

# Getting Started With DG-Sim

Apex Resource Management Solutions

[www.apexrms.com](http://www.apexrms.com)

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This brief tutorial will provide you with an overview of how to get started using **DG-Sim**. Additional background information on **DG-Sim** can be found at [www.apexrms.com/caribou-simulation-model](http://www.apexrms.com/caribou-simulation-model)

## Step 1: Install DG-Sim

**DG-Sim** is a *module* within the [SyncroSim](#) simulation modeling framework; as such running **DG-Sim** requires that the **SyncroSim** software be installed on your computer.

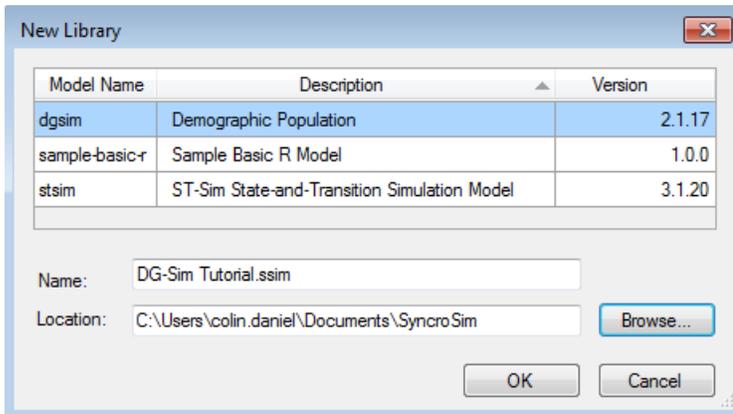
1. To install **DG-Sim**, follow the instructions at [www.apexrms.com/dg-sim-download/](http://www.apexrms.com/dg-sim-download/)
2. Once installed, open the **SyncroSim** Windows application.

## Step 2: Setup a DG-Sim project

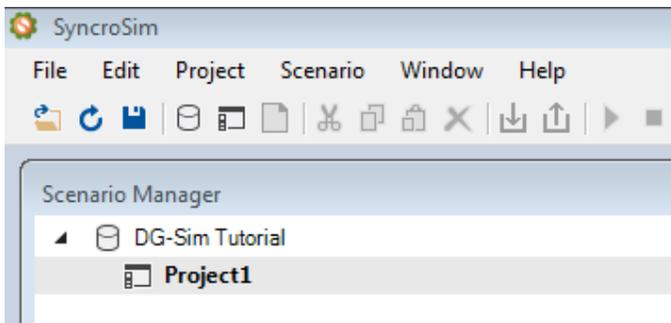
A *Library* in **DG-Sim** is a database of model inputs/outputs (saved as a single file with the extension *.ssim*), which contains one or more *Projects*. Each *Project* is typically associated with a particular wildlife population. Typically a population is divided into multiple age/sex classes, each of which can be assigned different demographic parameters. A suite of model inputs in **DG-Sim** is referred to as a *Scenario*.

As an alternative to the steps below, which involve creating a model from scratch, a complete **DG-Sim** library file, with all the steps in this tutorial already completed, is available for download [here](#). Once downloaded you can double-click on this *dg-sim-tutorial.ssim* file (from **Windows Explorer**) to load this Library directly in SyncroSim. You can then skip directly to Step 4.

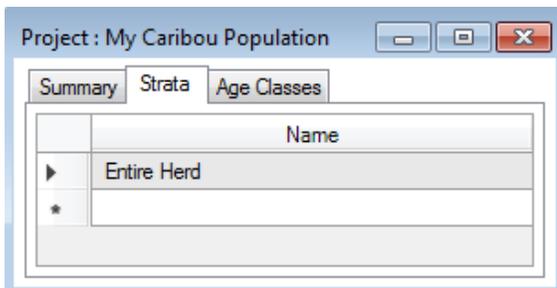
1. From within the **SyncroSim** application, select the **File | New Library** menu to create a new DG-Sim model Library.



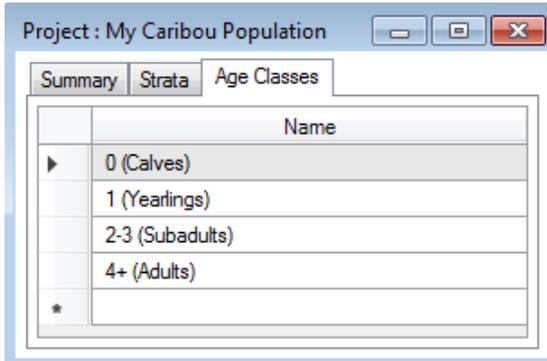
2. Highlight **dgsim** as your **Model Name**; name your new library **DG-Sim Tutorial.ssim** and **Browse** to the location where you would like to save the library. Then click **OK**.
3. The **Scenario Manager** window will display the new library you have created with a default Project named **Project 1**.
4. Right click on the Project called **Project1** and **Rename...** it to **My Caribou Population**.



5. You begin by defining the strata (or sub-populations) and age classes that you plan to model for your population. Right-click on the **My Caribou Population** Project and select **Properties**. On the **Strata** tab enter **Entire Herd** as the name of the single population (i.e. no sub-populations) you are modeling.



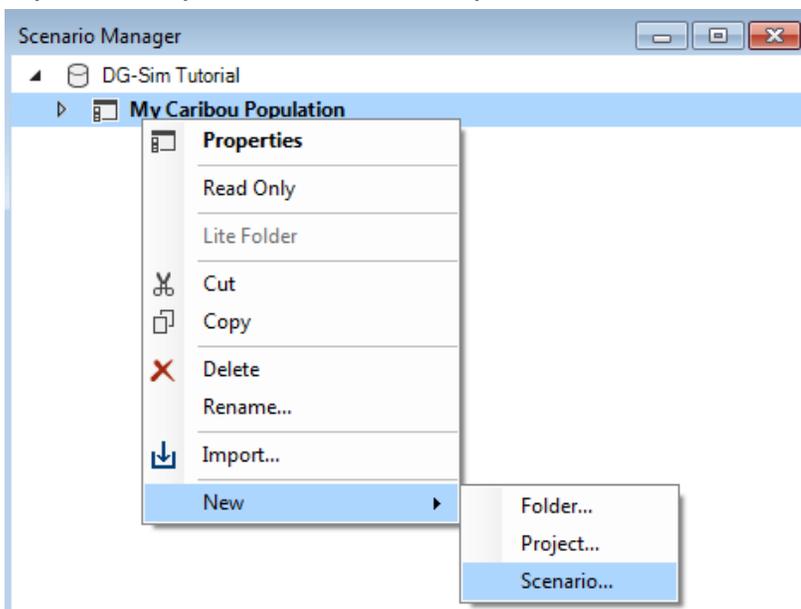
6. Still in **Properties** for this Project, switch to the **Age Classes** tab and define the following age classes:



You will be able to define demographic parameters and report output for each of these age classes. Close the **Project: My Caribou Population** window.

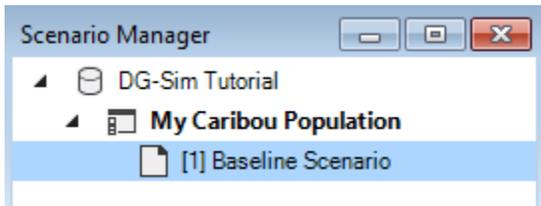
### Step 3: Parameterize a model scenario

1. Having defined the structure of your model (using **Project Properties**), you will now setup a Scenario of model inputs. In the **Scenario Manager** window, right click again on the **My Caribou Population** Project and select the **New | Scenario** menu.

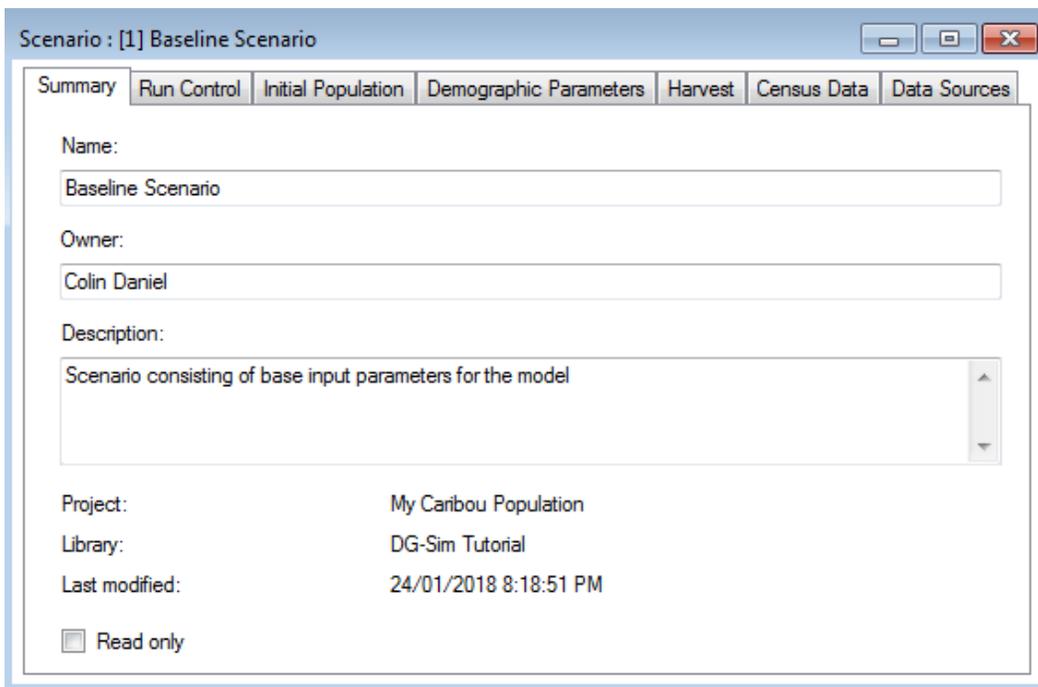


2. **Name** your Scenario **Baseline Scenario** and optionally give it an Author and Description. Click **OK**.

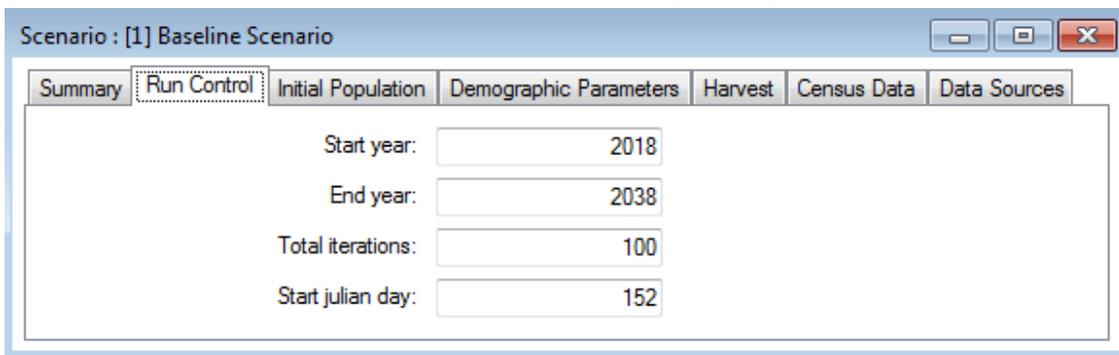
- To open this new Scenario, in the **Scenario Manager** window click on the arrow to the left of the **My Caribou Population** Project to expand the contents of this node and uncover the newly created Scenario called **Baseline Scenario**.



- Right click on the **Baseline Scenario** and select **Properties** to then open this Scenario and set its properties.



- Click first on the **Run Control** tab and select to run for 20 years, starting in the year 2018 on Julian day 152 (June 1<sup>st</sup>), and repeated for 100 Monte Carlo iterations. The **Start Julian day** represents the date at which the simulation begins each year, as well as the parturition (i.e. birth) date for females, and the date at which model output is reported.



6. Click on the **Initial Population** tab and enter the values shown below:

Scenario : [1] Baseline Scenario

Summary Run Control Initial Population Demographic Parameters Harvest Census Data Data Sources

Initial population size:

|                    |        |
|--------------------|--------|
| Mean               | 50,000 |
| Minimum            | 48,000 |
| Maximum            | 57,000 |
| Standard Deviation | 1,0000 |

Initial population distribution:

|   | Sex    | Minimum Age | Maximum Age | Relative Amount |
|---|--------|-------------|-------------|-----------------|
| ▶ | Female | 0           | 0           | 6.0000          |
|   | Female | 1           | 1           | 5.0000          |
|   | Female | 2           | 3           | 9.0000          |
|   | Female | 4           | 10          | 35.0000         |
|   | Male   | 0           | 0           | 6.0000          |
|   | Male   | 1           | 1           | 5.0000          |
|   | Male   | 2           | 3           | 9.0000          |
|   | Male   | 4           | 10          | 25.0000         |
| * |        |             |             |                 |

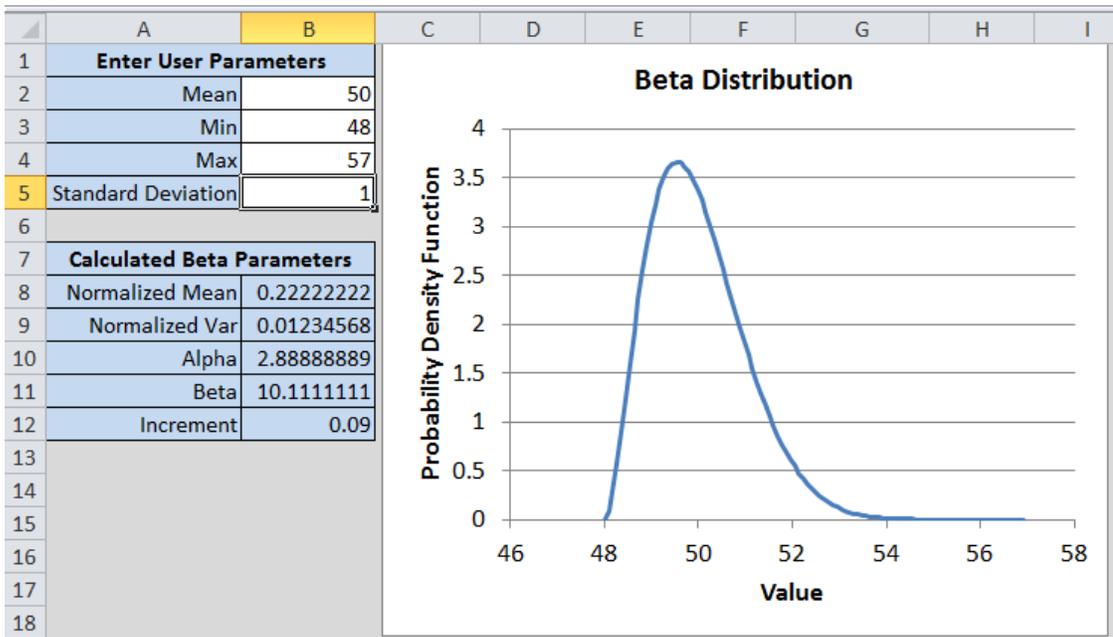
Context Menu:

- Cut
- Copy
- Paste
- Select All
- Delete
- Delete All
- Import
- Export
- Export All
- Stratum
- Sex

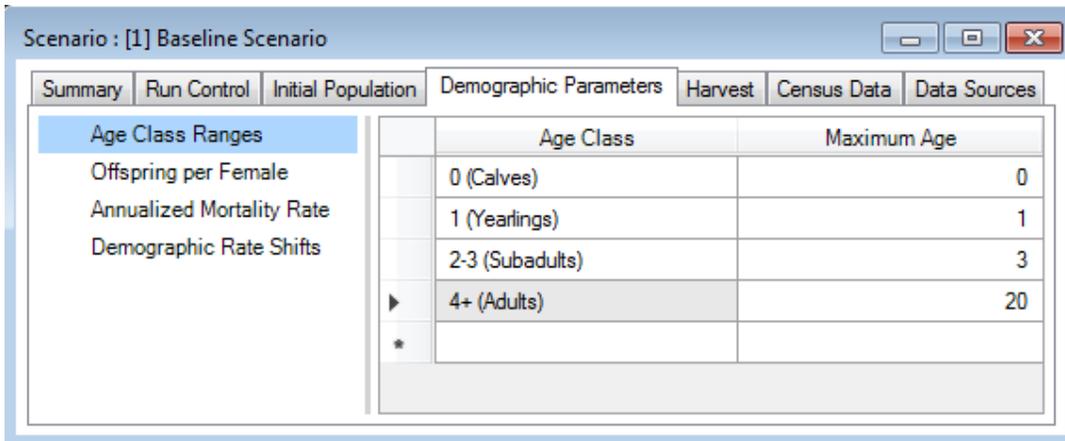
The information in the top table represents census data on the total population size observed at the start of the simulation (i.e. corresponding to June 1<sup>st</sup> 2018). This information includes the estimated mean population size, as well as measures of variability representing the minimum, maximum and standard deviation of this estimate. At runtime, the model will sample from a [Beta distribution](#) fitted to these parameters in order to set the initial total population size for each Monte Carlo iteration.

The information on the bottom table represents the age and sex distribution at the start of the simulation. Note that the optional **Sex** column is initially hidden; as with all optional columns in **DG-Sim**, to display it you simply right-click anywhere on the table's column header and select **Sex** to toggle this column on (as shown above).

Note that it can sometimes be challenging to come up with combinations of parameters that result in meaningful beta distributions. To help estimating beta distribution parameters, we suggest you download and the following [Excel file](#) to help visualize your beta distribution:

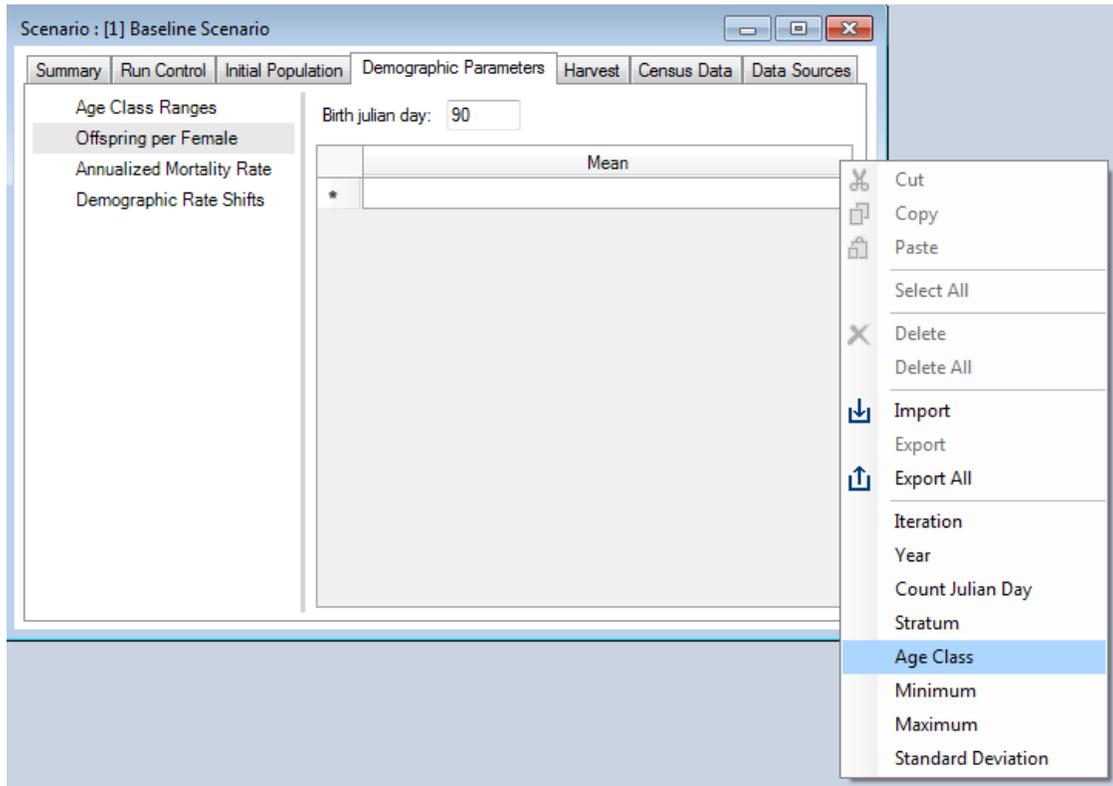


- Next click on the **Demographic Parameters** tab and select the **Age Class Ranges** option on the left. Then define the following maximum ages for each age class:

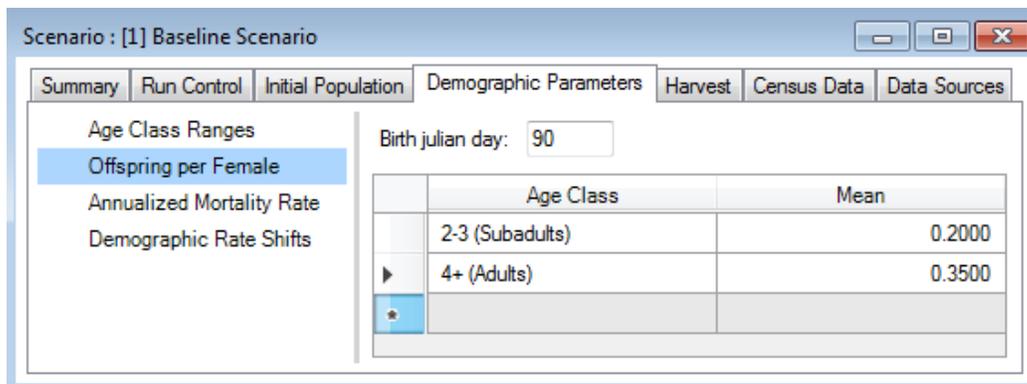


Note that while at runtime the model tracks every individual age (i.e. 0, 1, 2, 3, 4, 5...), the age classes defined here are used only to streamline the process of entering model inputs and reporting outputs. Note that the individuals that reach an age higher than the maximum age for the oldest age class will still be assigned to the oldest age class.

- Still under the **Demographic Parameters** tab, click on **Offspring per Female** to the left. The values entered here define the number of offspring per female born on a specified Julian Day.



- Begin by entering Julian Day 90 (i.e. June 1<sup>st</sup>) as the **Birth julian day**. This is the day on which calves are born in the model. Then right-click on the column header of the table, and in the context menu select **Age Class** (as shown above) to toggle on the optional **Age Class** column. Then enter the values shown below:



These values specify that sub-adult females have on average 0.2 and adult females have 0.35 offspring on Julian Day 90. Note that if the **Julian Day** is not specified the value is assumed to be the same as the start **Julian Day** defined in the **Run Control** screen. Note also that, by including additional optional fields, the number of offspring per female can be made to vary over time, and can be sampled from a beta distribution.

- Still under the **Demographic Parameters** tab, click on **Annualized Mortality Rate**. The values entered here define mortality rates (excluding harvest mortality). Right-click on the table and in the context menu select **Year**. Repeat the context menu selection to also add the following optional columns: **Minimum**, **Maximum** and **Standard Deviation**. Then enter the values shown below:

|  | Year | Mean   | Minimum | Maximum | Standard Deviation |
|--|------|--------|---------|---------|--------------------|
|  | 2018 | 0.1000 | 0.0100  | 0.2000  | 0.0300             |
|  | 2023 | 0.0800 | 0.0100  | 0.1600  | 0.0300             |
|  |      |        |         |         |                    |

In this example mortality between 2018 and 2022 is modelled to be on average 10% per year, sampled from a beta distribution with a minimum of 1%, a maximum of 20%, and a standard deviation of 3%. From 2023 onwards, mortality is modeled to be on average 8% per year, sampled from a beta distribution with a minimum of 1%, a maximum of 16%, and a standard deviation of 3%. Note that mortality can optionally also vary between age and sex classes.

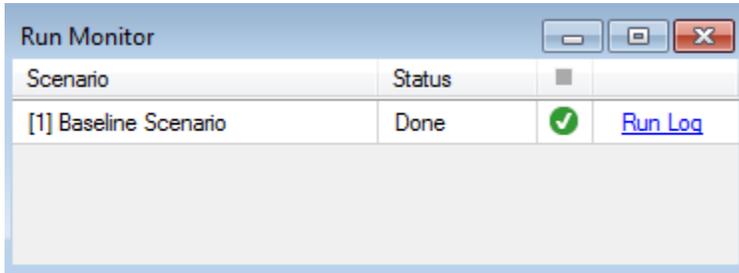
- Next click on the **Harvest** tab. By default the harvest is specified as a number of individuals harvested per year (although it can also be specified as a rate using the **Options** menu on the left). Between 2018 and 2025 we set the harvest at 100 females and 100 males per year; from 2026 onwards we set it to 50 females and 200 males per year. Toggle on the required optional fields (i.e. **Year** and **Sex**) and enter the information shown below:

|  | Year | Sex    | Mean     |
|--|------|--------|----------|
|  | 2018 | Female | 100.0000 |
|  | 2018 | Male   | 100.0000 |
|  | 2023 | Female | 50.0000  |
|  | 2023 | Male   | 200.0000 |
|  |      |        |          |

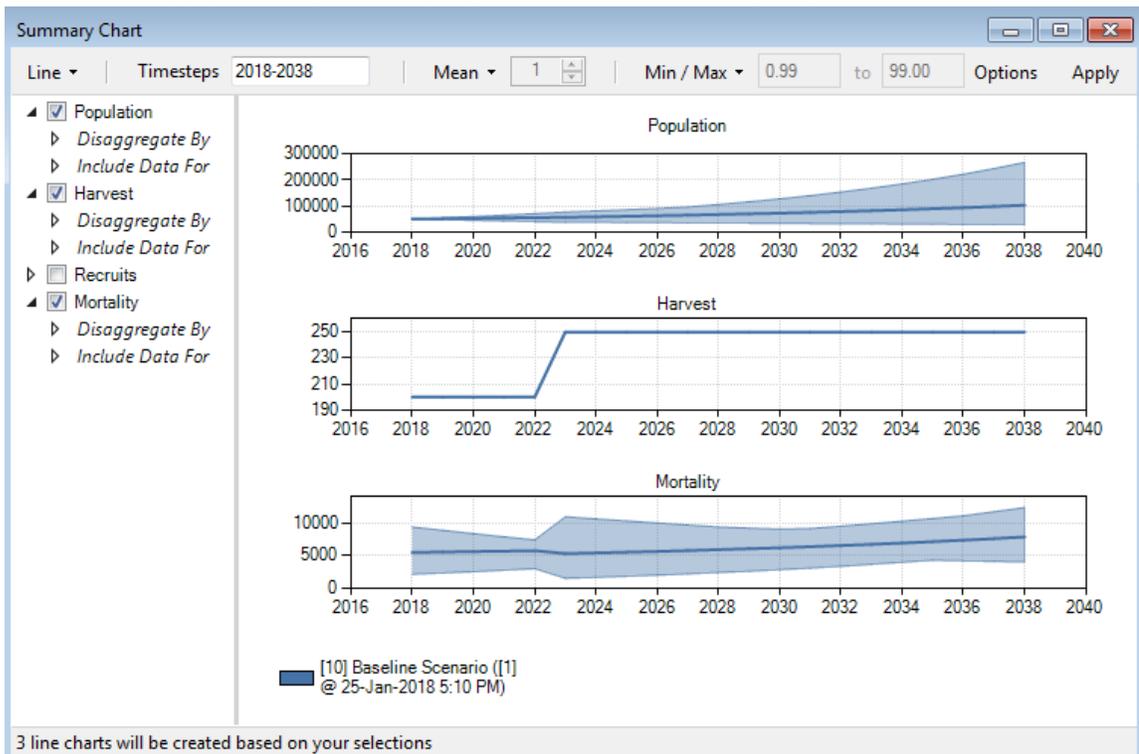
- Close the **Scenario: [1] Baseline Scenario** Window, then select the **File | Save** menu. You are now ready to do your first run of the model.

## Step 4: Run the model and view results

1. Right-click on the **Baseline Scenario** in the **Scenario Manager** window and select **Run** from the context menu. If prompted to save your project click **Yes**. The run should complete quickly. If the run is successful you will see a Status of **Done** in the **Run Monitor** window, at which point you can close the **Run Monitor** window; otherwise click on the **Run Log** link to see a report of any problems, make any necessary changes to your Scenario, and then re-run the Scenario.



2. To view results for your run, move to the **Charts** tab at the bottom left of the **Scenario Manager** screen and click on the  icon to create a new Chart. Name your new chart **Summary Chart** and click **OK**.
3. In the **Summary Chart** window, select **Population**, **Harvest** and **Mortality** as variables to display, then change the **None** option at the top of Chart window to **Min/Max** (to display error bars). Click on the **Apply** button (at the top right of the Chart window) to generate the chart.



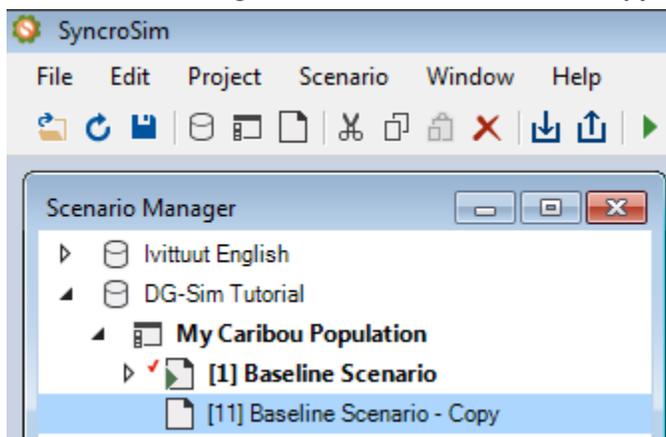
Note that, due to the uncertainty in **Mortality** rates, there is a lot of variation between Monte Carlo iterations in the **Population** projections. However because we did not specify any uncertainty in our future **Harvest** levels, the projections for **Harvest** are the same across all iterations.

4. Next select the **Reports** tab from the bottom of the **Scenario Manager** window (i.e. beside the **Charts** tab). Double click on **Population Size Summary** to generate a file with the model population projections (in either Excel or CSV format). By default an Excel file should open automatically (look for it on your Windows Task Bar) showing the projected number of individuals in each age/sex class by iteration and timestep.

### Step 5: Create a new scenario and compare results

In this final step we will copy the **Baseline Scenario** and double the harvest level. We will then compare results for the baseline and updated scenarios.

1. Return to ST-Sim, right-click on the **Baseline Scenario** Scenario in upper part of the **Scenario Manager** window, and select **Copy** from the context menu. Next right-click on the **My Caribou Population** Project and select **Paste** from the context menu. A new Scenario should appear in the **Scenario Manager** called **Baseline Scenario – Copy**.



2. Open this scenario and under the **Summary** tab rename it to **4X Harvest Scenario**. You can also update the **Description** accordingly if you like.

- Click on the **Harvest** tab for this Scenario and increase all the harvest values by a factor of 4:

Scenario : [11] 4X Harvest Scenario

| Annual Harvest Options | Year | Sex    | Mean     |
|------------------------|------|--------|----------|
|                        | 2018 | Female | 400.0000 |
|                        | 2018 | Male   | 400.0000 |
|                        | 2023 | Female | 200.0000 |
|                        | 2023 | Male   | 800.0000 |

- Close this Scenario. In the upper part of the **Scenario Manager** window, right-click on the new **4X Harvest Scenario** Scenario and select **Run** from the context menu.
- The run should complete quickly. You should now see results for both the **Baseline Scenario** and **4X Harvest Scenario** in your **Summary Chart** (you may need to re-open the Summary Chart under the **Charts** tab at the bottom of the **Scenario Manager** window and/or re-run the **Baseline Scenario**). Notice how the increased harvest has led to a compensatory decrease in natural mortality, resulting in similar population projections for both Scenarios.

