

PROJECTING THE ORDER OF MILITARY MERIT POPULATION. AN APPLICATION OF THE COHORT-COMPONENT METHOD.

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Abstract: *In 1972 the Canadian Armed Forces (CAF) created the Order of Military Merit (Order) to honor members who have demonstrated conspicuous merit and exceptional service. Despite efforts to ensure appointments to the Order were representative of the entire CAF, a 2007 study found that appointments had become concentrated at senior ranks. In response to this study, new nomination guidelines were released in 2007 and then augmented in 2010. The 2010 guidelines yielded some early positive results; however, the average years of service (YOS) at appointment target has not been met. The Order's advisory council requested a population forecast of the Order to determine the impact on the size and YOS profile of the serving Order population if the typical YOS at appointment is reduced to 18 to 23 years. This paper presents the methodology used to model the Order population and discusses the impact of appointing members to the Order earlier in their career.*

Key words: cohort-component, population projection, population model, population dynamics, order of military merit, military honors and awards.

1. INTRODUCTION

The Order of Military Merit (Order) is an honor which recognizes conspicuous merit and exceptional service of members of the Canadian Armed Forces (CAF). When it was first created in 1972, the Chief of Defence Staff (CDS) explained to the nominating commands that while merit was the overriding criterion

the order would only be meaningful to the public and

members of the CF [1] if appointments were representative of the entire CF and not limited to a specific environment, command, linguistic group, occupation or rank [2].

Despite efforts to ensure appointments to the Order were representative of the entire CAF, a 2007 study found that appointments were increasingly concentrated at senior ranks for both officers and non-commissioned members

(NCMs). Consequently, the average years of service (YOS) of appointees had increased from less than 12 years in 1972 to 29 years in 2007 and the perception of the award became such that it was only for high ranking members [3].

In response to the 2007 study, CANFORGEN 188/07 was released to reiterate the basic principles of the Order and the advisory board's desire "*to see a broader distribution of nominees among all ranks*" [4]. In addition, a benchmark of 18 to 23 YOS was set when considering candidates for initial appointment. The motivation for this benchmark was to "recognize people at the peak of their career rather than at retirement" [5], which would increase the visibility of Order members among the serving CAF population, allow appointees to serve as role models for a longer period, and increase opportunities for advancement within the Order.

By 2010, the average YOS of appointees decreased to 26.1 years; however, rank representation remained a concern [6]. The CDS then released CANFORGEN 056/10 with more specific guidelines about how nominations should be distributed among the ranks [7]. The new guidelines yielded early positive results in terms of CAF representation; however, the average YOS of appointees did not decrease

further and was 26.3 years in 2016 [8].

Recognizing that it takes time for new trends to manifest, the Order's advisory council requested a population forecast to determine the impact on the size and YOS profile of the serving Order population if the typical YOS at appointment is reduced to 18 to 23 years. The aim of this paper is to present the methodology used to model the Order population and discuss the projected impact of appointing members to the Order earlier in their career. The focus of this study was on the Regular Force (Reg F) only.

2. METHODOLOGY

Statistical agencies across the globe employ the cohort-component method to produce population projections [9, 10, 11]. Populations are divided into cohorts by age and sex and can be further subdivided based on other demographic attributes. The cohort-component technique uses assumptions about demographic components of change, which are projected separately by cohort, to produce population projections. In general, the demographic components that impact the size of a population (or cohort) are deaths, births, immigration, and emigration. In addition to changes in these components, the size of the population at the beginning of a time

interval will impact the projected population size at the end of the time interval.

In the case of projecting the Order population, the components that affect the population size are attrition and appointments, which are analogous to deaths and births, respectively (1). In the CAF, YOS has been found to be a strong predictor of attrition [12]. Furthermore, in order to project the impact of YOS at appointment on the size of the Order population, the YOS of new appointees must be modelled. Therefore, Order cohorts are based on YOS rather than age and sex. As such, the cohort-

2.1. Data

Two databases were used for this study: the Director General Military Personnel Research and Analysis (DGMPPRA) historical personnel database and Monitor Mass (MM). The DGMPPRA database maintains historical records of CAF Reg F personnel; however, it does not include data on Honours & Awards, including appointments to the Order. MM does include data on Honours & Awards; however, only records of currently serving members of the CAF can be extracted from MM. Therefore, the DGMPPRA database was used to retrieve historical Reg F



Figure 1: Algorithm to project Order population.

component model applied in this study can be expressed as:

$$\text{population}_t[m] = \text{population}_{t-1}[m-1] + \text{appointments}_t[m] - \text{attrition}_t[m]$$

where m is YOS measured at the end of year t .

The sequence of steps required to project the Order population is depicted in **Figure 1**. Each of these steps will be discussed in detail in the sections that follows. First, the sources of data used in this study are discussed.

data and MM was used to retrieve current Order population data.

a. Initial population

The starting point for the Order population projection was taken as the total number of Reg F Order members at each YOS point as of the end of fiscal year 2017/2018 (FY 17/18).

The initial population is denoted as: $\text{population}_0[m-1]$,
 $\text{population}_0[m-1]$
 where $(m-1) \in [0,45]$

$$(m - 1) \in [0,45].(1)$$

b. Attrition

Projected attrition volume by YOS is calculated by applying YOS-based attrition rates to the projected population. For this study, it was assumed that the attrition rates for Reg F Order appointees would be the same as for the Reg F population in general at each YOS point. In order to minimize the effects of year-to-year fluctuations in attrition, five years of historical attrition data (from FY 12/13 to FY 16/17) were used to generate weighted average attrition rates (WAAR). The formula used to calculate WAAR by YOS is:

$$WAAR[m] = \frac{\sum_{t=1}^T attrition_t[m]}{\sum_{t=1}^T population_{t-1}[m-1]} \quad (2)$$

where $attrition_t[m]$ is the attrition volume in year t for members having m YOS at the end of year t ; and $population_t[m]$ is the population with m YOS at the end of year t .

It is assumed that all appointments occur once per year, at the end of the year, which is consistent with Order practices. Therefore, new appointees are not subjected to attrition in their year of appointment. Appointments are

discussed further in the following section. The projected attrition volume in year t for members with m YOS can then be expressed as:

$$attrition_t[m] = WAAR[m] * population_{t-1}[m-1]$$

$$attrition_t[m] = WAAR[m] \times population_{t-1}[m-1]. \quad (3)$$

c. Appointments

The annual number of appointments to the Order is a function of the size of the CAF population; specifically, 0.1% of the size of the CAF in the preceding year [13]. Historically, appointments are not distributed among CAF components based on each component's share of the CAF population. Trends show the Reg F receives about 85% of appointments; the Primary Reserve (P Res) receives about 15%; and the other sub-components of the Reserve Force (Res F) (i.e. Rangers, and Cadet Organizations Administration and Training Services) receive less than 1% [14]. Therefore, projections for the size of the entire CAF population (not only the Reg F) are required to project the number of annual appointments. Projections for the Reg F and P Res were retrieved from an internal strategic planning model, which takes into consideration Reg F and P Res strength targets and institutional capacity for recruitment and training

[15]; and the populations of the other Res F sub-components were assumed to remain constant.

YOS was assigned to projected appointments based on a probability distribution for YOS at appointment. Three different scenarios were considered. The first scenario, *S1: Historical*, which served as a baseline from which to compare the other scenarios, assigned YOS to projected appointments in accordance with the historical YOS at appointment distribution. This distribution is based on appointments of Reg F members to the Order from 2012 to 2017, as decoration dates prior to 2012 are unreliable. Due to data limitations, this distribution is based only on YOS at appointment data for members still serving in the CAF (2). As shown in **Figure 2**, historically, the majority (51%) of appointments occur between 24 and 29 YOS. For the second scenario, *S2: Shift 3yrs*, the historical YOS at appointment distribution was shifted down by three YOS, such that the majority of YOS assignments would be between 21 and 26 YOS. Similarly, for the third scenario, *S3: Shift 6yrs "Target"*, the historical YOS at appointment distribution was shifted down by six years. This scenario was labeled "Target" because the majority of YOS assignments are between 18 and 23

YOS, which was the target set by the Order advisory committee.

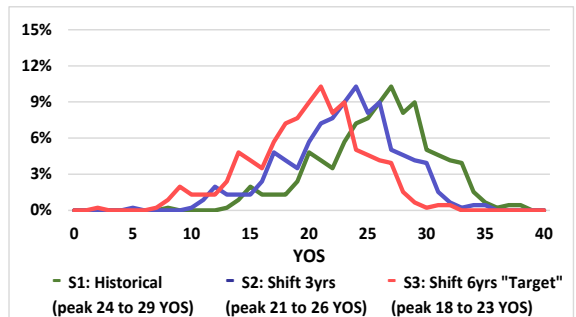


Figure 2: Distribution of YOS at appointment scenarios.

The projected volume of Reg F appointments to the Order in year t with m YOS is expressed as:

$$appointments_t[m] = \gamma[m] * (R * 0.001 * CAF_{population_{t-1}})$$

$$appointments_t[m] = \gamma[m] \times (R \times 0.001 \times CAF_{population_t}) \quad (4)$$

where R is the share of Reg F appointments and $\gamma[m]$ is the proportion of appointees assigned m YOS at appointment.

d. Projected population

The serving Order population for a given year is projected for each YOS cohort using **Equation 1**. This population then becomes the initial population for the next year and the sequence of calculations is repeated until the population has been projected for all years of interest.

3. ANALYSIS

Three scenarios were modelled to investigate the impact of appointing members to the Order earlier in their career than the historical norm. Each scenario

their career than the historical norm. Consequently, the average YOS of the Order population still serving in the Reg F in five FYs will be lower.

The results also show that if members are appointed earlier in their career, then the size of the

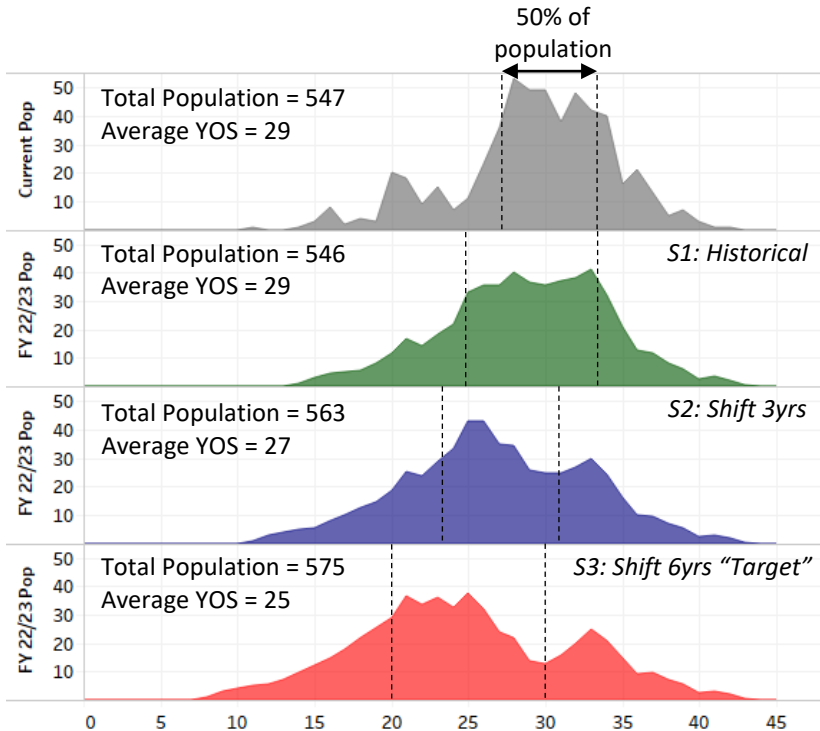


Figure 3: Current and projected population profiles by YOS.

projects the Order population by YOS from FY 18/19 to FY 22/23. **Figure 3** shows the initial Order population and the resulting population projections for FY 22/23 by scenario. It illustrates that the peak in the population profile by YOS shifts to the left if members are appointed to the Order earlier in

serving Order population in five FYs will be greater. This is due to decreased attrition: as the population profile by YOS shifts to the left, there are fewer members at the highest attrition points and more members at lower attrition points, resulting in an overall decrease in attrition. This can be seen in **Figure**

4, which shows that for *S2* and *S3*, attrition of members with 0-29 YOS is expected to increase over the next five FYs, while attrition of members with 30+ YOS is expected to decrease such that total attrition decreases. More specifically, if the distribution of YOS at appointment is reduced by three years or six years, then by FY 22/23:

- the average YOS of the serving Order population will decrease to 27 or 25, respectively, versus remaining at 29;
- there will be 17 or 29 fewer cumulative releases, respectively; and
- the serving Order population size will increase to 563 or 575, respectively, from the current size of 547.

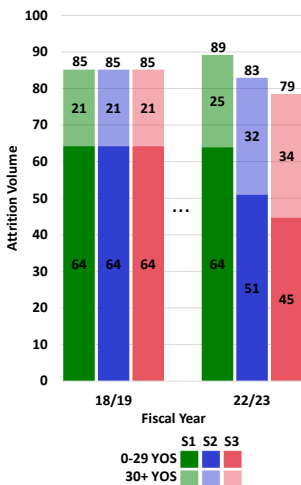


Figure 4: Projected attrition volume by YOS group: FY 18/19 and FY 22/23.

4. CONCLUSION AND REMARKS

The cohort-component method can be adapted to model various population dynamics. This technique allows analysts to investigate how variations in the change components impact population projections. For the purposes of this study, YOS at appointment distributions were varied to determine the impact on the size and YOS profile of the serving Order population. It was found that if YOS at appointment trends shift such that members are generally appointed sooner, then:

- the peak in the YOS profile of the serving Order population will shift and the average YOS will decrease;
- the number of members at the highest attrition points will decrease and the number of members at lower attrition points will increase, resulting in lower attrition overall; and
- the size of the serving Order population will increase.

The accuracy of a cohort-component projection is dependent on the accuracy of data on the demographic components of change. Data regarding members of the Order who have released from the CAF were not available for this study. Therefore, the results of this study are dependent on whether the YOS at appointment distribution of

currently serving Reg F Order members is representative of the whole Order and whether the attrition behavior of Order members is consistent with the attrition behavior of Reg F population members in general.

ENDNOTES

(1) Order members from the Reserve Force (Res F) who transfer to the Reg F could be considered analogous to immigration; however, this is a negligible contributor to the Reg F Order population, and therefore was not considered in this study.

(2) To ensure that this limitation would have a negligible impact on the results, the average YOS at appointment was computed and verified against documented historical YOS at appointment averages.

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