Sub-council Area Projections in Scotland using POPGROUP v4.0 software
Guidance: Population Projections

WARNING: Do not convert Excel files to more up-to-date version. The software only works with .xls.

Date: Published 23 March 2016

Contents

1. Before starting 2
1.1. Background 2
1.2. Software 2
1.3. Methodological notes 2
1.4. POPGROUP inputs and data sources 3

2. The strategy for these small area projections 6

3. POPGROUP model setup 7
3.1. POPGROUP model_setup 7
3.2. Check the setup 11

4. Data preparation and the training projection 13
4.1. Allocation of data to small areas 13
4.2. Local age-specific fertility and local age-sex-specific mortality 13
4.3. Base population 13
4.4. Constraining the population estimates 14
4.5. Births and fertility 15
4.6. Deaths and mortality 15
4.7. Migration 16
4.8. Special populations 17
4.9. Prepare the training projection scenario 17
4.10. Run the training projection 19

5. Developing input files that reflect recent local experience 21
5.1. Fertility - if no local fertility schedules have been used 21
5.2. Mortality - if no local mortality schedules have been used 23
5.3. Fertility and mortality - if local schedules have been used 26
5.4. Migration 28
5.5. Constraints 36
5.6. Special populations 37

6. The migration-led projection - constrained 38
6.1. Prepare the scenario 38
6.2. Run the projection 40

7. The migration-led projection - unconstrained 41
7.1. Running the projection without the SNPPs as a constraint 41

File amended from previous Fife 2010 guidance available on the NRS website.

1. Before starting

1.1. Background

This document containing advice on how to use POPGROUP V4.0 to produce Sub-council Area Projections (SCAP) in Scotland has been created as the result of a project funded by the Scottish Government Statistics Development Fund to produce and evaluate a set of projections for 301 small areas in Scotland. The National Records of Scotland (NRS) SCAP project was a one-off investigation running from June 2015-March 2016. The work was undertaken in consultation with a sub group of the Population and Migration Statistics (PAMS) Committee, the Projections Sub-Group, and information was published on the NRS website.

- The main report for this project, published on 23 March 2016, is available on the population and household sub-council area projections section on the NRS website.
- Papers on the project are available in the Projections Sub-Group section of the NRS website.
- Papers from the Projections Sub-Group meeting on 19 August 2015 are also available in the Projections Sub-Group section of the NRS website.
- Background to the project is available in a paper to PAMS on 6 May 2015 on the inception of sub-council area population and household projections.

This built upon a previous project which looked at producing small area projections using POPGROUP software for Fife council area. The documentation for the Fife Project is available on the NRS website (PDF).

1.2. Software

The software used for the project was POPGROUP V4.0.

Guidance for using POPGROUP is available listed under 'Manuals' on the University of Manchester website. POPGROUP can be purchased from Edge Analytics.

1.3. Methodological notes

Which small areas?

POPGROUP V4.0 allows up to 40 areas in one model.

The small areas will normally cover the whole of one council area in Scotland. It is possible to use the same method to make population projections for small areas that do not cover the whole of a council area, or cover more than one council area. However, in this user guidance document, the method detailed to estimate local population projections assumes that areas cover one council area completely and without overlap.

If several sets of small areas are to be projected, then a different model will be needed for each. This guidance should be followed for each set.

How small?

The projection procedures will work for small areas of any population, but are not as robust for small populations as for larger populations. Smaller populations often change from year to year in ways which differ from past trends. This volatility can affect the projection and recent changes can be exaggerated. As a rule of thumb, generally projections for populations of fewer than ten thousand could be considered more prone to errors though NRS have found that projections for smaller populations can appear reasonable when used with care.

Special populations

The projection may be less reliable if a sizable non-standard population is present. This might include a prison, boarding school, student hall of residence or armed forces base with approximately five per cent or more of the local population. The difficulty arises because such populations maintain their age-structure through replacement of those who leave; migration data available for small areas does not model this replacement precisely. The projections must be examined and used with caution for areas with large 'special populations'.

One strategy is to estimate the size of such a special population and make assumptions about its future size, outside of the projection of the rest of the population. An independent projection of these special populations can then be incorporated within the POPGROUP framework, using the Special Populations sheet in the Model Setup (described in the POPGROUP manual). However, care must be taken when computing the fertility, mortality and migration rates to be applied to the remainder of the population and it may be more practical to run the projection model without explicitly extracting special populations.

1.4. POPGROUP inputs and data sources

Three stages were used to produce the projections. Stage 1 is the preparatory 'training' projection which identifies past trends. Stage 2 uses the outputs from stage 1 in order to calculate local fertility and mortality differentials and to determine net migration and other changes. In stage 3, the assumptions determined in the previous two stages are fed into the migration-led projection. The data required for each stage are summarised below.

(a) Stage 1 - Inputs for the training projection (2001-2012)

Data available on request from NRS[1].

Note: The latest file of standard rates is included in the installation process so should not need to be changed (they can be downloaded from the University of Manchester website).

Footnote

1) Except armed forces and student data.

- **Popbase1.xls**
  Small Area Population Estimates (at 30 June 2001) by single year of age / sex / data zone[2]

- **Cons1.xls**
  Small Area Population Estimates 2002-2012 (at 30 June) by single year of age / sex / ward

- **Fert1.xls**
  Births (at 30 June) by ward total / sex
  Included: Age-specific fertility rates (standard Scottish schedule from the Office for National Statistics (ONS) Principal Projections)

- **Mort1.xls**
  Deaths (at 30 June) by age bands / sex / ward
  Included: Age-specific mortality rates (standard Scottish schedule from the Office for National Statistics (ONS) Principal Projections)

- **Mig_INMIG.xls and Mig_OUTMIG.xls**
  These files are required but do not require data input at this stage
  Included: Distribution of migrants (standard Scottish schedule from the Office for National Statistics (ONS) Principal Projections)

- **Specpop1.xls**
  Data for special populations (refer to Special Populations section above) may be entered, if desired, by single year of age / sex / ward.

  For the NRS sub-council area projection, published in March 2016, prisoner, armed forces and student data were included. Armed forces and student data cannot be made available due to disclosure issues around these data sources.

(b) Stage 2 – Calculating sub-council area trends (2013-2037)

In stage 2, the output from POPGROUP stage 1 is used to determine assumptions for net migration and other changes.

Template files for net migration and other changes are available on the NRS website with the relevant calculations included.

(c) Stage 3 - Inputs for the migration projection (2013-2037)

- **Cons2.xls**
  Population projections by council area for 2013-2037 (at 30 June) by single year of age / sex / ward from the NRS Council Area Sub-national Projections.

Footnote
2) 2001 data zones were used by NRS in the 2016 research study.

- **Mig_INMIG.xls and Mig_OUTMIG.xls**
  Net inflow and outflow / single year of age / sex / ward (from stage 2)
- **Fert2.xls**
  Fertility differentials, calculate total fertility rate
  Calculate from POPGROUP ‘comp_training.xls’ output file and input new data

- **Mort2.xls**
  Mortality differentials, calculate standardised mortality ratios
  Calculate from POPGROUP ‘comp_training.xls’ output file and input new data

- **Specpop2.xls**
  Special populations for 2013-2037
  Look at the trend of the recent data for special populations
  In some cases an average of these populations may not be appropriate e.g. if a prison has recently opened/closed

(d) Geography

- A geographical conversion ‘lookup’ table is required, specifying how each 2001 data zone is wholly or proportionately allocated to each small area. NRS assigned whole 2001 data zones to higher geographies using the population weighted centre of the data zone. If the data zone crossed the boundary of two sub-council areas, the population weighted centre was used to establish which sub-council area the data zone should be assigned to as a ‘best-fit’.
- If the same geography is required, the ‘lookup’ is available on request from NRS.
- POPGROUP requires a long label for each council area along with a short code (8 characters, non-numeric). Each sub-council area also requires a long label and a short code (8 characters, non-numeric).

2. The strategy for these small area projections

This guidance document aims to provide practical help in using POPGROUP software and the demographic information commonly available, to project the population of any set of small areas within Scotland.

Because areas of interest vary according to policy priorities in different parts of Scotland and over time, the strategy uses data for births and deaths for standard small areas (data zones) that can be aggregated by the user to their areas of interest.

Migration flows, however, cannot be aggregated in the same way. The inflows to two neighbouring data zones, for example, will each include the flows between them and so the inflow to the combined area is not the sum of the two inflows.

For migration, therefore, the strategy takes a different approach. The difference between annual population estimates is used to estimate the number of migrants in net terms. For example, if an area has forty people aged 25 in one year and fifty aged 26 the next, then ten more people of that age must have entered the area than left it during the year.

The strategy uses POPGROUP to make these indirect estimates of migration in a 'training projection' based on the population estimates published by NRS. Migration is calculated based on changes in the population estimates between successive years.

The training projection at the same time calculates differences between each small area's fertility and mortality from past vital events statistics of births and deaths.

These estimates are used in the main 'migration-led' projection, which assumes the continuation of recent experience in each small area, but also incorporates the future changes in fertility and mortality that are expected for Scotland as a whole.

Population projections **Steps in strategy**	**Summary of action or outputs for each small area**			
1. Data allocated to each small area	Births since 2001	Deaths since 2001	Population estimates since 2001	
2. Training projection	Local fertility differential	Local mortality differential	Local net migration	
3. Migration-led projection	Local fertility and mortality differences continued, with future Scotland time trend			Local migration continued

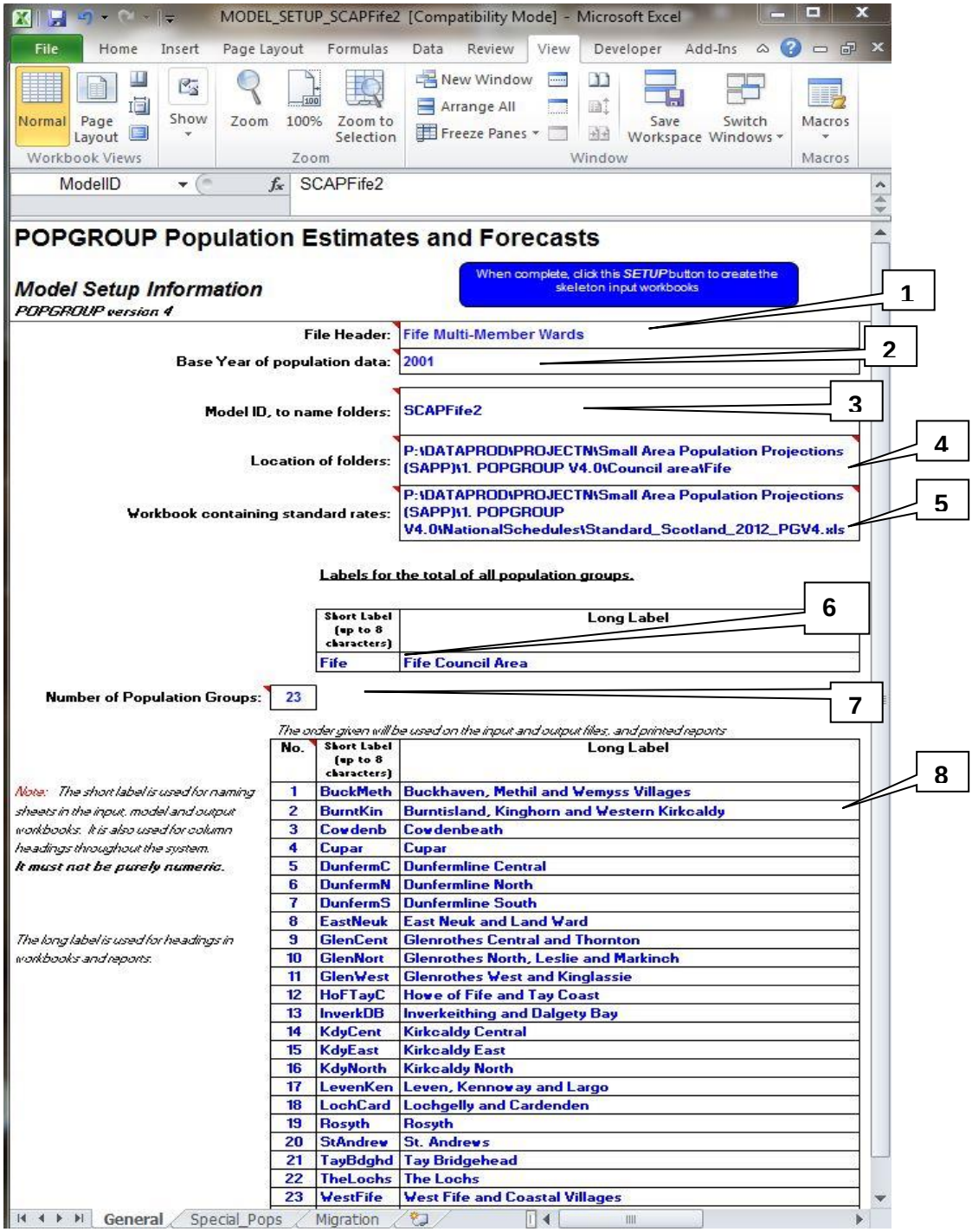
3. POPGROUP Model Setup

All files must be saved as .xls to run correctly.

3.1. POPGROUP Model_Setup

Open, complete, run and save the Model_Setup file, as in this example.

(a) Sheet 'General'



Notes:

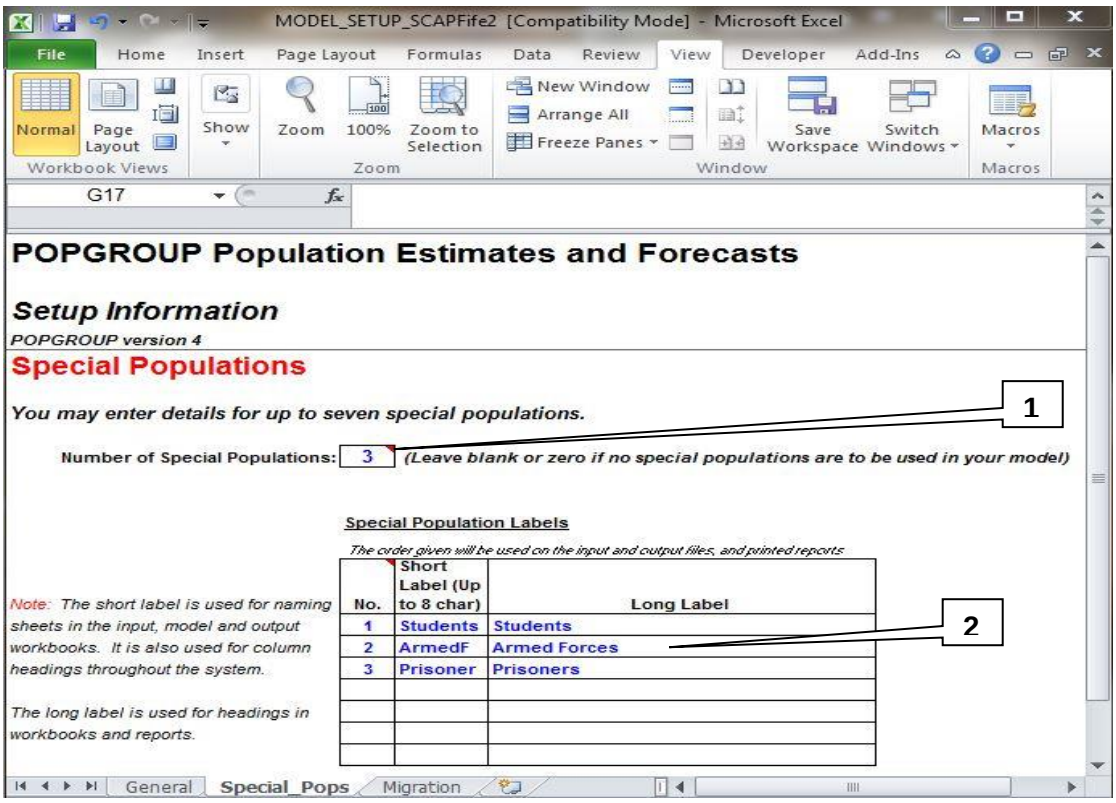
1. This is the name to describe the work, such as the geographical area covered, this will be reproduced at the top of each sheet on the input and output files.
2. The base year is 2001 (usually a census year), to allow entry of past births, deaths and population, which will be used in the ‘training’ projection to assess the differences between the small areas’ demographic experiences.
3. Set the model ID which POPGROUP uses to name its folders:

   <ID>_skel (skeleton files);

   <ID>_inp (input files);

   <ID>_out (output files)).
4. The directory paths and names are at the convenience of the user.
5. The latest file of standard rates is included in the installation process so should not need to be changed.
6. The all population groups short label is used for naming workbooks. The long label is used for headings in workbooks and reports. A sub-council area and council area cannot have the same short label. Note that in these instructions, the references to the ‘Fife’ worksheet are maintained throughout, but this will be different depending on the short label entered here.
7. Input the number of population groups (small areas) within the desired geography.
8. The sub-council area short label is used for naming worksheets and columns. The long label is used for headings in workbooks and reports.

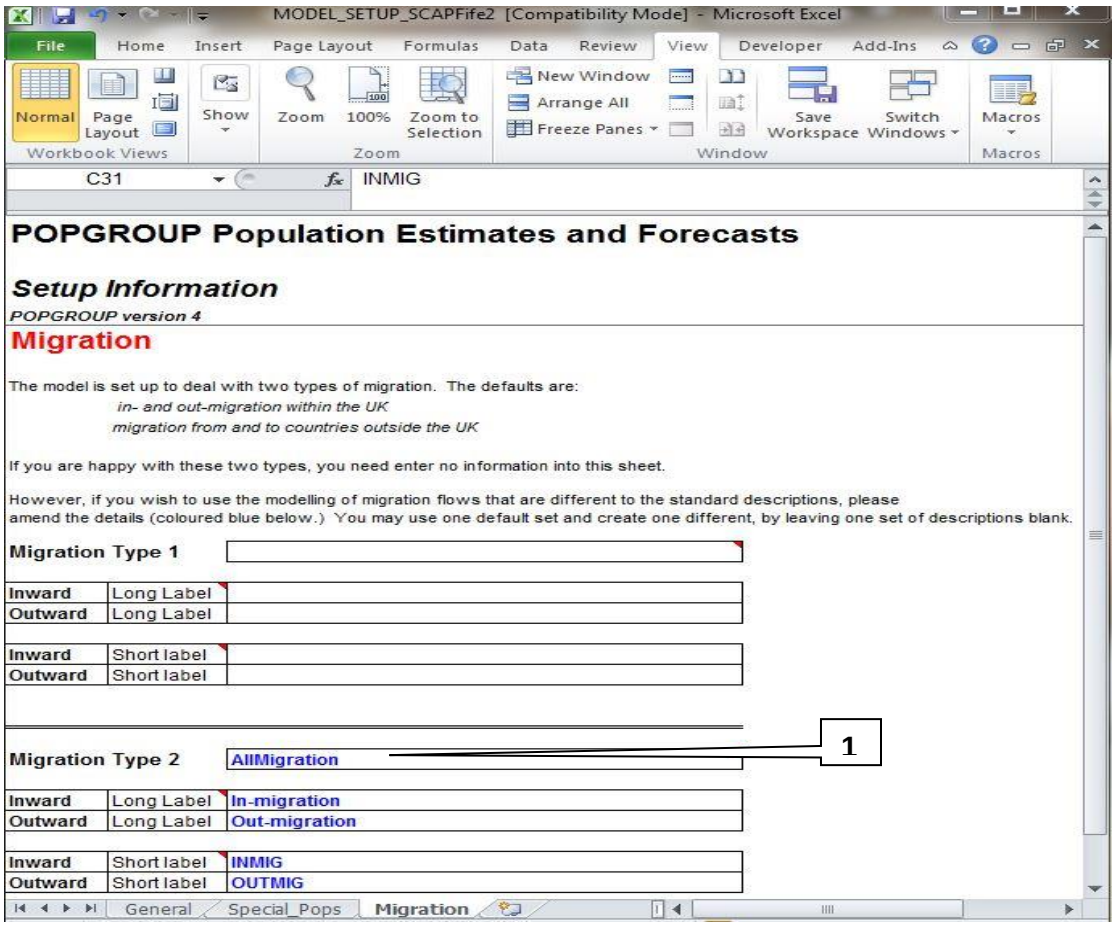
(b) Sheet 'Special pops'



Notes:

1. Identify the number of special populations. These cannot be added in later in the process but if they have been identified here then they can be used. They can also be left blank once identified and it won't affect the output.
2. Enter the names and short labels of any special populations to be used.

(c) Sheet 'Migration'



Notes

1. POPGROUP calculates single year of age schedules for in and out migration from the training projection. Delete the entries in the Migration Type 1 'UK' boxes as these are not counts. Migration Type 2 'Overseas' allows for counts, change this label to 'AllMigration' and change the long and short labels as above.
2. Please note that POPGROUP will maintain the Migration Type 1 and 2 labels in its outputs so 'UK' migration will be blank and 'Overseas' is actually 'AllMigration'.

(d) Sheet 'General'

1. Click the SETUP button to produce the skeleton files (can take several minutes depending on the number of sub-areas). The model setup file automatically saves in the same folder as the template setup file. POPGROUP notifies when the setup is complete.

3.2. Check the setup

Running the Model Setup will create three folders as requested. One will have skeleton files, and the other two will be empty, ready for input files and output files. These will be in the file location specified in the ‘General’ worksheet. The model setup file will also be saved.

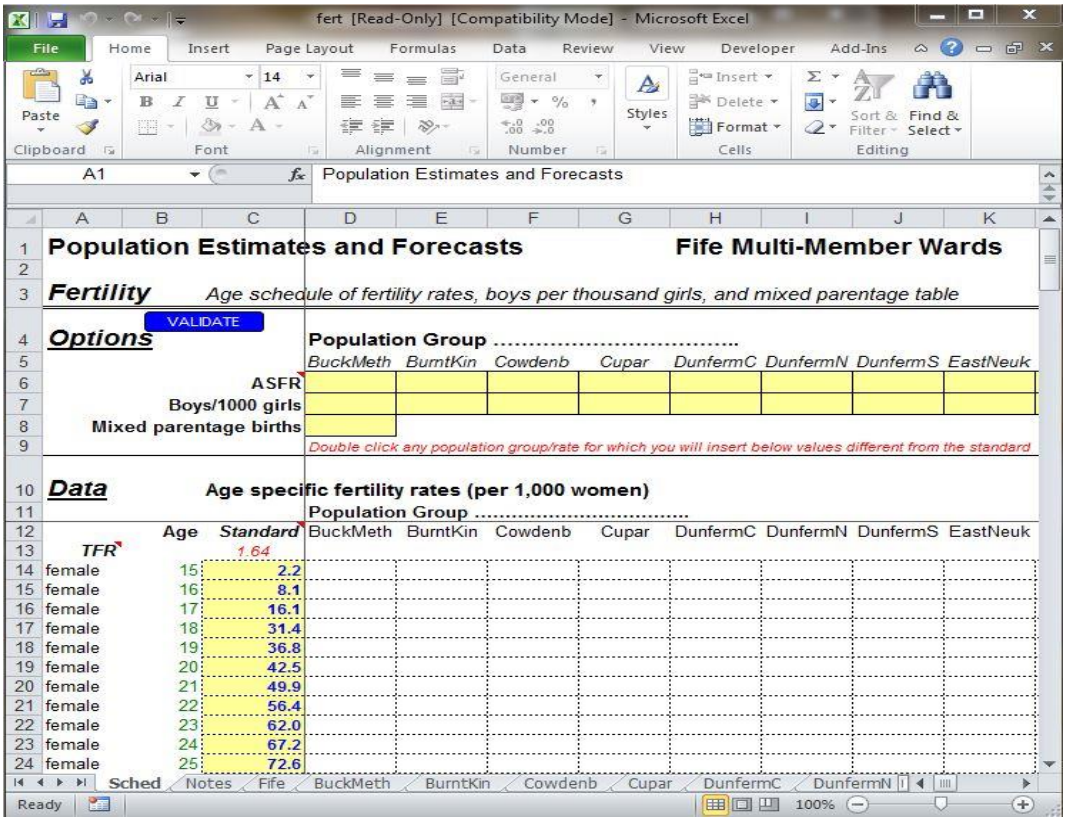
- MODEL_SETUP_<ID>.xls
- <ID>_inp
- <ID>_out
- <ID>_skel

The following data has been input to the files automatically.

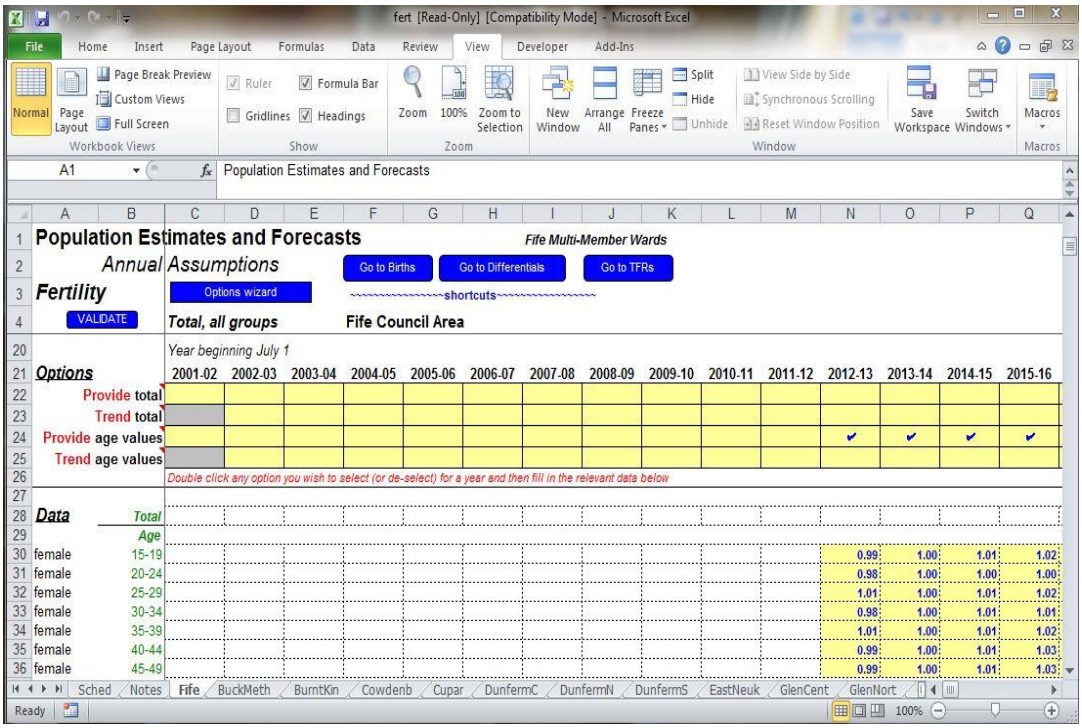
- On the skeleton files for fertility and mortality the Scotland standard schedules from the latest national projections will have already been entered on the ‘Sched’ sheet.
- The time trend from the Scotland projections will be already entered on the All-Groups sheet (in this example, Fife) as age and sex specific differentials from the standard schedule in future years. The local level of fertility and mortality will be specified separately for each small area, after the training projection.
- On the skeleton file for migration, the 2001 Census age-sex schedule of migration rates will have already been entered.

Example – Fert.xls

The ‘Sched’ worksheet contains Scotland standard schedules from the 2012-based national projections.



The council area worksheet (‘Fife’ in the example below) contains the time trend from Scotland projections, age and sex specific differentials from the standard schedule in future years.



4. Data preparation and the training projection

4.1. Allocation of data to small areas

The data must be available for the small areas identified in the Model Setup.

Input data is available at 2001 data zone level. During the NRS SCAP project, the data zones were aggregated to sub-council geography using the population weighted centre of the data zones.

4.2. Local age-specific fertility and local age-sex-specific mortality

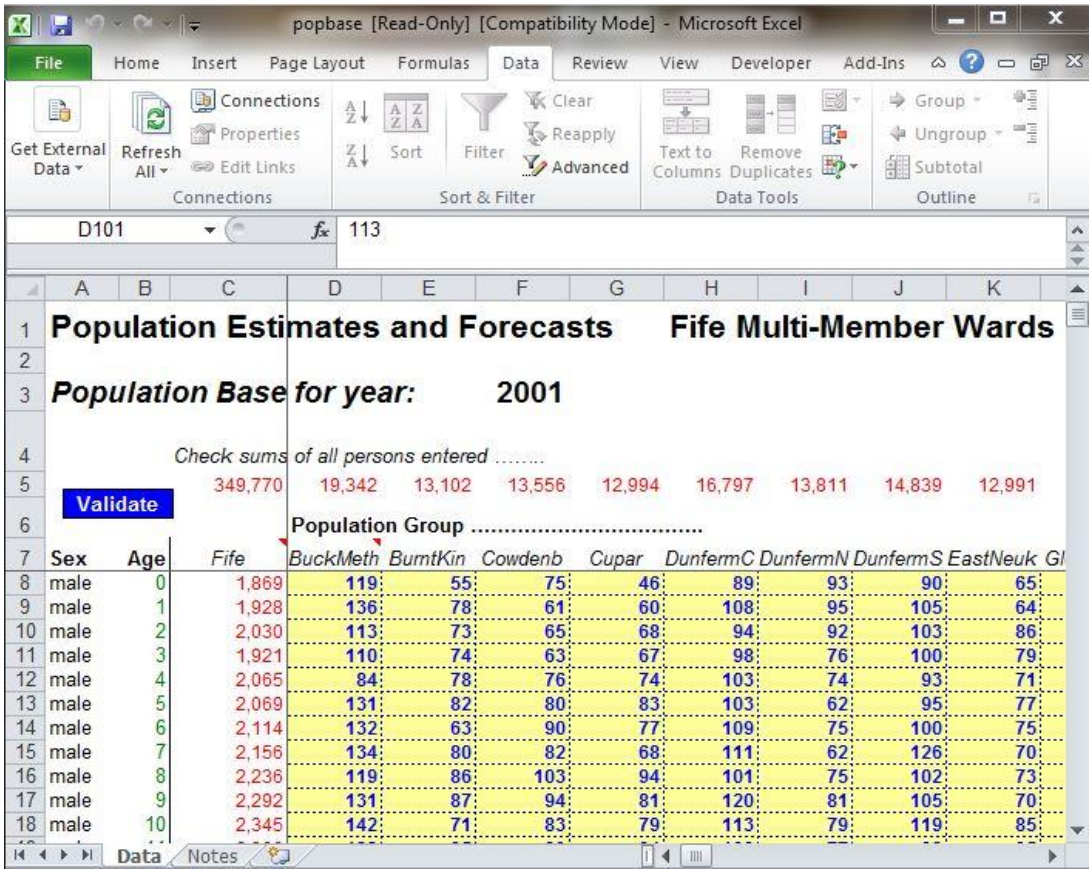
It may be possible to calculate local age-specific fertility and mortality for input to POPGROUP, however, previous research identified that the use of local age-specific schedules of fertility and mortality makes little difference to projections of births and deaths, once the level of fertility and mortality have been estimated. For the 2015-2016 NRS SCAP project, national schedules were used.

The use of local age-specific fertility and mortality rates are therefore marked as optional, below.

4.3. Base population

The base population in these projections is 2001, although the projection will only start after the latest year of population estimates entered.

1. Open the skeleton file popbase.xls.
2. Enter the mid-2001 population estimates for each small area for males and females.

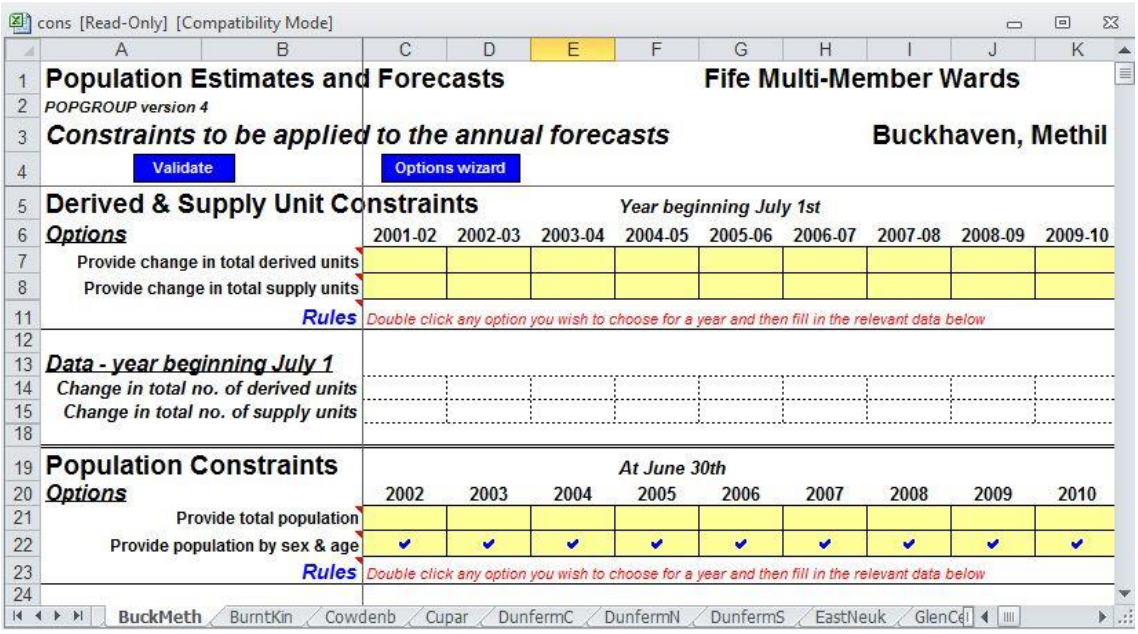


3. Validate the file by clicking the Validate button and checking the messages.
4. Save as popbase1.xls in the input directory that was created when the Model Setup was run.

4.4. Constraining the population estimates

Population estimates from 2002-2012 are used to constrain the model.

1. Open the skeleton file cons.xls.
2. Select all of the sub-council area worksheets to group them (by holding control and clicking on each worksheet). Then activate the 'Population constraints' options by double-clicking row 22 'Provide population by sex & age' for years 2002-2012. This activates the cells below to enable input of the data. Ungroup the sheets.

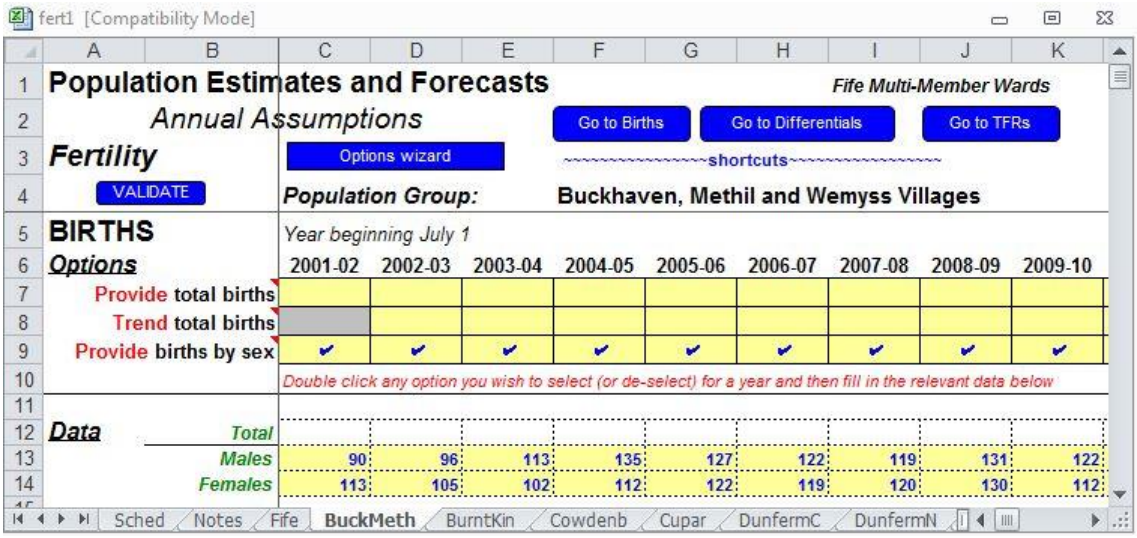


3. 5-year age/sex bands will also become active but are not required. Enter single year age/sex data. Enter the population estimates for the desired years starting from the mid-2002 population estimate for each small area by males then females.
4. Validate the file by clicking the Validate button on any or the worksheets and check the messages on the Notes worksheet.
5. Save as cons1.xls in the input directory that was created during the Model Setup.

4.5. Births and fertility

Enter the numbers of births for each sub-council area for the years used for the training projection. These are used to inform fertility assumptions in the training projection.

1. Open the skeleton file fert.xls.
2. Select all of the sub-council area worksheets to group them and activate the 'Births' options by double-clicking row 9 'Provide births by sex' for the years 2001-02 to 2011-12 (births are years beginning July 1). This activates the cells below to enable input of the data. Ungroup the sheets.
3. Enter births data for males and females for the years since 2001-02 for each sub-council area by males, then females.



4. *Optional (refer to section 4.2). On the 'Sched' sheet, enter the local area age-specific fertility rates, by clicking the option at the top of each small area's column, which removes protection from the column.*
5. Validate the file by clicking the Validate button on the Notes worksheet and checking the messages. A chart of 'Rates' is created. There will be only one line at this stage, the Scotland schedule of fertility. This is correct: the local fertility will be estimated in the next stage.
6. Save as fert1.xls in the input directory.

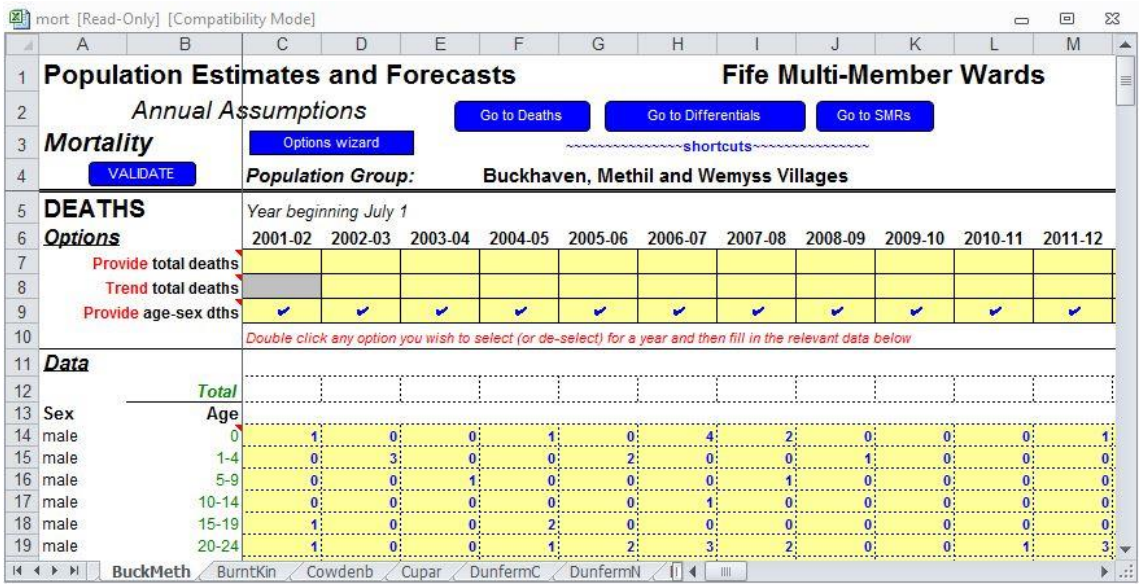
4.6. Deaths and mortality

Deaths are available from 2002 onwards. They may need to be formatted into the age bands used in POPGROUP. They are used to inform mortality assumptions in the training projection.

1. Open the skeleton file mort.xls
2. Select all of the sub-council area worksheets to group them and activate the 'Deaths' options by double-clicking row 9 'Provide age-sex dths' for the years 2001-02 to 2011-12 (Deaths are at year

beginning July 1). This activates the cells below to enable input of the data. Ungroup the sheets.

3. Enter the 5-year age/sex data in the correct cells for each year and sub-council area by males, and then females.



4. *Optional (refer to section 4.2). On the 'Sched' sheet, enter the local area age-sex-specific mortality rates, by clicking the option at the top of each small area's column, which removes protection from the column.*

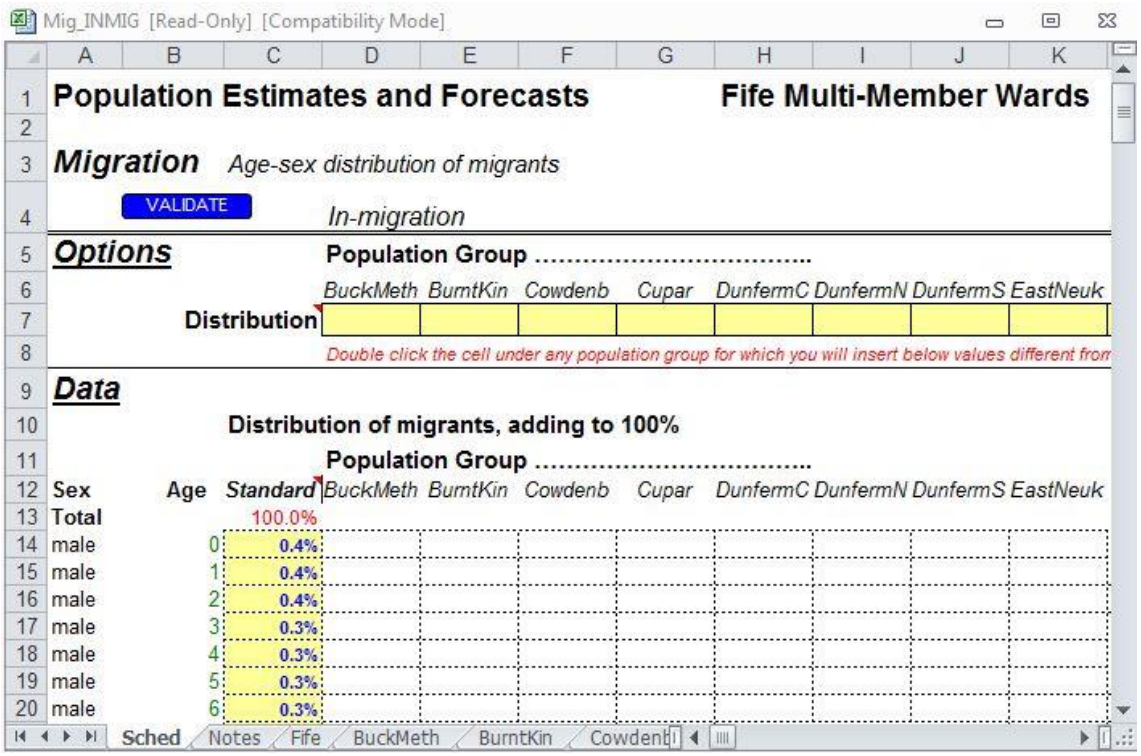
5. Validate the file by clicking the 'Validate' button on any of the worksheets and check the messages on the Notes worksheet. Charts of Male and Female rates are created. There will be only one line at this stage, the Scotland schedule of mortality. This is correct: the local mortality will be estimated in the next stage.

4.7. Migration

Migration will be calculated in the training projection but it is necessary to prepare the files.

1. Open the skeleton files Mig_INMIG.xls and Mig_OUTMIG.xls.

2. Check that the two files already have a standard schedule of migration rates on the 'Sched' sheet, which is documented on the 'Notes' sheet. This is all that is needed at present.



3. No changes have been made, so there is no need to validate.
4. Save as Mig_INMIG1.xls and Mig_OUTMIG1.xls in the input directory.

4.8. Special populations

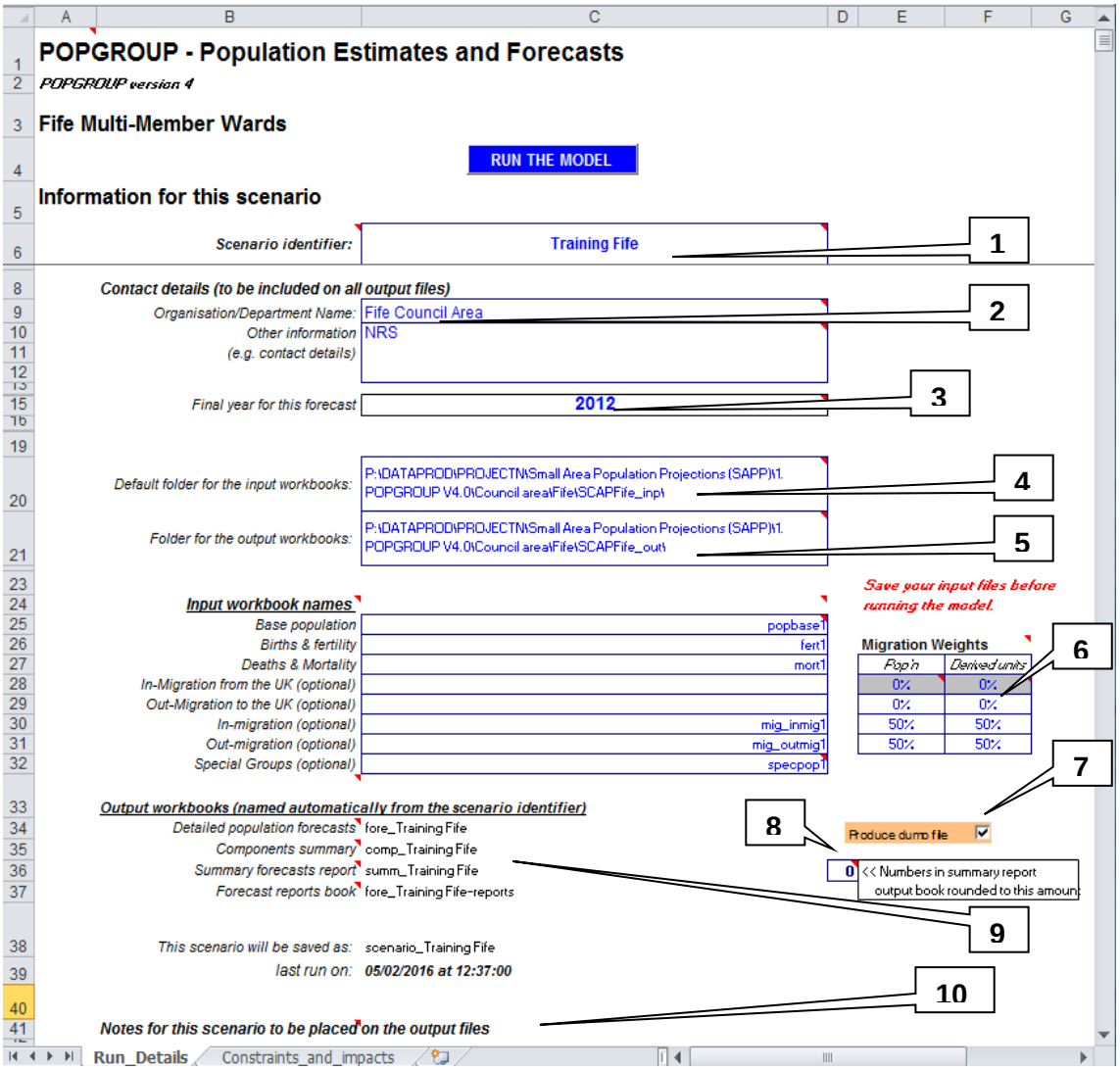
1. For the training projection period enter the available data by ward, sex and single year of age.
2. Save as specpop1.xls in the input folder.

4.9. Prepare the training projection scenario

A projection is now run for the years in which local births, deaths and population are known, in order to estimate the local levels of fertility, mortality and migration in each of recent years.

Open the skeleton file POPGROUPscenario.xls. Edit it as follows and run it; it will be saved automatically as scenario_training.xls in the input directory that was created when you ran the Model Setup.

(a) Sheet 'Run_Details':



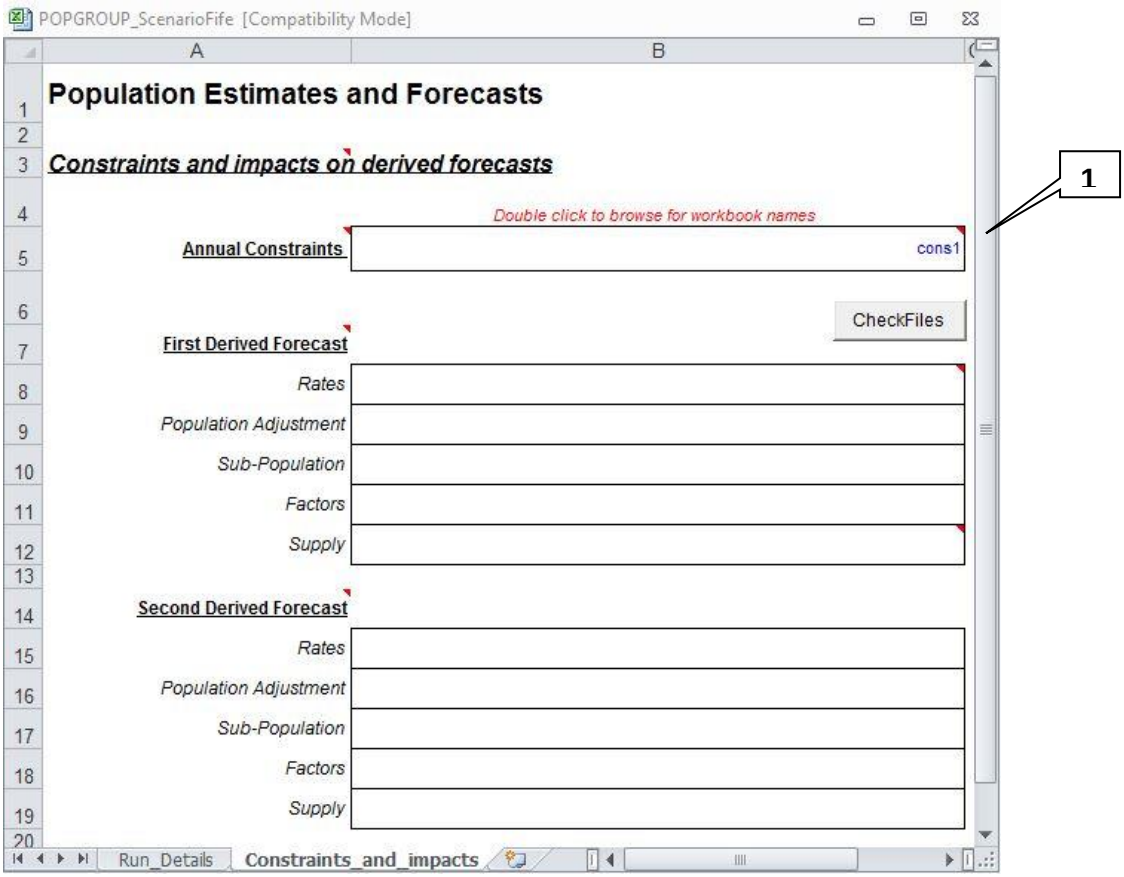
Notes:

1. Enter the scenario ID.
2. Include details that will be printed on output.
3. The final year for this projection should be the last year for which you entered population estimates in the constraints file (above).

   Note: It may well be later than the year used in this example, because more data will have been released since this guidance was prepared.
4. The default input and output directories will be already filled in.
5. Specify the files to be used for this scenario. If the naming suggestions above have been followed, the names in this illustration should be used.
6. Type 50% for the 'Migration weights' for 'Population' and 'Derived units' against MIG_INMIG1 ('In-migration') and MIG_OUTMIG1 ('Out-migration'). Do the same for derived units (or there will be an error message). Change 'In-Migration from the UK' and 'Out-Migration to the UK' to 0. These weights are used by POPGROUP to estimate migration when making it consistent with the constraint of population estimates.

7. Tick the check box for the ‘dump’ file, in which the estimated migration will be output.
8. Set rounding to **zero**.
9. The output files are named automatically, using the scenario ID.
10. Enter notes as desired

(b) Sheet ‘Constraints_and_impacts’:



Notes:

1. Enter the constraints file name.

4.10. Run the training projection

When you have entered all the above information, run the scenario by clicking the button on the ‘Run_Details’ sheet: **RUN THE MODEL**

1. This can take several minutes, depending on the number of sub-council areas. There will a message to confirm that all other workbooks will be closed as the model runs and another to query no specified files for UK migration. Click ‘ok’ to both.
2. When the model has run successfully, the scenario file and the output files will have been saved on the outputs folder. With the exception of fore_Training-dump.xls the files have been automatically opened.

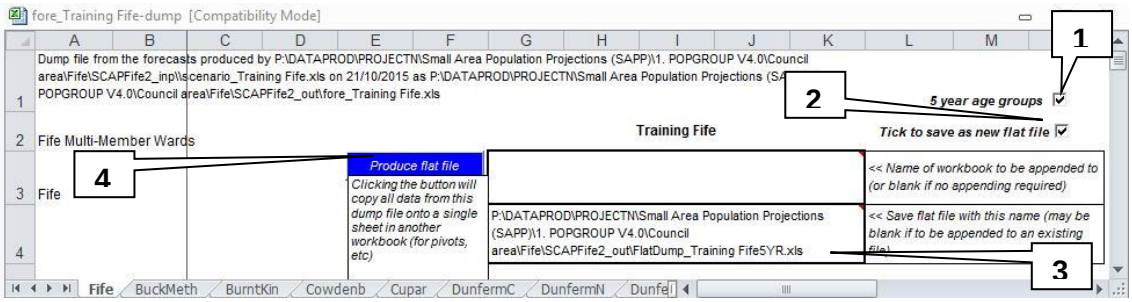
3. You can explore the output using ‘fore_Training-reports.xls.

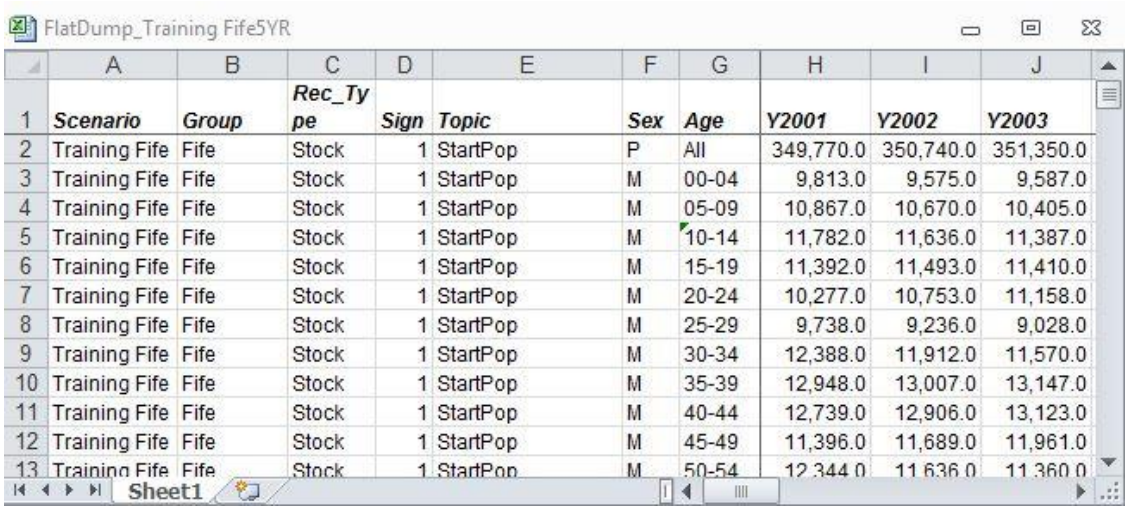
(a) 5 year age bands

In this next stage we will be using ‘fore_Training-dump.xls’. This gives the data on individual sheets for each area. We will use it to create flat dump files with all of the data on one worksheet for five year age bands and for single year of age.

1. On the ‘Fife’ worksheet in fore_Training-dump.xls check that ‘5 year age groups’ is ticked (refer to image below).
2. Check that ‘Tick to save as new flat file’ is ticked.
3. The default filename is ‘FlatDump_Training.xls’. Change to ‘FlatDump_Training5YR.xls’.
4. Click ‘Produce flat file’ (cell E3) which will be saved in the output folder.

Note that for migration POPGROUP has maintained the label overseas migration (Mig_OverseasIn and MigOverseasOut). It is not in fact overseas migration, but is total migration, the information that we want to use.





FlatDump_Training Fife5YR

	A	B	C	D	E	F	G	H	I	J
1	Scenario	Group	Rec_Type	Sign	Topic	Sex	Age	Y2001	Y2002	Y2003
2	Training Fife	Fife	Stock	1	StartPop	P	All	349,770.0	350,740.0	351,350.0
3	Training Fife	Fife	Stock	1	StartPop	M	00-04	9,813.0	9,575.0	9,587.0
4	Training Fife	Fife	Stock	1	StartPop	M	05-09	10,867.0	10,670.0	10,405.0
5	Training Fife	Fife	Stock	1	StartPop	M	10-14	11,782.0	11,636.0	11,387.0
6	Training Fife	Fife	Stock	1	StartPop	M	15-19	11,392.0	11,493.0	11,410.0
7	Training Fife	Fife	Stock	1	StartPop	M	20-24	10,277.0	10,753.0	11,158.0
8	Training Fife	Fife	Stock	1	StartPop	M	25-29	9,738.0	9,236.0	9,028.0
9	Training Fife	Fife	Stock	1	StartPop	M	30-34	12,388.0	11,912.0	11,570.0
10	Training Fife	Fife	Stock	1	StartPop	M	35-39	12,948.0	13,007.0	13,147.0
11	Training Fife	Fife	Stock	1	StartPop	M	40-44	12,739.0	12,906.0	13,123.0
12	Training Fife	Fife	Stock	1	StartPop	M	45-49	11,396.0	11,689.0	11,961.0
13	Training Fife	Fife	Stock	1	StartPop	M	50-54	12,344.0	11,636.0	11,360.0

Sheet1

(b) Single year of age

1. On the ‘Fife’ worksheet untick ‘5 year age groups’.
2. Check that ‘Tick to save as new flat file’ is ticked.
3. The default filename is ‘FlatDump_Training.xls’. Change to ‘FlatDump_TrainingSYOA.xls’.
4. Click ‘Produce flat file’ which will be saved in the output folder.

Note that for migration POPGROUP has maintained the label overseas migration (Mig_OverseasIn and MigOverseasOut). It is not in fact overseas migration, but is total migration, the information that we want to use.

FlatDump_Training FifeSYOA

	A	B	C	D	E	F	G	H	I	J	K
1	*Scenario*	*Group*	*Rec_Type*	*Sign*	*Topic*	*Sex*	*Age*	*Y2001*	*Y2002*	*Y2003*	*Y2004*
2	Training Fife	Fife	Stock	1	StartPop	P	All	349,770.0	350,740.0	351,350.0	353,050.0
3	Training Fife	Fife	Stock	1	StartPop	M	00	1,869.0	1,770.0	1,874.0	1,924.0
4	Training Fife	Fife	Stock	1	StartPop	M	01	1,928.0	1,889.0	1,777.0	1,888.0
5	Training Fife	Fife	Stock	1	StartPop	M	02	2,030.0	1,937.0	1,907.0	1,811.0
6	Training Fife	Fife	Stock	1	StartPop	M	03	1,921.0	2,045.0	1,949.0	1,931.0
7	Training Fife	Fife	Stock	1	StartPop	M	04	2,065.0	1,934.0	2,080.0	1,969.0
8	Training Fife	Fife	Stock	1	StartPop	M	05	2,069.0	2,067.0	1,938.0	2,095.0
9	Training Fife	Fife	Stock	1	StartPop	M	06	2,114.0	2,075.0	2,069.0	1,949.0

Sheet1

5. Developing input files that reflect recent local experience

This section uses output from the training scenario to modify the input for fertility, mortality and migration.

The section refers to **‘average recent’** fertility, mortality and migration. NRS practice for sub-national projections uses an average of the latest five years’ experience, with each of those years weighted equally. The same approach is used here. There may be good reasons to use a different number of years, or to weight more recent years more heavily, and this is up to the user.

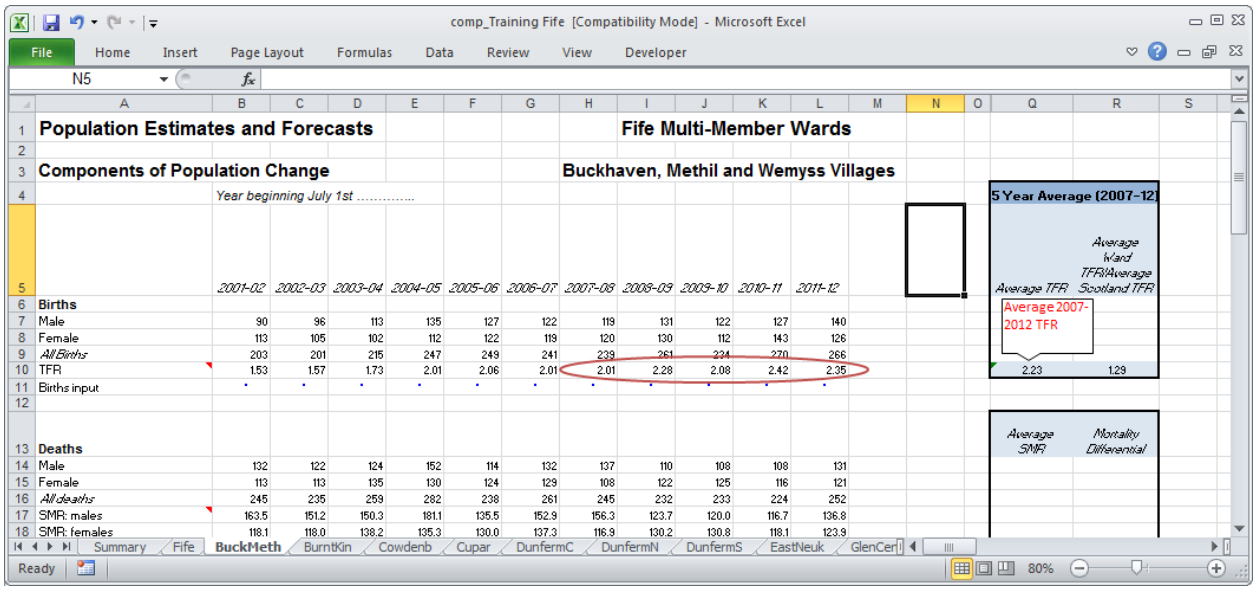
5.1. Fertility - if no local fertility schedules have been used

The ‘Sched sheet’ on fert1.xls only has the standard column entered, with Scotland rates. In this section you will create a fertility differential for each small area.

(a) Calculate total fertility rate (TFR) for sub-council areas

1. Open ‘comp_Training.xls’.

2. Calculate the average recent TFR for each small area (refer to example – column Q). This can be done for all areas by grouping the worksheets as they are all set up in the same way.



(b) Calculate TFR for Scotland

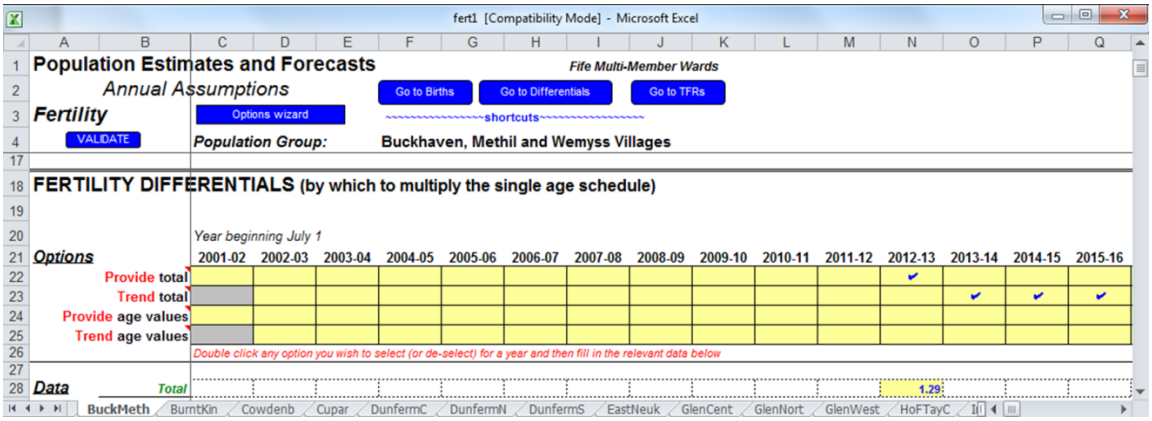
3. Obtain the TFR for Scotland from the NRS vital events publications. Age-specific birth rate, per 1,000 female population, Scotland, 1951 to latest year is available on the NRS website.
4. From this table, calculate the average Scottish Total Fertility Rate for the same period used to calculate the average for the sub-council areas (e.g. 5 years).

(c) Calculate fertility differential from national experience for sub-council areas

5. For each small area, its fertility is represented in this POPGROUP model as a *differential* from the national experience, calculated as the ratio:

$$\frac{\text{(Average recent TFR in the small area)}}{\text{(Average recent TFR for Scotland)}}$$

6. Open fert1.xls where you will next enter the total differential for the first year when births are not known (2012/13) and then continue to use this differential in each subsequent year.



Group sub-council area worksheets and activate the fertility differential total cells ‘Provide total’ (for the first year births are not known) and then ‘Trend total’ (to the end of the projection period).

7. Ungroup and enter the ‘Average Ward TFR/Average Scotland TFR’ figure in row 28 (e.g. for BuckMeth 1.29).The same figure will be used for the projection period which is why we have activated the ‘Trend total’. Enter this figure for all areas.
8. Validate the file by clicking the Validate button on the Notes worksheet and check the messages on the Notes worksheet. There is no change to the ‘Rates’ chart.
9. Save as fert2.xls in the input directory that was created when you ran the Model Setup.

There are now two sets of fertility assumptions. The file ‘fert2.xls’ contains the most developed local assumptions, as follows:

- For past years, the number of boys and girls born in each local area.
- For years when the number of births is not yet known, a projection based on:
    a. The standard schedule of age-specific fertility rates for Scotland taken from the latest national projections. (‘Sched’ sheet).
    b. The ratio of local fertility to Scotland’s fertility. (Small area sheet, total differential).
    c. The future age-specific change in fertility for future years, taken from the latest national projections. (All groups sheet, age-specific differentials).

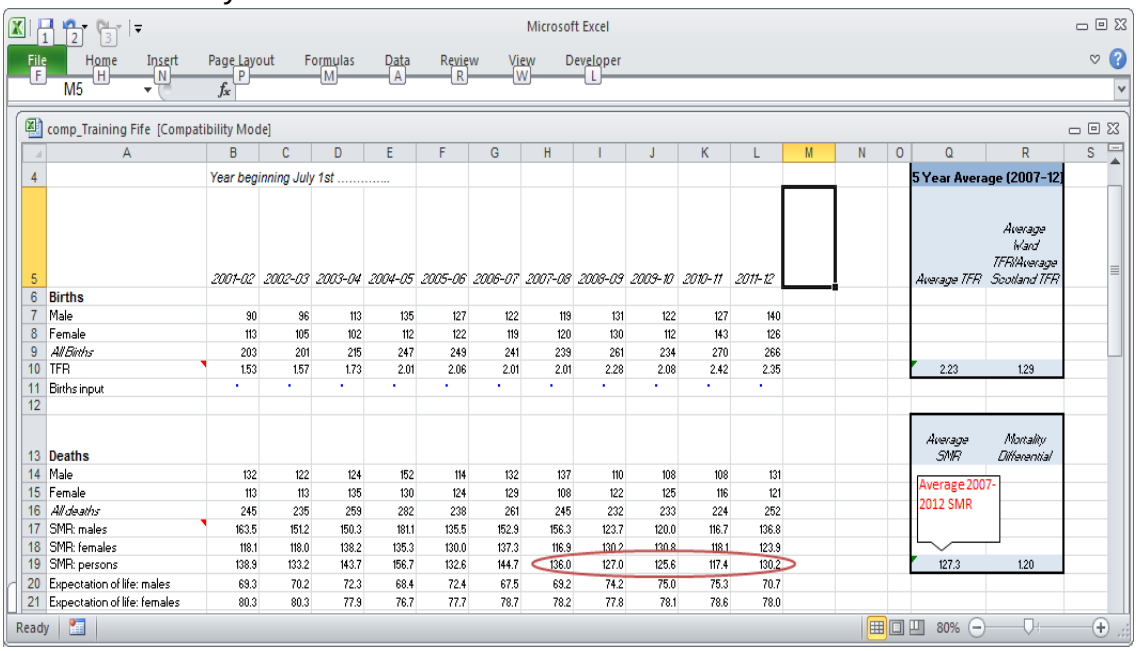
5.2. Mortality - if no local mortality schedules have been used

The ‘Sched’ sheet on mort1.xls only has the standard column entered, with Scotland rates. In this section you will create a mortality differential for each small area.

The comp_training.xls file contains the standard mortality ratio (SMR) for each local area in each past year since 2001, based on the number of deaths in those years (this is the same file as was used for the fertility calculations in the previous section).

(a) Calculate SMR for sub-council areas

1. Open ‘comp_Training.xls’.
2. As for fertility, compute the average recent SMR for each small area (refer to example – column Q (=AVERAGE(H19:L19)). This can be done for all areas by grouping the worksheets as they are all set up in the same way.



	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	Average TFR	Average Ward TFR/Average Scotland TFR
Births													
Male	90	96	113	135	127	122	119	131	122	127	140		
Female	113	105	102	112	122	119	120	130	112	143	126		
All Births	203	201	215	247	249	241	239	261	234	270	266		
TFR	1.53	1.57	1.73	2.01	2.06	2.01	2.01	2.28	2.08	2.42	2.35	2.23	1.29
Births input	.	.	.	.	.	.	.	.	.	.	.		
Deaths													
Male	132	122	124	152	114	132	137	110	108	108	131		
Female	113	113	135	130	124	129	108	122	125	116	121		
All deaths	245	235	259	282	238	261	245	232	233	224	252		
SMR: males	163.5	151.2	150.3	181.1	135.5	152.9	156.3	123.7	120.0	116.7	136.8		
SMR: females	118.1	118.0	138.2	135.3	130.0	137.3	116.9	130.2	130.8	118.1	123.9		
SMR: persons	138.9	133.2	143.7	156.7	132.6	144.7	136.0	127.0	125.6	117.4	130.2	127.3	1.20
Expectation of life: males	69.3	70.2	72.3	68.4	72.4	67.5	69.2	74.2	75.0	75.3	70.7		
Expectation of life: females	80.3	80.3	77.9	76.7	77.7	78.7	78.2	77.8	78.1	78.6	78.0		

(b) Calculate SMR for Scotland

3. The 2012-based tables for Scotland can be found on the ONS website.
4. Calculate the average Scottish Standard Mortality for the same period used to calculate the average for sub-council areas (e.g. 5 years).

(c) Calculate SMR differential from national experience for sub-council areas

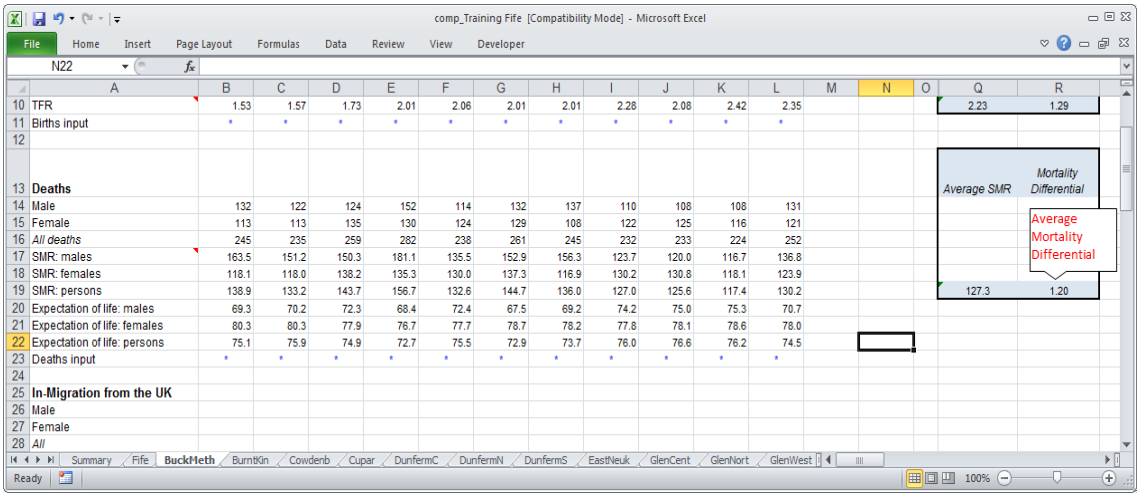
The SMR in POPGROUP measures the recent local mortality, indexed on the standard mortality, which in this case is for Scotland at the start of the national projections. We need also to take into account the change in national mortality over that period.

1. Compute the differential for each local area from the national experience:

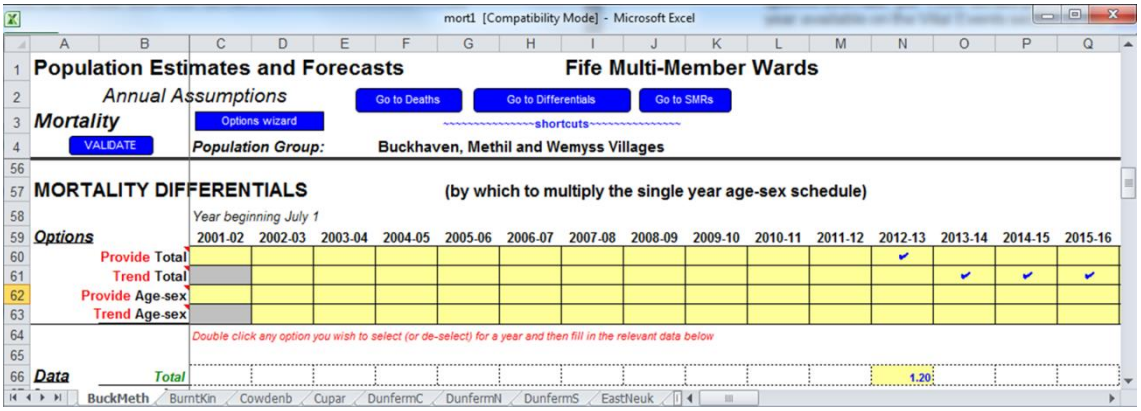
The Scotland standard average mortality figure should be the second year of the most recent forecast (2013/2014 for the 2012-based projection)

(Average recent SMR in the small area) * (Scotland standard average mortality)
100 * (Scotland recent average mortality)

For BuckMeth (127.3 * 1,819) / (100 * 1,927)) = 1.20.



2. Open mort1.xls where you will next enter the total differential for the first year when deaths are not known and then continue to use this differential in each subsequent year (e.g. BuckMeth 1.20).



3. Group sub-council area worksheets and activate mortality differential total ‘Provide total’ (for the first year deaths are not known) and then ‘Trend total’ (to the end of the chosen projection period).
4. Ungroup and enter the ‘Mortality Differential’ figure in the activated cell in row 66. The same figure will be used for the projection period which is why we have activated the ‘Trend total’.
5. Validate the file by clicking the Validate button on the Notes worksheet and check the messages on the Notes worksheet. There is no change to the ‘Rates’ chart.

6. Save as mort2.xls in the input directory that was created when the Model Setup was run.

There are now two sets of mortality assumptions. The file 'mort2.xls' contains the most developed local assumptions, as follows:

- For past years, the number of deaths in each local area. Within the age-groups provided, the deaths at each single year of age are distributed using the standard Scotland schedule of mortality rates.
- For years when the number of deaths is not known, a projection based on:
    a. The standard schedule of age-sex-specific mortality rates for Scotland taken from the latest national projections. ('Sched' sheet).
    b. The ratio of local mortality to Scotland's mortality. (Small area sheet, total differential).
    c. The future age-sex-specific change in mortality for future years, taken from the latest national projections. (All groups sheet, age-sex-specific differentials).

5.3. *Fertility and mortality - if local schedules have been used (otherwise skip to 5.4)*

Follow this section if on the 'Sched' sheets in fert1.xls and mort1.xls age-specific fertility and mortality were chosen to be entered for each sub-council area, as well as the standard column.

In this section you will create fertility and mortality differentials that relate the recent years used to the year used to indicate future change. This is needed because fertility and mortality may have changed since the years used to compute the local fertility schedule. (Use section 5.1 if you have not entered local fertility schedules for each small area on the 'Sched' sheet).

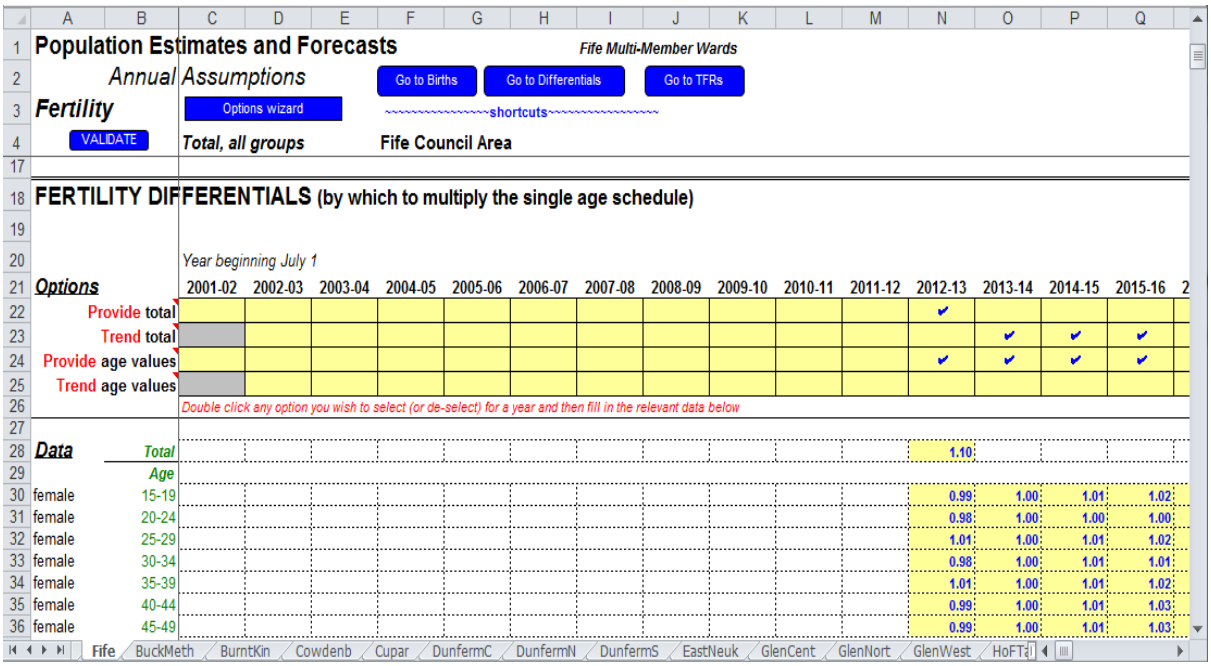
(a) Fertility

1. *Obtain the TFR for Scotland from NRS vital events publications. Age-specific birth rate, per 1,000 female population, Scotland, 1951 to latest year available on the Vital Events section of the NRS website.*
2. *From this table, calculate the average Scottish Total Fertility Rate for the same period taken to calculate the average for the sub-council areas (e.g. 5 years).*
3. *Note the TFR from the standard schedule: this is in 'fert1.xls' 'Sched' sheet, at cell C13.*
4. *Compute the ratio of the average recent TFR for Scotland to the standard schedule.*

5. *For all areas, the link between fertility estimated recently, and fertility changes foreseen in the national projection, is represented in this POPGROUP model as a differential, calculated as the ratio:*

   (Standard TFR)
   (Average recent TFR for Scotland)

6. *Open fert1.xls and enter this ratio in the 'All Groups' (in the example, Fife) sheet, in the area for fertility differentials. Choose the option to 'provide total' differential for the first year when births are not known, and then choose the option to 'trend total' in each subsequent year (refer to the below illustration. In this case the ratio was 1.10).*

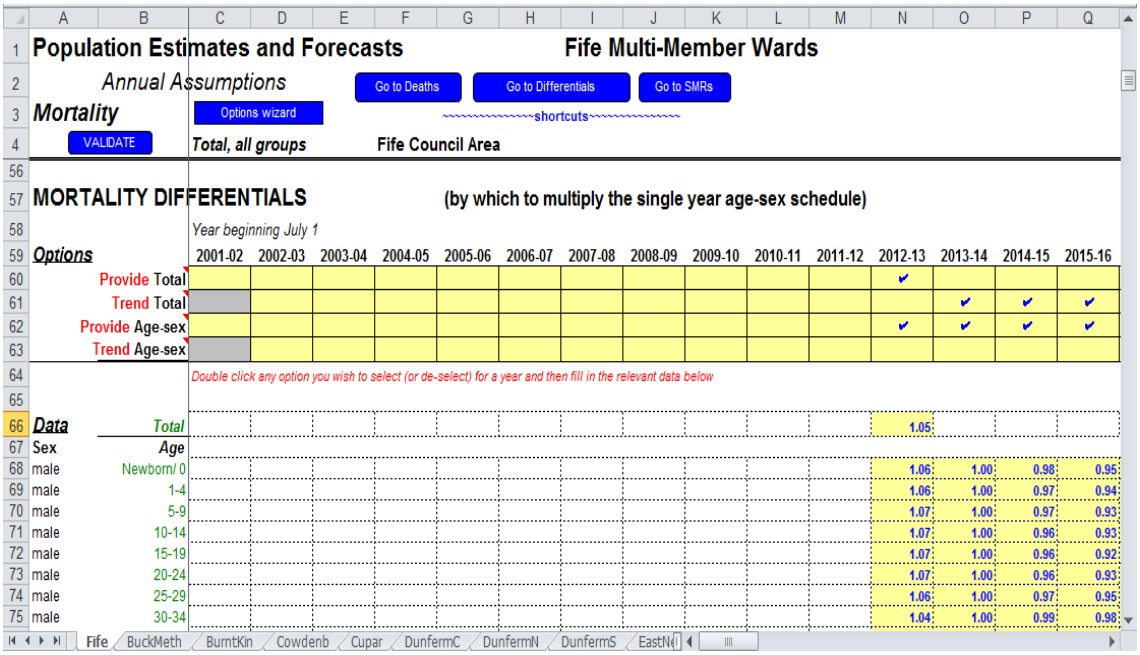


(b) Mortality

1. *The [latest tables for Scotland]() can be found on the ONS website.*
2. *Calculate the average Scottish standard mortality for the same period taken to calculate the average for sub-council areas (e.g. 5 years).*
3. *Compute the average mortality in the standard schedule, across all ages, from column C in the 'mort1.xls' 'Sched' sheet.*
4. *Compute the ratio of the two, which will be used by POPGROUP as a differential for all groups:*

   (Scotland standard average mortality)
   (Scotland recent average mortality)

5. *Open mort1.xls and enter this ratio in the 'All Groups' (in this example, Fife) sheet, in the area for mortality differentials. Choose the option to 'provide total' differential for the first year when deaths are not known, and then choose the option to 'trend total' in each subsequent year (refer to the below illustration. In this case the ratio was 1.05).*



Population Estimates and Forecasts — Fife Multi-Member Wards

Annual Assumptions — Go to Deaths | Go to Differentials | Go to SMRs

Mortality — Options wizard — shortcuts

VALIDATE — Total, all groups — Fife Council Area

MORTALITY DIFFERENTIALS (by which to multiply the single year age-sex schedule)

Year beginning July 1

Options	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
Provide Total												✔			
Trend Total													✔	✔	✔
Provide Age-sex												✔	✔	✔	✔
Trend Age-sex															

Double click any option you wish to select (or de-select) for a year and then fill in the relevant data below

Data	Total															
												1.05				
Sex	Age															
male	Newborn/ 0											1.06	1.00	0.98	0.95
male	1-4											1.06	1.00	0.97	0.94
male	5-9											1.07	1.00	0.97	0.93
male	10-14											1.07	1.00	0.96	0.93
male	15-19											1.07	1.00	0.96	0.92
male	20-24											1.07	1.00	0.96	0.93
male	25-29											1.06	1.00	0.97	0.95
male	30-34											1.04	1.00	0.99	0.98

Fife | BuckMeth | BurntKin | Cowdenb | Cupar | DunfermC | DunfermN | DunfermS | EastNi

6. *Validate the file, then save the file with a different name, mort2.xls.*

5.4. Migration

The fore_Training-dump.xls file contains the numbers of migrants at each age and sex, for each year since mid-2001, which are consistent with the mid-year population estimates. We will use these migration estimates to create a set of assumptions for the future that continue recent experience. There are two stages required for migration.

- Stage 1 - SYOA schedules (council area)
- Stage 2 - 5 year counts of in and out migration (sub-council areas)

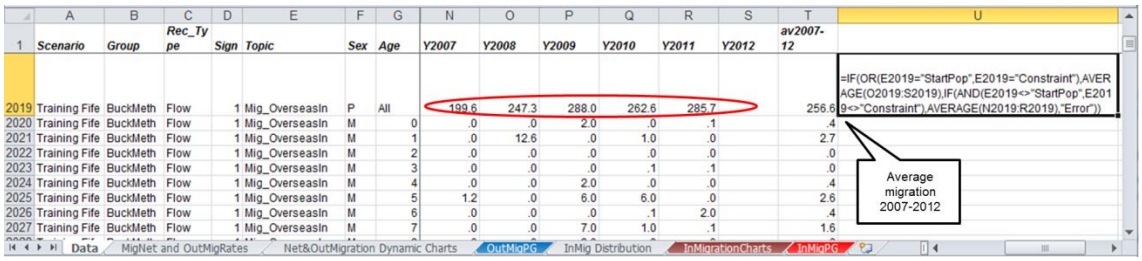
Stage 1 - SYOA Schedules (council area)

An Excel template file, provided by Professor Ludi Simpson, calculates 5 year average migration for each single year of age. This is then used to create the schedules to distribute the counts of in and out migrants (calculated later) amongst the population of each sub-council area. The Excel template file is called: 'FlatDump_TrainingSYOAAnalysis_Avg5year' and is available from the user guidance section on the NRS website.

This file takes the information from each local area's experience in the past 5 years, as estimated in the training projection. Alternatively, the formula on the 'Data' sheet (column U) can be altered to calculate a longer or shorter-term average as desired by the user.

(a) Out-migration age-specific migration rates (ASMR)

1. This stage calculates the single year of age distribution of out migrants for the sub-council areas which is applied for all years. It is assumed you do not have counts by single year of age.
2. Open the template file FlatDump_TrainingSYOAAnalysis_Avg5year.
3. Copy the data from FlatDump_TrainingSYOA.xls (created in section 4.10); this is the local area's estimated migration from the training projection.
4. Paste into FlatDump_TrainingSYOAAnalysis_Avg5year.xls 'Data' worksheet after clicking in cell A1.
5. Click on cell G3 (0-9 are not stored as numbers so won't show up in the pivot table), select all the cells to the bottom of this column (Ctrl+Shift and press the down arrow key), scroll back up to G3 where there will be an exclamation mark. Toggle to the left of the cell, click and select 'Convert to Number'. Then select Row G, right-click Format cells and set to General.
    a. Check the formulas in the final column have not been over-written. These formulae calculate the average of years 2007-08 to 2011-12 (5 years).



	A	B	C	D	E	F	G	N	O	P	Q	R	S	T	U
1	Scenario	Group	Rec_Type	Sign	Topic	Sex	Age	Y2007	Y2008	Y2009	Y2010	Y2011	Y2012	av2007-12	
2019	Training Fife	BuckMeth	Flow	1	Mig_OverseasIn	P	All	199.6	247.3	288.0	262.6	285.7		256.6	=IF(OR(E2019="StartPop",E2019="Constraint"),AVERAGE(O2019:S2019),IF(AND(E2019<>"StartPop",E2019<>"Constraint"),AVERAGE(N2019:R2019),"Error"))
2020	Training Fife	BuckMeth	Flow	1	Mig_OverseasIn	M	0	.0	.0	2.0	.0	.1		.4	
2021	Training Fife	BuckMeth	Flow	1	Mig_OverseasIn	M	1	.0	12.6	.0	1.0	.0		2.7	
2022	Training Fife	BuckMeth	Flow	1	Mig_OverseasIn	M	2	.0	.0	.0	.0	.0		.0	
2023	Training Fife	BuckMeth	Flow	1	Mig_OverseasIn	M	3	.0	.0	.0	.1	.1		.0	
2024	Training Fife	BuckMeth	Flow	1	Mig_OverseasIn	M	4	.0	.0	2.0	.0	.0		.4	
2025	Training Fife	BuckMeth	Flow	1	Mig_OverseasIn	M	5	1.2	.0	6.0	6.0	.0		2.6	
2026	Training Fife	BuckMeth	Flow	1	Mig_OverseasIn	M	6	.0	.0	.0	.1	2.0		.4	
2027	Training Fife	BuckMeth	Flow	1	Mig_OverseasIn	M	7	.0	.0	7.0	1.0	.1		1.6	

    b. The pivot table will need to be updated if the column heading changes by adding it to the 'Values' section e.g. (sum of) avg 2007-12. This may take some time due to the amount of data. This also applies to 'InMig Distribution'.
6. Right-click in the pivot table on the sheet 'MigNet and OutMigRates', and choose Refresh. This will take a few minutes due to the amount of data. If the pivot table is blank this is because the 'Group' remembers the Fife sub areas, refer to 'b' below to resolve this. Apply the following:
    a. The pivot table includes 'All' under age groups, deselect this in the 'Pivot Table Field List' by clicking on the 'Age' filter and deselecting 'All'. (If you don't do this there will be an error on the Male and Female total columns for 'OutMigrationRate per 1000 start pop'.
    b. Check under 'Groups' that the correct areas are included. The 'Group' field seems to have a memory of previous areas listed so you may need to make sure the correct areas have been checked on the 'Group' list. You can do this in the 'Pivot Table Field List' by

clicking on the ‘Group’ filter and checking areas are appropriate. Then ensure that they are in alphabetical order. This will have to be repeated in the ‘InMig Distribution’ pivot table.

Sum of av2007-12	Column Labels										
	M										
Row Labels	0	1	2	3	4	5	6	7	8	9	10
Mig_OverseasIn	63	47	39	40	41	33	37	33	32	34	36
BuckMeth	0	3	0	0	0	3	0	2	1	0	3
BurntKin	1	1	3	2	3	1	4	1	2	2	3
Cowdenb	1	3	2	0	1	1	2	0	2	1	1
Cupar	1	0	1	2	2	1	2	2	1	3	2
EastNeuk	0	1	1	1	0	1	4	1	1	1	0
GlenCent	3	0	4	3	2	3	2	1	0	1	1
GlenNort	4	2	4	0	1	2	2	2	2	3	0
GlenWest	3	0	3	2	4	0	1	2	2	1	4
HoFTayC	2	4	2	0	2	2	1	2	1	2	0
InverkDB	1	2	0	2	1	1	1	2	2	2	0
KdyCent	4	1	0	1	1	1	2	2	2	1	1
KdyEast	2	1	1	3	1	0	3	2	1	0	5
KdyNorth	2	2	2	3	1	1	1	0	1	2	1
LevenKen	0	4	4	3	2	1	0	1	3	4	1

Data | MigNet and OutMigRates | Net&OutMigration Dynamic Charts | OutMigPG

7. The pivot table refresh at stage 6 automatically updates 'InMig Distribution'. Make sure the field 'Value field settings' in the pivot table is set to 'Show value as' '% of row total' (again this will have changed if the ‘Values’ heading has changed).

Sum of av2007-12	Column Labels									
	M									
Row Labels	0	1	2	3	4	5	6	7	8	
Mig_OverseasIn Distribution	0.84%	0.63%	0.53%	0.53%	0.55%	0.45%	0.49%	0.45%	0.43%	0.4
BuckMeth	0.17%	1.06%	0.00%	0.02%	0.16%	1.03%	0.16%	0.63%	0.23%	0.0
BurntKin	0.42%	0.37%	0.86%	0.49%	0.79%	0.43%	1.09%	0.42%	0.49%	0.5
Cowdenb	0.24%	0.99%	0.77%	0.01%	0.46%	0.38%	0.92%	0.01%	0.69%	0.2
Cupar	0.28%	0.00%	0.42%	0.54%	0.54%	0.48%	0.82%	0.69%	0.34%	0.9
EastNeuk	0.18%	0.54%	0.63%	0.63%	0.18%	0.36%	1.63%	0.27%	0.27%	0.4
Fife	0.84%	0.63%	0.53%	0.53%	0.55%	0.45%	0.49%	0.45%	0.43%	0.4
GlenCent	1.22%	0.01%	1.30%	1.01%	0.79%	0.94%	0.72%	0.36%	0.00%	0.5
GlenNort	1.43%	0.58%	1.35%	0.13%	0.26%	0.65%	0.71%	0.53%	0.71%	0.9
GlenWest	0.92%	0.07%	1.00%	0.67%	1.19%	0.08%	0.40%	0.53%	0.73%	0.3
HoFTayC	0.97%	1.50%	0.83%	0.17%	0.65%	0.67%	0.48%	0.75%	0.32%	0.6
InverkDB	0.33%	0.88%	0.17%	0.66%	0.49%	0.48%	0.32%	0.72%	0.64%	0.8
KdyCent	1.23%	0.32%	0.14%	0.19%	0.33%	0.33%	0.59%	0.65%	0.59%	0.3
KdyEast	0.44%	0.31%	0.27%	0.89%	0.28%	0.11%	0.77%	0.55%	0.17%	0.0
KdyNorth	0.71%	0.78%	0.57%	1.21%	0.23%	0.50%	0.50%	0.15%	0.21%	0.5
LevenKen	0.07%	1.19%	1.13%	0.89%	0.61%	0.42%	0.12%	0.36%	0.83%	1.0

OutMigPG | InMig Distribution | InMigrationCharts | InMigPG

8. The sheet 'MigNet and OutMigRates' contains the data for the Schedule sheet of Mig_OUTMIG2.xls. Re-organise it as follows:
   a. Copy these data (A3 to GC*) and paste special - as values and transpose - into the sheet 'OutMigPG'.
   b. Delete all data apart from columns A, B, C and 'OutMigrationRate per 1000 start pop' (it should be the last column) and delete the column for the council area - it is not needed.
   c. If necessary sort the rows for small areas into the same order as the Schedule sheet requires (they should be alphabetical by default which is correct).

	A	B	C	D	E	F	G	H
1	Sum of av2007-12		Row Labels	OutMigrationRate per 1000 start pop	BuckMeth	BurntKin	Cowdenb	Cupar
2	Column Labels	M	0	490	18	4	19	22
3			1	568	35	5	19	57
4			2	626	50	32	5	3
5			3	549	16	37	43	24
6			4	464	50	3	6	25
7			5	409	22	0	27	17
8			6	353	19	2	6	5
9			7	352	16	27	14	8
10			8	399	23	10	17	37
11			9	370	50	10	12	5
12			10	440	12	14	9	15
13			11	292	8	9	8	0
14			12	300	14	7	25	0
15			13	321	24	18	8	10

OutMigPG | InMig Distribution | InMigrationCharts | InMigPG

d. Open ‘Mig_OUTMIG1’ and on the ‘Sched’ worksheet activate Migration Options Population Group for all sub-council areas to activate the age-specific migration rates (per 1,000 population).

e. Enter the rates (from cell E2) to ‘MIG_OUTMIG1’ starting in cell D14 for males and D110 for females.

9. Validate the 'MIG_OUTMIG1' file by clicking the Validate button on the Notes worksheet and check the messages on the Notes worksheet.

10. Save as ‘Mig_OUTMIG2’.xls in the input directory that was created when the Model Setup was run.

Mig_OUTMIG2 [Compatibility Mode]

Population Estimates and Forecasts **Fife Multi-Member Wards**

Migration *Age-sex schedule of migration rates, per thousand population*

VALIDATE *Out-migration*

Options **Population Group .....**

	BuckMeth	BurntKin	Cowdenb	Cupar	DunfermC	DunfermN	DunfermS	EastNeuk
ASMigR	✔	✔	✔	✔	✔	✔	✔	✔

Double click the cell under any population group for which you will insert below values different from

Data

Age specific migration rates (per 1,000 population)

Population Group .....

Sex	Age	Standard	BuckMeth	BurntKin	Cowdenb	Cupar	DunfermC	DunfermN	DunfermS	EastNeuk
male	0	2.1	18.8	13.7	16.1	23.8	18.9	14.7	6.6	31.6
male	1	2.2	29.6	8.7	11.6	39.7	33.2	29.7	2.1	12.2
male	2	2.2	44.7	13.4	22.8	1.5	18.8	43.1	6.5	16.4
male	3	2.1	20.1	44.9	22.7	12.6	26.0	27.7	11.4	45.6
male	4	2.0	38.7	18.7	10.6	22.1	8.6	32.6	5.3	20.5

MaleRates | FemaleRates | Sched | Notes | Fife | Buck

(b) In-migration age-specific migration rates (ASMR)

1. This stage calculates the single year of age distribution of in-migrants for the sub-council areas, which is then applied for all years. The data has been prepared in stage (a) above.

2. The sheet 'InMig Distribution' contains the data for the Schedule sheet of 'Mig_INMIG2.xls'. Reorganise it as follows (same steps as for out-migration)

a) Copy these data (selecting extent of data) and paste special - as values and transpose - into the sheet 'InMigPG'.

b) Delete the column for the council area - it is not needed.

c) If necessary sort the rows for small areas into the same order as the Schedule sheet requires (they should be alphabetical by default which is correct).

	A	B	C	D	E	F	G	H
1	Sum of av2007-12		Row Labels	Mig_OverseasIn Distribution	BuckMeth	BurntKin	Cowdenb	Cupar
2	Column Labels	M	0	0.84%	0.17%	0.42%	0.24%	0.28%
3			1	0.63%	1.06%	0.37%	0.99%	0.00%
4			2	0.53%	0.00%	0.86%	0.77%	0.42%
5			3	0.53%	0.02%	0.49%	0.01%	0.54%
6			4	0.55%	0.16%	0.79%	0.46%	0.54%
7			5	0.45%	1.03%	0.43%	0.38%	0.48%
8			6	0.49%	0.16%	1.09%	0.92%	0.82%
9			7	0.45%	0.63%	0.42%	0.01%	0.69%
10			8	0.43%	0.23%	0.49%	0.69%	0.34%
11			9	0.46%	0.00%	0.55%	0.23%	0.90%
12			10	0.48%	1.17%	0.79%	0.23%	0.81%
13			11	0.53%	0.39%	0.91%	0.61%	1.22%
14			12	0.45%	0.71%	0.73%	0.08%	0.75%
15			13	0.47%	0.32%	0.49%	0.46%	0.68%

OutMigPG | InMig Distribution | InMigrationCharts | InMigPG

d) Open ‘Mig_INMIG1’ and on the ‘Sched’ worksheet activate ‘Migration Options Population Group’ for all sub-council areas to activate the ‘Distribution of migrants’.

e) Paste special (as values) the rates (from cell E2 in sheet ‘InMigPG’) to ‘MIG_OUTMIG1’ starting in cell D14 for males and D110 for females.

f) Check that the percentages all add to 100% in ‘MIG_OUTMIG1’ row 13.

Mig_INMIG2 [Compatibility Mode]

	A	B	C	D	E	F	G	H	I	J	K
1	**Population Estimates and Forecasts**									**Fife Multi-Member Wards**	
2											
3	***Migration***	*Age-sex distribution of migrants*									
4	VALIDATE		*In-migration*								
5	***Options***		**Population Group**								
6			*WestFife*	*DunfNor*	*DunfCen*	*DunfSou*	*Rosyth*	*InverkDB*	*TheLochs*	*Cowdenb*	
7		**Distribution**	✔	✔	✔	✔	✔	✔	✔	✔	
8			*Double click the cell under any population group for which you will insert below values different fr*								
9	***Data***										
10			**Distribution of migrants, adding to 100%**								
11			**Population Group**								
12	**Sex**	**Age**	*Standard*	*WestFife*	*DunfNor*	*DunfCen*	*DunfSou*	*Rosyth*	*InverkDB*	*TheLochs*	*Cowdenb*
13	**Total**		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
14	male	0	0.4%	1.1%	1.0%	0.9%	0.9%	0.9%	0.6%	0.7%	0.3
15	male	1	0.4%	0.9%	0.2%	0.7%	1.2%	0.7%	0.7%	1.1%	0.8
16	male	2	0.4%	0.5%	0.2%	0.9%	0.7%	0.6%	0.3%	0.4%	0.4
17	male	3	0.3%	1.2%	0.5%	0.3%	0.8%	0.7%	1.0%	0.7%	0.2
18	male	4	0.3%	0.6%	0.1%	0.8%	0.9%	0.8%	0.6%	1.3%	0.4

MaleRates | FemaleRates | Sched | Notes | Fife | We

3. Validate the ‘Mig_INMIG1’ file by clicking the Validate button on the Notes worksheet and check the messages on the Notes worksheet.

4. Save as ‘Mig_INMIG2.xls’ in the input directory that was created when the Model Setup was run.

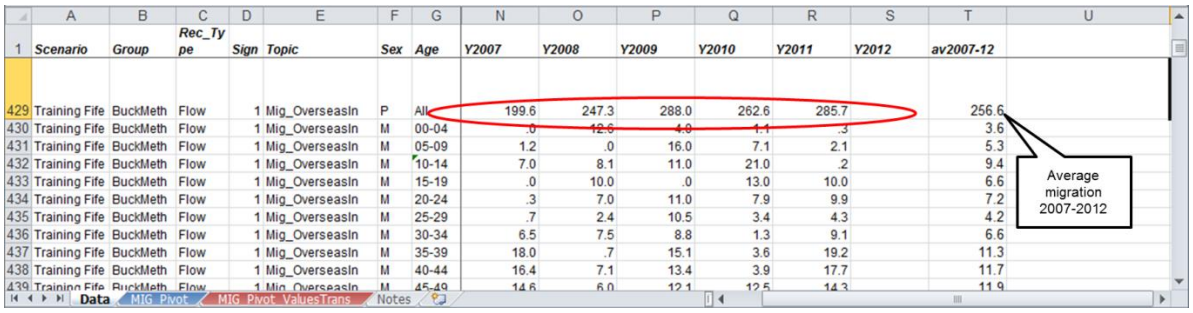
Stage 2 - 5 year counts of in and out migration (sub-council areas)

The Excel template file, provided by Professor Ludi Simpson, calculates 5 year average migration for 5 year age groups for each sub-council area. The Excel template file is called 'FlatDump_Training5YRAnalysis_Avg5year' and is available from the user guidance section on the NRS website.

It is assumed that you do not have counts for single year of age which is why we calculated the age-specific migration rates in Stage 1. Here we input counts of in and out migration for each sub-council area in five year age groups.

(a) Age/sex distribution of OUT migrants

1. Open the template file FlatDump_Training5YRAnalysis_Avg5year
2. Copy data up to the last year in 'FlatDump_Training5YR.xls' (created in section 4.10); this is the local area's estimated migration from the Training projection.
3. Paste into FlatDump_Training5YRAnalysis_Avg5year.xls 'Data' worksheet after clicking in cell A2.
    a) Check the formulas in the final column have not been over-written. These formulae calculate the average of years 2007-08 to 2011-12 (5 years).
    b) Change this formula if you wish to change the average to include more or fewer years. (The pivot table will need to be updated if the column heading changes by adding it to the 'Values' section). This may take some time due to the amount of data. This also applies to 'Mig_OverseasIn'.



	A	B	C	D	E	F	G	N	O	P	Q	R	S	T
1	Scenario	Group	Rec_Type	Sign	Topic	Sex	Age	Y2007	Y2008	Y2009	Y2010	Y2011	Y2012	av2007-12
429	Training Fife	BuckMeth	Flow	1	Mig_OverseasIn	P	All	199.6	247.3	288.0	262.6	285.7		256.6
430	Training Fife	BuckMeth	Flow	1	Mig_OverseasIn	M	00-04	.0	12.6	4.0	1.1	.3		3.6
431	Training Fife	BuckMeth	Flow	1	Mig_OverseasIn	M	05-09	1.2	.0	16.0	7.1	2.1		5.3
432	Training Fife	BuckMeth	Flow	1	Mig_OverseasIn	M	10-14	7.0	8.1	11.0	21.0	.2		9.4
433	Training Fife	BuckMeth	Flow	1	Mig_OverseasIn	M	15-19	.0	10.0	.0	13.0	10.0		6.6
434	Training Fife	BuckMeth	Flow	1	Mig_OverseasIn	M	20-24	.3	7.0	11.0	7.9	9.9		7.2
435	Training Fife	BuckMeth	Flow	1	Mig_OverseasIn	M	25-29	.7	2.4	10.5	3.4	4.3		4.2
436	Training Fife	BuckMeth	Flow	1	Mig_OverseasIn	M	30-34	6.5	7.5	8.8	1.3	9.1		6.6
437	Training Fife	BuckMeth	Flow	1	Mig_OverseasIn	M	35-39	18.0	.7	15.1	3.6	19.2		11.3
438	Training Fife	BuckMeth	Flow	1	Mig_OverseasIn	M	40-44	16.4	7.1	13.4	3.9	17.7		11.7
439	Training Fife	BuckMeth	Flow	1	Mig_OverseasIn	M	45-49	14.6	6.0	12.1	12.5	14.3		11.9

4. Right-click in the pivot table on the sheet 'Mig Pivot', and choose Refresh. The pivot table has filtered out everything except 'Mig_OverseasIn' and 'Mig_OverseasOut' by sex.
    a. Check under 'Groups' that the correct areas are included. The 'Group' field has a 'memory' of previous areas listed so you may need to make sure the correct areas have been checked on the 'Group' list. You can do this in the 'Pivot Table Field List' by clicking on the 'Group' filter and checking areas as appropriate. Then ensure that they are in alphabetical order.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1																			
2																			
3	Sum of av2007-12		Sex	Age															
4			M																M Total
5	Topic	Group	00-04	05-09	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75+	
6	Mig_OverseasIn	BuckMeth	4	5	9	7	7	4	7	11	12	12	8	13	7	5	5	14	131
7		BurntKin	10	10	10	3	10	14	14	22	12	11	5	10	6	7	5	16	165
8		Cowdenb	6	6	4	6	9	9	15	8	9	10	13	5	5	3	5	17	131
9		Cupar	5	10	12	6	3	10	15	10	10	8	7	5	9	4	6	16	137
10		DunfermC	9	8	5	6	15	9	16	12	9	11	4	6	6	4	5	13	137
11		DunfermN	6	3	4	7	19	17	10	9	9	5	7	5	5	6	5	19	135
12		DunfermS	32	16	12	11	23	49	57	50	30	13	12	9	12	9	4	7	347
13		EastNeuk	5	7	3	1	9	15	7	7	9	4	7	7	10	7	3	15	116
14		Fife	231	170	177	304	286	296	365	305	250	223	195	167	163	137	104	326	3698
15		GlenCent	12	7	7	5	9	12	8	12	6	12	5	6	4	6	5	16	134
16		GlenNort	12	11	9	4	4	6	18	14	10	10	12	10	9	8	4	15	155
17		GlenWest	12	6	11	12	9	9	14	11	13	10	6	7	9	5	5	15	156
18		HoFTayC	10	7	5	4	5	9	17	11	7	10	7	5	10	8	4	14	132
19		InverkDB	6	7	9	3	8	7	11	18	8	7	6	7	7	6	3	11	125
20		KdyCent	7	8	7	6	25	18	14	5	10	7	12	5	6	2	5	17	154

Data | MIG_Pivot | MIG_Pivot_ValuesTrans | Notes

5. The sheet ‘MIG_Pivot’ contains the data for the sub-council area sheets of Mig_INMIG2.xls and Mig_OUTMIG2.xls. Re-organise it as follows:

   a. Copy these data and paste special - as values and transpose - into 'Mig_Pivot_ValuesTrans’ (A1).

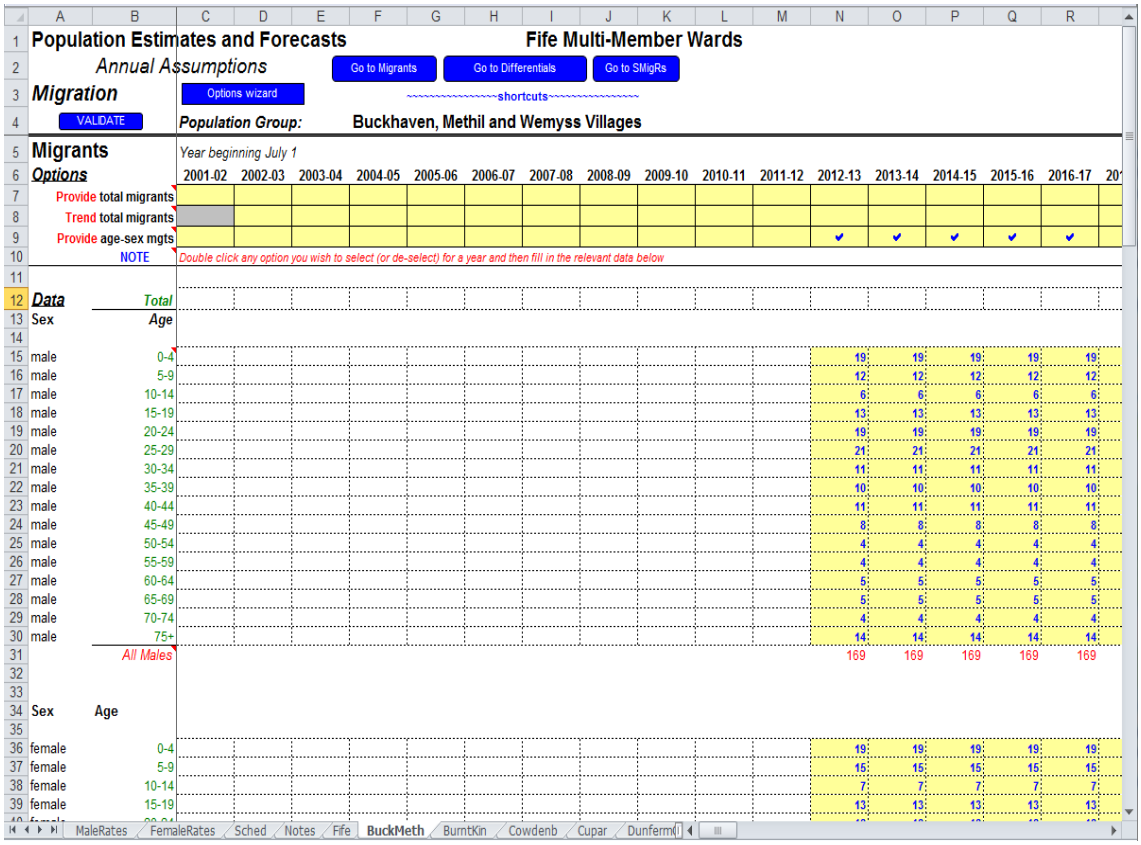
   b. Delete the column for the council area from both In and Out-Migration - it is not needed.

	A	B	C	D	E	F	G	H	I	J	K
1	Sum of av2007-12		Topic	Mig_OverseasIn							
2			Group	BuckMeth	BurntKin	Cowdenb	Cupar	DunfermC	DunfermN	DunfermS	EastNeuk
3	Sex	M	00-04	4	10	6	5	9	6	32	5
4	Age		05-09	5	10	6	10	8	3	16	7
5			10-14	9	10	4	12	5	4	12	3
6			15-19	7	3	6	6	6	7	11	1
7			20-24	7	10	9	3	15	19	23	9
8			25-29	4	14	9	10	9	17	49	15
9			30-34	7	14	15	15	16	10	57	7
10			35-39	11	22	8	10	12	9	50	7
11			40-44	12	12	9	10	9	9	30	9
12			45-49	12	11	10	8	11	5	13	4
13			50-54	8	5	13	7	4	7	12	7
14			55-59	13	10	5	5	6	5	9	7
15			60-64	7	6	5	9	6	5	12	10
16			65-69	5	7	3	4	4	6	9	7
17			70-74	5	5	5	6	5	5	4	3
18			75+	14	16	17	16	13	19	7	15
19		M Total		131	165	131	137	137	135	347	116
20		F	00-04	4	12	9	9	7	3	38	7

Data | MIG_Pivot | MIG_Pivot_ValuesTrans | Notes

   c. Open ‘Mig_OUTMIG2’ and group the sub-council area sheets. Activate Migrants Options ‘Provide age-sex mgts’ for the years required for the migration projection, then ungroup the worksheets.

   d. Enter the ‘MigOverseasOut’ rates (from ‘MIG_Pivot_ValuesTrans’ worksheet in ‘FlatDump_Training 5YRanalysis_Avg5year.xls’) to ‘MIG_OUTMIG2’ starting in row 15 for males and 36 for females. Repeat for each area. Assume the same number of migrants for each year



e. Validate the file by clicking the Validate button on the Notes worksheet and check the messages on the Notes worksheet.

f. Save as ‘Mig_OUTMIG2’.xls in the input directory that was created when the Model Setup was run.

(b) Age/sex distribution of IN migrants

The data has been prepared in stage (a) above.

1. The sheet 'Mig_Pivot_ValuesTrans’ contains the data for the sub-council area sheets of Mig_INMIG2.xls.

   a. Open ‘Mig_INMIG2’ and group the sub-council area sheets. Activate Migrants Options ‘Provide age-sex mgts’ for the migration projection years, ungroup the worksheets.

   b. For each sub-council area worksheet in ‘MIG_INMIG2’, enter the ‘MigOverseasIn’ rates (from ‘MIG_Pivot_ValuesTrans’ worksheet in ‘FlatDump_Training 5YRanalysis_Avg5year.xls’) in row 15 for males and row 36 for females. Repeat for each area. Enter the same numbers for each year of the projection period.

   c. Validate the file by clicking the Validate button on the Notes worksheet and check the messages on the Notes worksheet.

   There will be a warning – e.g. “BuckMeth - No flow data was provided for year 2001-02 to 2011-12 although a value was provided in a later year. Zero will be assumed in all age sex groups for these years – WARNING” However, this is not used for the migration projection so can be ignored.

d. Save as ‘Mig_INMIG2’.xls in the input directory that was created when the Model Setup was run.

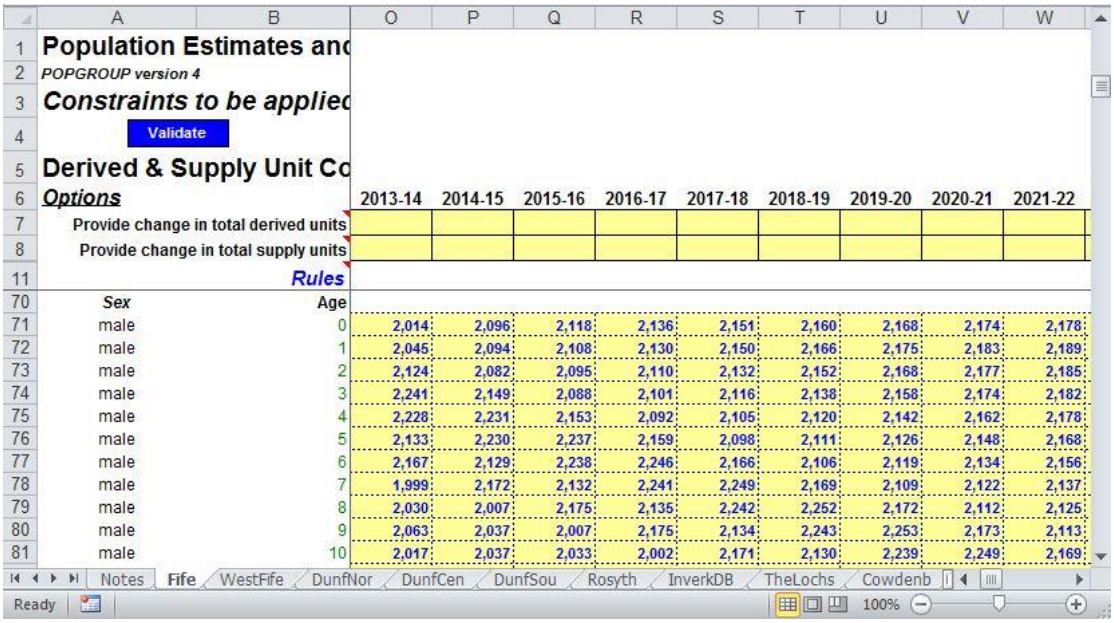
There are now two sets of migration assumptions. The files ‘Mig_IN2.xls’ and ‘Mig_OUT2.xls’ contain the most developed local assumptions, as follows:

- For previous years, the migration will be computed according to the population estimate in the constraints file, for each local area.
- For years after the known population estimates, a projection based on:
    a. The small area’s recent experience of migration, for five-year age groups (each small area sheet).
    b. Within each age group, the distribution between single years of age is based on the schedule of age-sex-specific migration rates (‘Sched’ sheet).
    c. In each case, only the estimate of net migration is robust. The division between in- and out-migration is not based on local information, but is simply calculated to be consistent with past population estimates.

5.5. Constraints

Projections can be constrained to the published Sub-national Population Projection (SNPP) figures.

1. Open ‘cons1.xls’.
2. On the all groups (‘Fife’) worksheet, activate ‘Population Constraints’ ‘Provide population by sex & age’ for the migration projection years.
3. Use the most recent sub-national projections by council area by single year of age and sex which are available on the Population section of the NRS website
4. Save as ‘cons2’.xls in the input directory that was created when the Model Setup was run.



Population Estimates and
POPGROUP version 4
Constraints to be applied
Validate
Derived & Supply Unit Co
Options
Provide change in total derived units
Provide change in total supply units
Rules

Sex	Age	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
male	0	2,014	2,096	2,118	2,136	2,151	2,160	2,168	2,174	2,178
male	1	2,045	2,094	2,108	2,130	2,150	2,166	2,175	2,183	2,189
male	2	2,124	2,082	2,095	2,110	2,132	2,152	2,168	2,177	2,185
male	3	2,241	2,149	2,088	2,101	2,116	2,138	2,158	2,174	2,182
male	4	2,228	2,231	2,153	2,092	2,105	2,120	2,142	2,162	2,178
male	5	2,133	2,230	2,237	2,159	2,098	2,111	2,126	2,148	2,168
male	6	2,167	2,129	2,238	2,246	2,166	2,106	2,119	2,134	2,156
male	7	1,999	2,172	2,132	2,241	2,249	2,169	2,109	2,122	2,137
male	8	2,030	2,007	2,175	2,135	2,242	2,252	2,172	2,112	2,125
male	9	2,063	2,037	2,007	2,175	2,134	2,243	2,253	2,173	2,113
male	10	2,017	2,037	2,033	2,002	2,171	2,130	2,239	2,249	2,169

Notes | Fife | WestFife | DunfNor | DunfCen | DunfSou | Rosyth | InverkDB | TheLochs | Cowdenb

Ready 100%

5.6. Special populations

1. If any special populations were accounted for in the training projection in the file ‘specpop1.xls’, then these should be considered for the migration projection also.
2. Depending on the nature of the population, an average or an assumption of the most recent figures remaining constant may be most appropriate e.g. if a new prison opened recently an average may not be possible.

6. The migration-led projection - constrained

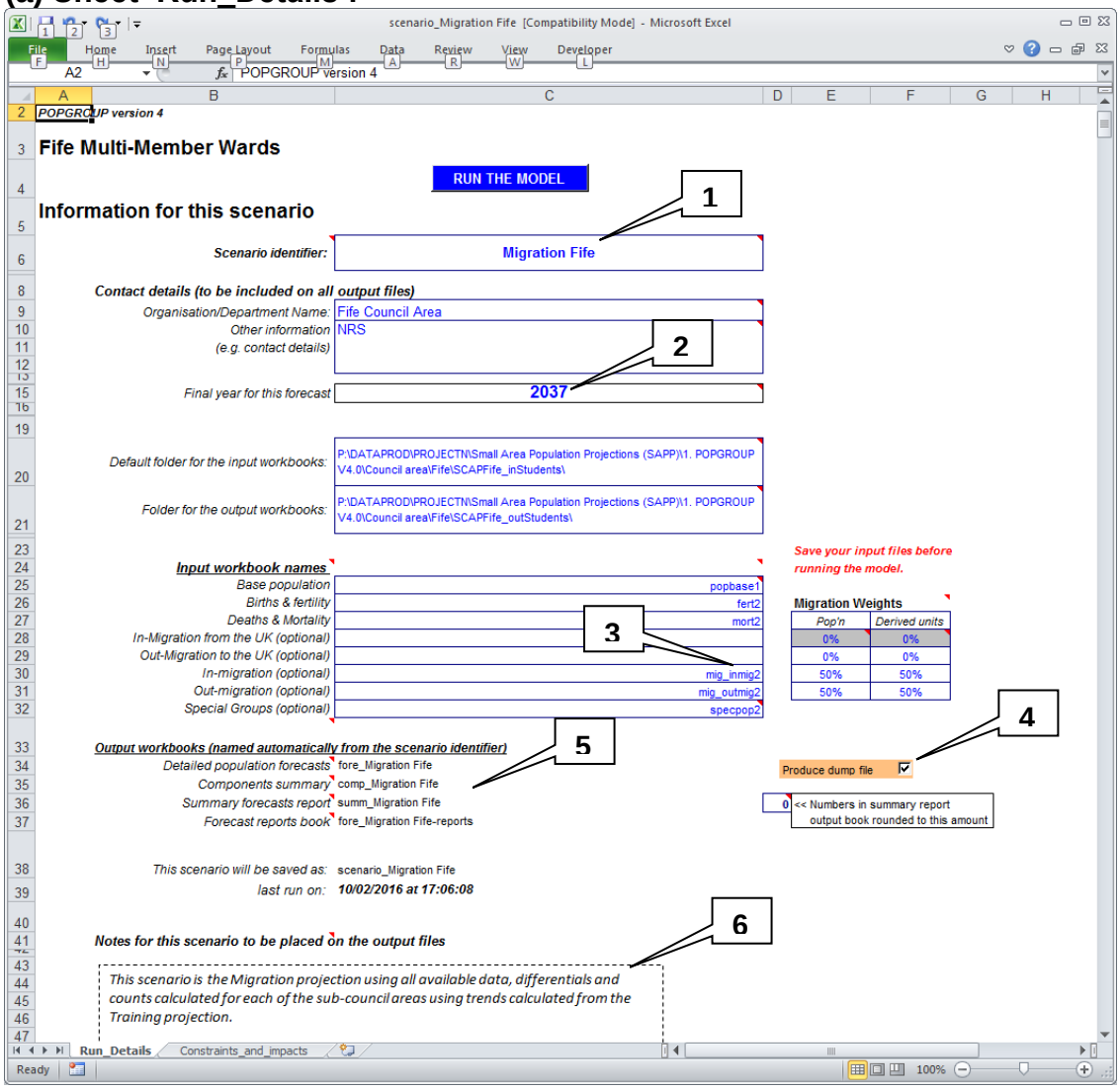
This section prepares the scenario for a projection that continues the experience of the recent past, using the input files that have been prepared as described in the previous sections. Such a projection is sometimes called a ‘trend projection’, although apart from following future fertility and mortality trends expected nationally it does not identify or continue any local trends. It maintains the same fertility and mortality differences between areas, and the same level of migration in each area.

This is also sometimes called a ‘migration led’ projection, in distinction to projections led by a scenario of possible housing developments when migration is projected to fill the housing that is expected to be available. We use the term ‘migration led’ in this guidance.

6.1. Prepare the scenario

Open the input file ‘scenario_training<ID>.xls’. Edit it as follows and run it; it will be saved automatically as ‘scenario_Migration<ID>.xls’ in the input directory that was created when the Model Setup was run.

(a) Sheet ‘Run_Details’:

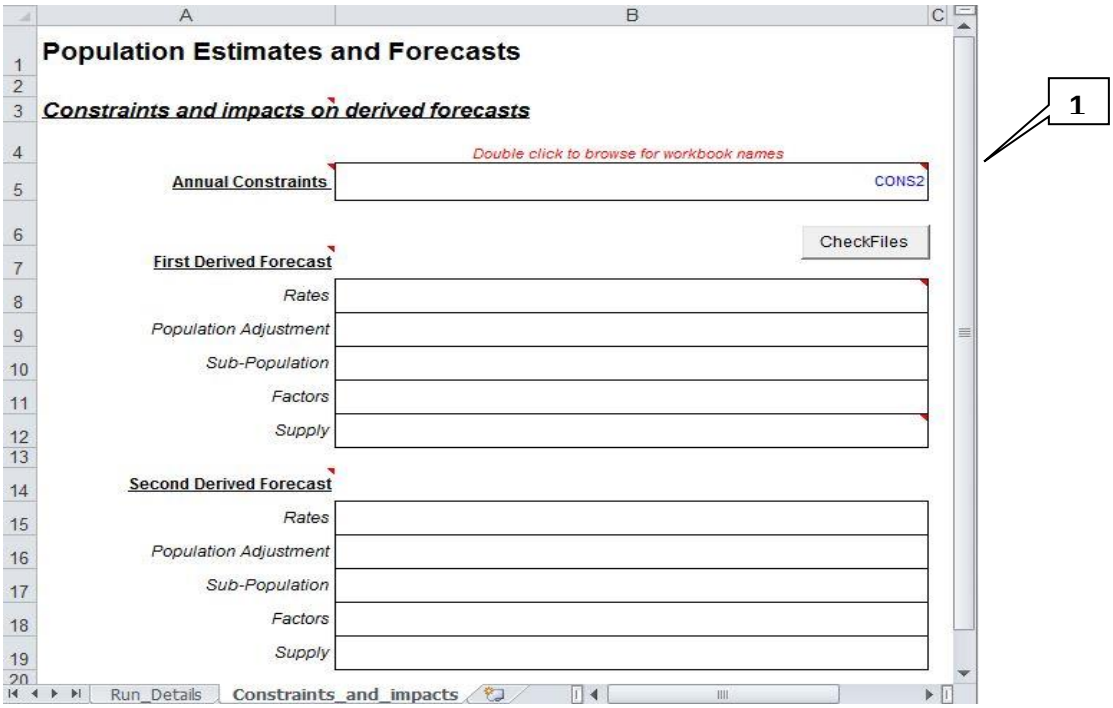


Notes:

1. Change the scenario ID to ‘Migration [Council Area]’ to distinguish from the training run.
2. The final year for this projection will depend on the uses it will be put to. Remember that projections further ahead are less reliable.
3. Amend the files to be used for this scenario. Only the population base has not changed from the training scenario. The other files have suffix 2 (if the naming convention suggested here has been followed).
4. There is no need for the dump file this time (but there is no harm in producing it if you want its output. It is much larger than any other file, because it dumps all the projection information in great detail).
5. The output files are named automatically, using the scenario ID.
6. Enter notes as desired.

(b) Sheet 'Constraints_and_impacts':

Cons2.xls as well as containing the past population estimates used in the training run now also contains the sub-national population projections for the council area



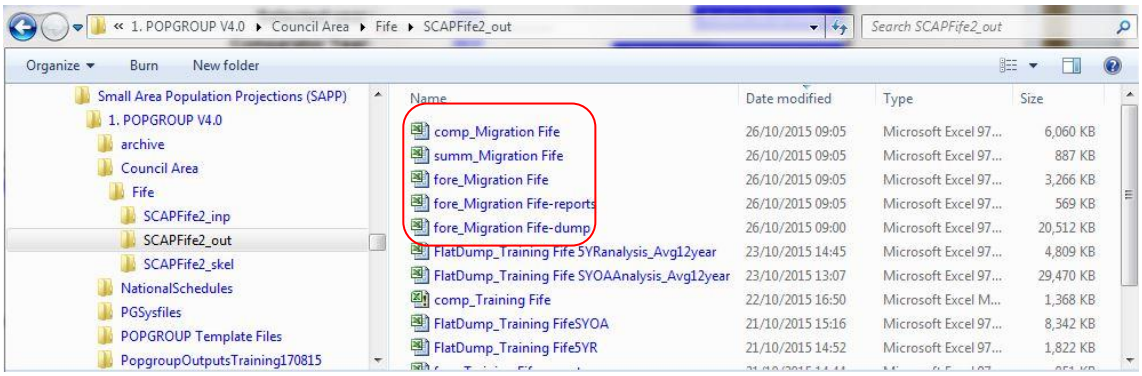
Notes:

1. Redirect to cons2.xls and check file.

6.2. Run the projection

When you have entered all the above information, make sure all the Excel files are closed, with the exception of the scenario file. Run the scenario by clicking the button on the 'Run_Details' sheet: **RUN THE MODEL**

1. When the model has run successfully, the scenario file ('scenario_Migration Fife.xls') will be stored in the input directory and the output files will have been saved in the outputs directory.



2. The following files are automatically opened:
   - 'fore_Migration_reports.xls' – to generate charts (approx. 500KB).

- ‘fore_Migration.xls’ – contains population projections by sex/SYOA for SCAP areas (approx. 3MB).
- ‘comp_Migration.xls’ – components of population change (approx. 6MB).
- ‘summ_Migration.xls’ – summary table of results on one page plus age band summary of SCAP areas (approx. 900KB).

As the dump file was ticked it has also been saved but has not opened automatically:

- ‘fore_Migration_dump.xls’ – contains all data (approx. 20MB).

3. Explore the output using ‘fore_Migration-reports.xls’.

7. The migration-led projection - unconstrained

7.1. Running the projection without the SNPPs as a constraint

Once the projection has been run, it can be run again without the SNPPs as a constraint, if desired. This will help identify the impact of the constraint on the projected results produced in POPGROUP.

1. Follow the instructions from section 6.1 to 6.2 and change the Scenario ID to ‘Migration [council area] unconstrained’.
2. Remove ‘cons2’ from the ‘constraints_and_ impacts’ sheet and replace with ‘cons1’, then run.
3. The unconstrained projection still uses calculations of fertility and mortality rates from the national projections. It simply removes the council area level constraint from the projection.