. The forecasting component **OPPSIM** will have <u>three</u> distinct modules:

1. The <u>first</u> module will be two time-series models retained from the earlier forecast – a medium- and a long-term forecasting model. The long-term model will use the basic "demographic" model from OPF, modified to include male, Women Offender, and male-Aboriginal offender population forecasts. The medium-term forecast will use the "accounting" model from OPF, also re-developed to cover these same populations. This model will also incorporate admission and release projections from the new admission module.

2. The <u>second</u> module (completely new) will forecast offender risk/needs profiles, including release and re-admission probability forecasts.

3. The <u>third</u> module (also new) will forecast new federal admissions. It will start with crime trends but will eventually use comprehensive criminal court, Youth and Adult custody, labour force, and other relevant socio-economic trends.

A system to collect and manage historical databases. This will be called OPPS-2 (after the original Offender Population Profile System, 1990-93), and will be developed in parallel with **OPPSIM**. This is an automated mini-mart, for storing and managing standardized monthly research files of population profile and count statistics, for forecasting, simulation modeling and interactive impact analysis.

Development of the two components will proceed in parallel. To facilitate this, OPPSIM will use the SAS[©] Information System application software for development of both the forecasting and data-mart components. The research mini-mart (OPPS-2) will be developed using SAS/WA[©], and the **OPPSIM** forecasting models will be developed in SAS/ETS[©] and SAS/STAT[©]. The project will be developed to Windows95[©] and Windows NT[©] platform standards. The Research Branch has had significant success using this integrated approach (i.e., SAS was used both for the OPF forecast models and the first OPPS system).

It is proposed to go significantly beyond what was planned for the OPFS project. Circumstances have changed since that project was originally defined and the new system should keep abreast of the current forecasting and data management technologies.

CSC's activities have become more deeply focused on population profiling which is recognized as indispensable for effective population management. Today's population forecast must be aligned to support strategic simulation exercises and population projections. Put simply, the new forecast must help the Service differentiate among offenders by providing strategic information and population profile projections over various planning horizons. OPPSIM is designed to address this forecasting requirement whereas the OPFS was not.

A. Time-Series Forecasts

Although we have focused on the innovations in OPPSIM, there will also be a continuing need for CSC's traditional and proven time-series models. The current OPF models are the result of nearly two decades of experience with forecasts and testing. Two basic models need to be preserved: i) a "demographic model" for long-term forecasting; and ii) an "accounting model" for forecasting medium-term populations. Both models retain their validity even though one at least will need considerable re-engineering. Both must be expanded, to provide forecasts for additional offender populations (i.e., Women, male Aboriginals).

i) Incorporating the time-series models:

OPPSIM will incorporate both the medium- and long-term offender population forecast models. The "accounting model" is used specifically for medium-term (1-5 year) projections, since this type of model looses accuracy beyond 4-5 years. A "demographic model" is used to extend the medium term forecasts, with the two projections spliced together at years 4-6 to give a smoothed 10-year long-term forecast. This maximizes the accuracy of each method and gives more reliable overall results.

ii) The long-term demographic model:

The current demographic model is used for long-term (10-year) forecasting, and relies on regional trends in age-group incarceration rates combined with Statistics Canada 10-year age-group population projections. The current demographic model is available only for the male on-register population. Therefore, new demographic models

are needed for male Aboriginal and female offenders. This model is still very valid but needs to be updated with population projections from the 1996 Census.

A new demographic model specifically for female offenders will be delayed until historical data for the new Women Offender institutions is available. Actual data is currently available only for a National forecast for female offenders and population "estimates" (based on "region of sentencing") have to be used for Regional forecasts. This situation will continue until we have real historical data for all of the new institution (in about 5 years).

iii) The medium-term accounting model:

The current accounting model is used to forecast medium-term (5-year) population growth by projecting historical net monthly admissions minus releases. The current medium-term model also applies only to the male on-register population, and is currently non-functional because OMS (as a result of Bill C-36) has changed the definition of custody admission and release. This model will be re-developed for OPPSIM, to forecast female offender and male-Aboriginal offender populations and to use projections from the new federal admission forecast (Module 3).

iv) Community Supervision population models

The current forecast for the community supervision population uses a regression (simple moving average) model. This model has been producing unacceptable results (see part 4) and a new model is needed. An accounting model will be adapted for medium-term forecasting of the community supervision population. This new model will incorporate input of institutional release rates and community failure rates (derived from Module-2). The model will include Day Parole, Full Parole and Statutory Release offenders.

B. Offender Profile Forecasts

i) The approach:

OPPSIM will use Offender Intake Assessment (OIA) risk/needs indicators to forecast future offender profiles. When sufficient historical trend data have been collected, offender profile models will be developed to:

- Forecast an **incarcerated population profile** *(using OIA);*

- Forecast a **community supervision population profile** *(using Community Risk/Needs Management Scale (CRNMS))*;

- Forecast **institutional release rate** (using OIA historical "reintegration" probabilities);

- Forecast **community failure rates** (using Community Risk/Needs Management Scale historical "reintegration" trends);

- Forecast **long-range accommodation needs** for the institutional population (using historical trends from the Custody Rating Scale).

ii) The models and forecasted populations:

The offender profile model will be a stand-alone module, and will produce forecasts for male, female, Aboriginal and non-Aboriginal offender populations both, in custody and under community supervision.

The **OPPSIM** offender-profiling module will have a generic capacity for special impact analysis and simulations.

C. Federal Admission Forecasts

This model will predict new federal admissions. The major factors which determine admissions to federal custody are: 1) the number of crimes committed, 2) the number of people arrested, tried, and convicted, and 3) the number sentenced (and their length of sentence) to a federal term.

In addition, this model will estimate indirect effects from other socio-economic trends (e.g., unemployment rates, population demographic trends, school dropout rates, etc.). These factors and relationships are not as well understood, so the model will be gradually expanded as tests identify an important new contribution.

A stand-alone module will be developed for federal admissions forecasting, to allow future changes and enhancements to OPPSIM without requiring the whole system to be modified.

A multivariate regression forecast mode will be used, with independent forecasts developed for each of the administration Region of the Service to accurately reflect regional criminal justice and socio-economic trends.

D. A Supporting Data Mini-Mart

Offender data for population forecasting must be consistent with official by reported CSC offender statistics. Therefore, all forecasting data will be derived from the OMS, the source for all official offender statistics.

However, data from OMS cannot be used directly, as there is no provision to capture offender population snapshots and keep these as historical files. A special research database must be constructed for forecasting and simulation. These research files will consist of offender population snapshots, extracted at monthly intervals from OMS and maintained in their own data mini-mart.

Experience has showed this to be very practical approach, the Research Branch having used this approach in the original Offender Population Profile System (OPPS) seven years ago. A bonus is that monthly-offender snapshots are ideal to use for simulation modeling while the development tools today are much more powerful.

Advanced data warehousing methodology (i.e., SAS/WA$^{©}$) will be used to capture and manage data extracted from OMS every month. The forecasting models will also be developed in the SAS system (i.e., using SAS/ETS$^{©}$ and SAS/STAT$^{©}$). The SAS interactive tools (i.e., SAS-Insight$^{©}$) will be used for simulations and impact analysis. This will insure an integrated platform for both the database and forecasting components.

- A research mini-mart (OPPS-2) will capture, organize and manage monthly population snapshots. The OPPS-2 system will be developed in parallel with OPPSIM.

- Historical population profiles from the old OPPS system (March 1990 through August 1993) will be resurrected and integrated into OPPS-2;

- When available, OMS data back-up tapes will be used to fill the gaps in the monthly information files (e.g., the data that was not captured, from September 1993 to the present).

E. Timeframes and Workplan:

i) Accounting (medium-term) model:

- A new medium-term accounting model will be developed, and will including a model for male, Women, and male Aboriginal populations. **[March 1999].**

- The medium-term accounting model will be extended to forecast the community supervision population. **[End of FY 1998-99].**

ii) Demographic (long-term) model:

- Forecasts for long-term male, male Aboriginal, and Women Offender populations are provided in this report. These will be revised once new demographic projections (from the 1996 Census) are released **[November 1998].**

iii) Offender profile:

- A pilot of the offender profile forecasting module will be complete and tested this FY. Preliminary forecasts (using 3 years of data) will be available **[March 1998].**

- This model will become fully functional (with 5-years of historical data) [January 1999].

iv) Admission model:

- An admission model, which uses only crime trends, will be available by the end of this year. **[March 1998]**

- Collection of other criminal justice process information will occur incrementally. Adult Provincial Correction counts and admissions will be modeled the following year. **[March 1999].**

- Adult Criminal Court data will be added the year following. [March 2000].

- Youth Court and Youth Corrections is largely indirect (Youth trends first impact Provincial courts and Adult Corrections), so modeling these indicators will follow Adult Courts. **[March 2001]**

- Other non-justice and demographic indicators will be added over time. A proposal to develop these indicators in collaboration with Statistics Canada subject matter experts awaits approval. **[FY 1998-2001].**

PART III: <u>REVIEW OF THE EXISTING TIME-SERIES FORECASTS</u>

The Research Branch used the OPF model suite when it conducted the last (August 1992) CSC forecasting.[2] At that time, the forecasting suite included:

1) a medium-term forecast (3-5 years) – used in the annual Treasury Board budget plans, and;

2) a long-term forecast (6-10 years) – used for Long-Range Accommodation Planning (LRAP).

Note: The LRAP has now been replaced by the NCAOP. Forecasting requirements now reflect this consolidated planning instrument.

The forecasting models used in August 1992 are illustrated in Table 1 (below). The principal medium-term (5-year) model used an "accounting" approach and was used only to estimate the male on-register offender population – simple regression models were used to forecast other offender populations;

The main long-term forecast (6-10 years) used a demographic model. A simple time-series regression model was used for other offender populations;

Note: Forecasts were determined separately for each Region, and the are rolled-up to give a National forecast.

The long-term "male on-register population" forecast was considered sufficient for long-term accommodation planning, since male offenders represented 98% of CSC's institutional demand, and there was a single federal institution (P4W) for Women Offenders.

Several Women Offender's institutions have been in operation for a short time. A "special" long-term forecast was developed using regional distribution estimates to assist in the initial planning of these institutions, but a demographic model (similar to the model for men) will be developed a future phase.

Male-Aboriginal offenders were forecasted using a 5-year projection based on a simple moving average (regression) model. However, proposals for special aboriginal-only institutions indicate a male Aboriginal long-term forecast is becoming appropriate.

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[2] Roger Boe, **CSC Offender Population Forecast for 1993 to 2002**. Correctional Service of Canada, August, 1992.

Also, demographic trends for the Aboriginal population are different enough that a separate demographic model would be appropriate.

We have traditionally forecasted only a medium-term projection for the supervision population. However, the current model uses a simple moving average (regression) and not linked to the institutional population, or to estimates of custody releases. The models are therefore quite unsatisfactory and new ones are required.

Finally, a forecast for the "total institutional population" (the on-register population minus day paroles) was a special model used only in 1992. This projection addressed specific corporate objectives and would no longer be needed.

Table 1: Models Used in the 1992 Forecast

FORECASTING METHODS AND FORECAST PERIODS		
OFFENDER SUB-POPULATION	**MEDIUM-TERM (5-YEAR)**	**LONG-TERM (10-YEAR)**
Male On-Register Institutional (Daily Returns)*	Accounting Model (e.g., projection of admissions minus releases)	Demographic Model (e.g., projections of age based incarceration rates)
Female On-Register by Institution	Simple Regression (SMA) 3-Year Moving Averages	…
By Region of Sentence*	(as above)	…
Supervision Population(s)	Simple Regression (SMA) 3-Year Moving Averages	…
Male Aboriginal On-Register	Simple Regression (SMA) 3-Year Moving Averages	…
* New in 1992. (...) No forecast for this group, or this forecast period.		

A. The Male On-Register Population

The long-term forecast of the male on-register population traditionally has provided the main projections for long-range accommodation planning. This historical series has survived the transition to OMS relatively well. With some adjustments, these models can be incorporated into OPPSIM.

Since the male on-register growth trend has been basically linear for some four of the past seven decades, forecasting with a simple trend extrapolation method has been possible when quick projections have been needed. However, the slope of the linear trend is found to vary significantly for each of the past three decades, so simple linear projections will be less accurate than the models used in OPF.[3]

For this series, the historical data extends for nearly seven decades. For the past three decades, the trend is reasonably linear. A test of this linearity confirms this

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[3]   Using a simple linear model the growth over the period 1969 to 1978 averaged 270 net additional male offenders per year; this increased to an average of 445 net offenders from 1979 to 1988, and then declined 235 offenders per year for the most recent (1989-1997) period.

for the three most recent ten-year periods (e.g., for 1969-78, 1979-88 and 1989-97). One earlier period (1949-58) also evidenced a basic linear trend.

Table 2 (below) shows the goodness-of-fit when a basic linear model was tested for each ten-year period since 1929. A poor linear fit (indicated by a low R^2 value) is noted for three earlier periods (e.g., 1929-38, 1939-48 and 1958-68).

Table 2: Historical Male On-Register Population

Testing the Goodness-of-Fit of a Simple Linear Models, Seven Periods (1929 to 1997)		
10-Year Period	**Simple Linear Model**	**Goodness-of-Fit**
1. 1929-38	Y= 23.7 + 3468	$R^2 = 0.017$ *
2. 1939-48	Y = -9.8 + 3460	$R^2 = 0.008$ *
3. 1949-58	Y = 152.2 + 4143	$R^2 = 0.909$
4. 1959-68	Y = 104.6 + 6355	$R^2 = 0.472$ *
5. 1969-78	Y = 270.9 + 6758	$R^2 = 0.872$
6. 1979-88	Y = 445.5 + 8547	$R^2 = 0.935$
7. 1989-97	Y = 234.6 + 12,961	$R^2 = 0.839$
* Model indicates a non-linear trend		

Thus, despite all the demographic and legislative changes that have occurred in society over the past 30 years, a time-series model will still describe the historical male on-register population trend with reasonable accuracy. (This can be visualized by examining each of the trends in the following Chart below):

CHART 1 - MALE ON-REGISTER POPULATION: LINEAR MODEL FIT BY DECADE
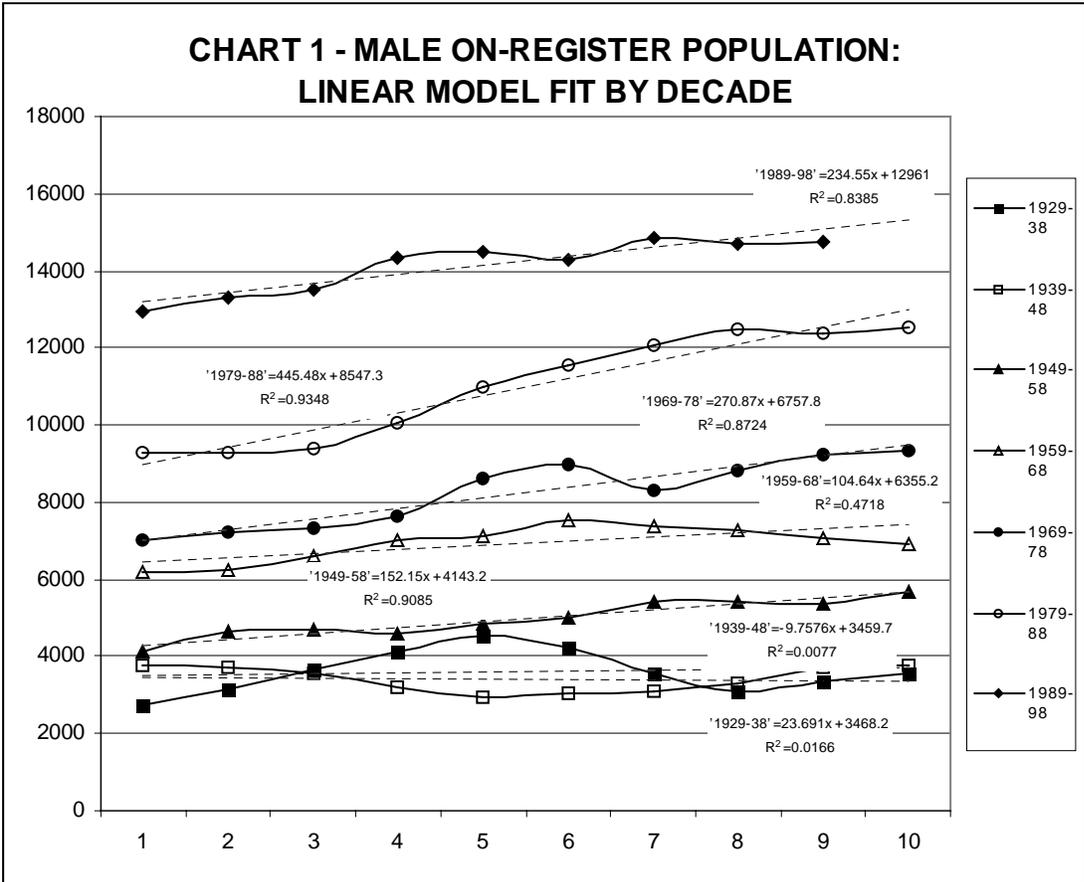
In summary, the trend in the growth of the male on-register population (who account for about 97% of the federal inmates) has increased in fairly stable and predictable ways. Therefore, the **OPPSIM** will be able to adapt the models and time-series from OPF with minor revisions. Specifically, some counting differences (between OIS and OMS) need to be resolved and a suitable common definition of "on-register" decided upon.

PART IV: PROVISIONAL FORECASTS

Using the OPF models, interim forecasts were developed for the main components of the federal offender population. These forecasts use historical data that have been updated as accurately as possible, but estimates were required to bridge several discontinuities and data gaps.

Note: The interim forecasts for this report use data obtained from the MIC, the official source of OMS offender population information for the CSC. It is important that all official statistics use a common source. However, these results will differ somewhat from the current NCAOP forecasts, which use data from the IMS system.

The basic assumption in time-series modeling is that future will be much like the past. The environmental conditions for the period 1998-2007 are expected to be at least as varied as in the previous decade. On the one hand, overall crime rates seem likely to continue their decline, and a recent reduction in violent crime should also continue, due to the continuing aging of the population.

On the other hand, these trends will likely be offset to some degree by growing public frustration and fear of crime, which has manifest itself in calls for harsher penalties and tougher discretionary release conditions.

Meanwhile, on the social and economic front, the economy appears positioned for sustained improvements over the next few years and social program spending may also be increased as the deficit is reduced. Should these factors continue to balance out as they have in years previous, then projecting an annual growth of the federal offender population that is near the lower end of the historical range (i.e., 2.5 to 3%) appears reasonable.

A. Male On-Register Population Forecast

The full OPF "demographic" model could not be tested at this time, since Statistics Canada will not release population projections from the 1996 Census for another year. However, we did determine that a variant of the basic linear model best fit the trend for each region. This was usually an exponential smoothing model and the forecasts and models are shown in Appendix A, along with the comparable predictions from the 1993-2002 forecast.

Note: For forecasting, the March 31 offender population counts for each year.

Even without the usual "damping" effect of the demographic component, the population forecast for 1998-2007 are more conservative than those projected five years ago (e.g., the projections for 1993-2002).

- The annual rate of growth projected in the 1998-2007 forecast is smaller than the 1993-2002 forecasts (i.e., a net average increase of 1.4% per year, versus 2.2%).

The main reasons for this is that the "actual" growth of the population between 1993 and 1997 was less than had been forecasted in 1992. Therefore, the 1997 forecasts start from a lower base and use a shallower trend.

- This difference between the two forecasts (aside from the absence of the demographic component), likely reflects the declines in the crime rate that began in 1991.

The male on-register population increased from 14,353 to 14,747 inmates between 1992 and 1997, a net increase of 394 offenders or nearly 2.7%. An increase of 1,840 male offenders had been projected for this period in the 1992 forecast, or an increase of 12.8%. Therefore, the male on-register population actually increased by only one-quarter of what had been projected in 1992.

The male on-register population is projected to increase from 14,747 offenders in 1997, to 16,865 offenders by 2007, an increase of 2,118 offenders (or 14.4%). The projected net population increase for each Region, by March 31, 2007, is forecasted as follows:

Table 3: Provisional Male On-Register Population Growth, by Region

ATL	QUE	ONT	PRA	PAC	**NAT**
10.7%	12.9%	12.1%	20.6%	13.1%	**14.4%**

For the Regions, the 1998-2007 projections are lower than the 1993-2002 projections in Quebec, Ontario and the Pacific Region. The 1998-2007 and the 1993-2002 projections are very similar for the Prairies Region. The 1998-2007 projection is above the 1993-2002 trend for the Atlantic Region.

The actual male on-register population count has shown some year-to-year variance over this period --- it is premature to say how much of this is due to counting differences associated with the new OMS offender database system. Overall, the 14.4% growth that is projected for the end of 2007 would represent the smallest total increase in the past three decades.

However, this lower rate of growth is consistent with the trend, where the male inmate population growth rate has declined from one decade to the next. This is evident from the table below:

Table 4: Trends in the Growth Rate (Male On-Register Population)

Ten Year Periods	1978-1987	1988-1997	1998-2007
Final Population	12,386	14,747	16,865
Starting Population	9,338	12,386	14,747
Net Increase	+3,048	+2,361	+2,118
Total Increase (%)	32.6%	19.1%	14.4%
Ave. Annual Growth Rate (%)	3.0%	1.9%	1.4%

B. Female Offender On-Register Population Forecast

The absence of time-series data reflecting the new female offender institutions will pose problems for effective forecasting for at least the next five years. The new institutions opened recently in each Region (replacing the central Prison for Women in Ontario) has fundamentally altered the regional location of the female offender population. It will take five years before a new data series sufficiently reflects these changes.

A "special" forecast was conducted in 1993 using "region of sentence" to predict where the likely demand for new facilities would occur. These estimates provide a significantly different regional projection one would get using the actual distributions when the Prison for Women was the main location (this can be seen in APPENDIX B). This approach provides the best estimate we have of historical regional placement.

Note: Data on the actual female offender inmate count (each March 31) is from the institutional census conducted by the Women Offender Services Sector.

The actual female on-register population increased from 314 offenders in 1992, to 335 by 1997, an increase of just 21 female offenders (6.7%). This compares with the 1992 forecast where a gain of 44 female offenders was projected for this period (14%). The actual growth of the female on-register population increased at less than half of the rate projected in 1992.

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The female on-register population is projected to increase from 335 offenders in 1997, to 400 offenders by 2007, an increase of 65 offenders or 19.4%. These interim forecasts indicate an uneven increase across the regions, as shown in the following figures:

Table 5: Female On-Register Population Growth, by Region

ATL	QUE	ONT	PRA	PAC	NAT
36.1%	- 5.6%	30.2%	23.2%	- 9.1%	19.4%

These forecasts are based on provisional estimated time-series. There is no way of checking their validity until real institutional populations can be analyzed from future years. These estimates are a temporary bridge to that future time.

C. Male Aboriginal On-Register Population Forecast

The actual male Aboriginal on-register population has increased at a higher rate than the male non-Aboriginal population. Between 1992 and 1997, the total increase was 36.5% versus only 2.7% for non-Aboriginal males during this period. This increase was also more rapid than was predicted by the 1993-2002 forecast (i.e., from 1,560 to a forecasted 1,873, or 20.1%).

The actual male Aboriginal on-register population increased from 1,560 in 1992, to 2,130 in 1997, an increase of 570 offenders (36.5%). The forecasted increase was a gain of only 313 Aboriginal male offenders in the same period, or only 20%.

The 1998-2007 forecast projects the Aboriginal male on-register population to increase from 2,130 in 1997 to 2,946 by 2007, a gain of 816 offenders (38.3%).

Overall, the projected population growth will continue at a higher rate for male Aboriginal offenders, with some variation by region. In the Atlantic and Ontario Region, the forecasted growth will be less than the national average, while the Prairie and Pacific Region growth is forecast to exceed the national rate. The increase forecasted for Quebec Region is very high, a projection that may have been exaggerated by the rapid increase experienced over just the past few years. The projected regional growth to 2007 is as follows:

Table 6: Male Aboriginal On-Register Population Growth by Region

ATL	QUE	ONT	PRA	PAC	NAT
21.7%	67.1%	25.4%	41.3%	56.1%	38.3%

According to these projections, the male Aboriginal on-register population will represent nearly 18% of the total male on-register offender population by 2007 (nearly 3,000 of the projected 17,000 male on-register population).

D. Total Community Supervision Population Forecast

The supervision population models from the OPF are based on a regression (simple moving average) approach. When we tested the fit of various trend models for each of the 24 possible series (i.e., Table 3, below), however, we were not very successful. This confirms that trend models are not the best models to use for forecasting the supervision population.

Table 7: Historical Community Supervision Population

SERIES MODEL TYPE AND R^2	ATLANTIC	QUEBEC	ONTARIO	PRAIRIE	PACIFIC	NATIONAL
DAY PAROLE	Damped Exponential Smoothing 0.583	Damped Exponential Smoothing 0.722	Damped Exponential Smoothing 0.617	Linear Trend 0.255	Random Walk with Drift 0.292	Damped Exponential Smoothing 0.712
FULL PAROLE	Damped Exponential Smoothing 0.756	Damped Exponential Smoothing 0.653	Damped Exponential Smoothing 0.867 *	Log Linear Trend 0.741	Damped Exponential Smoothing 0.667	Damped Exponential Smoothing 0.834 *
STATUTORY RELEASE	Linear (Holt) Exponential Smoothing 0.352)	Linear Trend 0.791	Log Damped Exponential Smoothing 0.831 *	Log Linear Trend 0.184	Log Damped Exponential Smoothing 0.703	Linear (Holt) Exponential Smoothing 0.761
SUPERVISION TOTAL	Simple Exponential Smoothing 0.044	Damped Exponential Smoothing 0.786	Damped Exponential Smoothing 0.908 *	Damped Exponential Smoothing 0.459	Log Damped Exponential Smoothing 0.775	Damped Exponential Smoothing 0.886 *

Of the 24 different time-series that were modeled, a satisfactory goodness-of-fit could only be found for only 5 individual series. For each series, we show the best trend model we could obtain, along with the relevant r^2 test and the model type (see Table 3).

This supports the view that most of these series are not trended. The tests shows only 5 models have an r^2 score greater than 0.800, the minimum level we set as

acceptable. More important, the actual projections derived from these trend models may not be very useful for planning purposes.

The actual supervision population peaked in 1994 and has declined in each of the three years since. A trend model will be biased toward the most recent information, and will therefore project these recent declines forward into the future. However, beyond a certain point this is unrealistic while the institutional population is still growing. This anomaly indicates that a simple trend model cannot be relied upon for forecasting the community population. A different model (i.e., the accounting approach) will be used in OPPSIM.

In light of these comments, caution is urged when interpreting the interim forecast that is provided. For this report, a forecast is provided only for the "total" supervision population.

The actual total community supervision population decreased from 9,673 in 1992, to 8,773 by 1997, a decrease of 900 offenders (-9.3%). In comparison, the 1992 forecast projected a gain of 1,162 offenders in the same period (or about +12%; see Appendix D).

The 1998-2007 forecasts the total community supervision population to increase at a much slower rate relative to 1992. The projected population will rise from 8,773 in 1997 to 9,539 by 2007, a gain of 766 offenders, or almost 9%.

Once again, there is considerable regional variation in these forecasts (shown below):

Table 8: Provisional Community Supervision Population Growth, by Region

ATL	QUE	ONT	PRA	PAC	**NAT**
-18.5%	22.8%	-2.3%	16.5%	7.6%	**8.7%**

A new forecasting model for the community supervision population is being developed for **OPPSIM**. The use of a time-series approach for the supervision population has been recognized as inadequate for a number of years, and this will be abandoned. The inadequacies were not obvious when the supervision population was growing, but become immediately apparent when there is a period of decline. The new

approach will take account of the flow between custody and supervision (e.g., where admissions predict releases, with a suitable delay).

One should not place too much confidence on the individual community supervision population series. For this reason, only projections for the total community supervision population are provided in Appendix D.