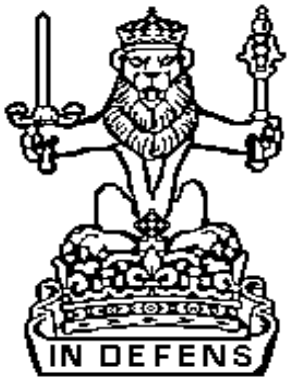

General Register Office for Scotland
information about Scotland's people

Small Area Population Projections

Fife Multi-Member Ward Projections

Comparison of Different Scenarios Using POPGROUP

March 2010

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KEY FINDINGS

Fertility

- The use of total fertility rates estimated from births, together with the national age-specific pattern, should be sufficient for most purposes.

- Local age–specific fertility rates can add some accuracy to the projections, so the provision of ‘age of mother’ data at some level of detail would be beneficial.

- If local age-specific fertility rates are used, the age/sex structure of the underlying population data must be as accurate as possible, especially in areas with ‘special’ populations, such as students.

Mortality

- The use of standardised mortality ratios estimated from deaths, together with the national age-specific pattern should be sufficient for most purposes.

- Local age–specific mortality rates can add some accuracy to the projections, so the provision of ‘age at death’ data at some level of detail would be beneficial.

Migration

- The recent net impact of migration at each age and sex can be estimated from successive population estimates without the need for direct counts of local migration.

- Population projections will not be significantly helped by standard estimates of migration flows for data zones.

- Migration data would be useful for other purposes, and could be defined with other purposes in mind, including flows between data zones so that aggregated data could be properly derived.

1. Purpose

This paper reports on the results of an investigation into the effects of using various different fertility, mortality and migration assumptions when producing small area population projections using POPGROUP.

Using the results of this investigation, the General Register Office for Scotland (GROS) will determine what data should be made available to councils and health boards so that they can run their own local small area population projections in POPGROUP. The data made available should allow users to produce good quality population projections at different levels of geography.

There may be some restrictions on the level of detail that GROS is able to provide to users because of disclosure control issues.

2. Introduction

The Centre for Census and Survey Research (CCSR) at the University of Manchester has produced population projections for the Multi-Member Wards (MMWs) in Fife, based on data supplied by GROS and Fife Council, using POPGROUP software. Assumptions were made about future fertility, mortality and migration rates in the production of the population projections in this particular scenario (referred to here as the 'Main' scenario).

All data (population, births, deaths, migration, etc.) in the 'Main' scenario have been allocated to MMWs using data zone statistics. Where a data zone crosses the boundary of two or more MMWs, proportions provided by Fife Council have been applied to the data.

This report compares the results of the 'Main' scenario with other scenarios run in POPGROUP, where the fertility, mortality and migration assumptions are different, and also with the scenario where MMW data were derived from whole data zones (that is, data zones that cross MMW boundaries were not proportioned, but the whole data zone was allocated to one MMW).

The scenarios discussed in this report are listed in Table 2.1.

Table 2.1: Summary of scenarios

Scenario	Description
Main	The scenario produced by CCSR for Fife Council.
Main_dz	Same as the 'Main' scenario, except that whole data zones were used when allocating population, births, deaths and migration estimates to wards.
6-year(F)	MMW fertility differentials based on a 6-year average (rather than the 4-year average used in 'Main').
ASFR1	Unsmoothed age-specific fertility rates, age of mother at time of birth.
ASFR2	Smoothed age-specific fertility rates, age of mother at time of birth.

ASFR3	Smoothed age-specific fertility rates, age of mother at the start of the year.
TFR1	MMW fertility differentials derived from Age Specific Fertility Rates ('ASFR1') (unsmoothed ASFR).
TFR2	MMW fertility differentials derived from 'ASFR2' (smoothed ASFR).
TFR3	MMW fertility differentials all equal to 1.
6-year(M)	MMW mortality differentials based on a 6-year average (rather than the 4-year average used in 'Main').
ASMR1	Age-specific mortality rates.
ASMR2	Smoothed age-specific mortality rates.
ASMigR1	Age-specific migration rates based on recent migration flows at data zone level.
ASMigR2	Migration flows to 'rest of Fife' and 'outside Fife' rather than 'rest of UK' and 'overseas' (unsmoothed).
ASMigR3	Migration flows to 'rest of Fife' and 'outside Fife' rather than 'rest of UK' and 'overseas' (smoothed).
ASMigR4	No distinction made between 'rest of UK' and 'overseas' migration flows. Only total in and out migration used.
ASMigR5	No migration.

Another scenario (the 'Training' scenario) was run before any of these, to produce rates (fertility, mortality, migration) at MMW level that could provide a baseline estimate of recent fertility, mortality and migration. These were used in the 'Main' projection, which is then compared with scenarios based on other estimates of demographic rates. The 'Training' scenario is a relatively simple projection that only produces a forecast for 2007. For example, in terms of fertility, it initially uses Scotland-level Total Fertility Rates (TFRs) and future fertility differentials for 5-year age groups, but then adjusts these to GROS population estimates since 2001 and the number of births and deaths for each MMW for the period 2001-2007. The main purpose of this scenario is to produce demographic rates for each MMW for 2001 to 2007 that can be used in other scenarios.

The results of different scenarios were compared. There is no 'most accurate' projection since the future population is not yet known. The estimates used for some scenarios may have greater 'face validity' if they are based on more detailed local data: the aim is to assess whether the results of using these more plausible estimates provides significantly different projections. Where projections from different scenarios are different, in some cases one set of results may be most plausible in the way it deals in an expected manner with special areas. Fife MMWs include the special areas of St Andrews (with many students), and Dunfermline South (fast growing from family housing developments in the past decade).

The projections all aim to continue recent local demographic change. 'Dwelling-led' projections, which explore the impact of planned housing developments, are often a further activity in local planning for which the POPGROUP software is used, but are not discussed in this report.

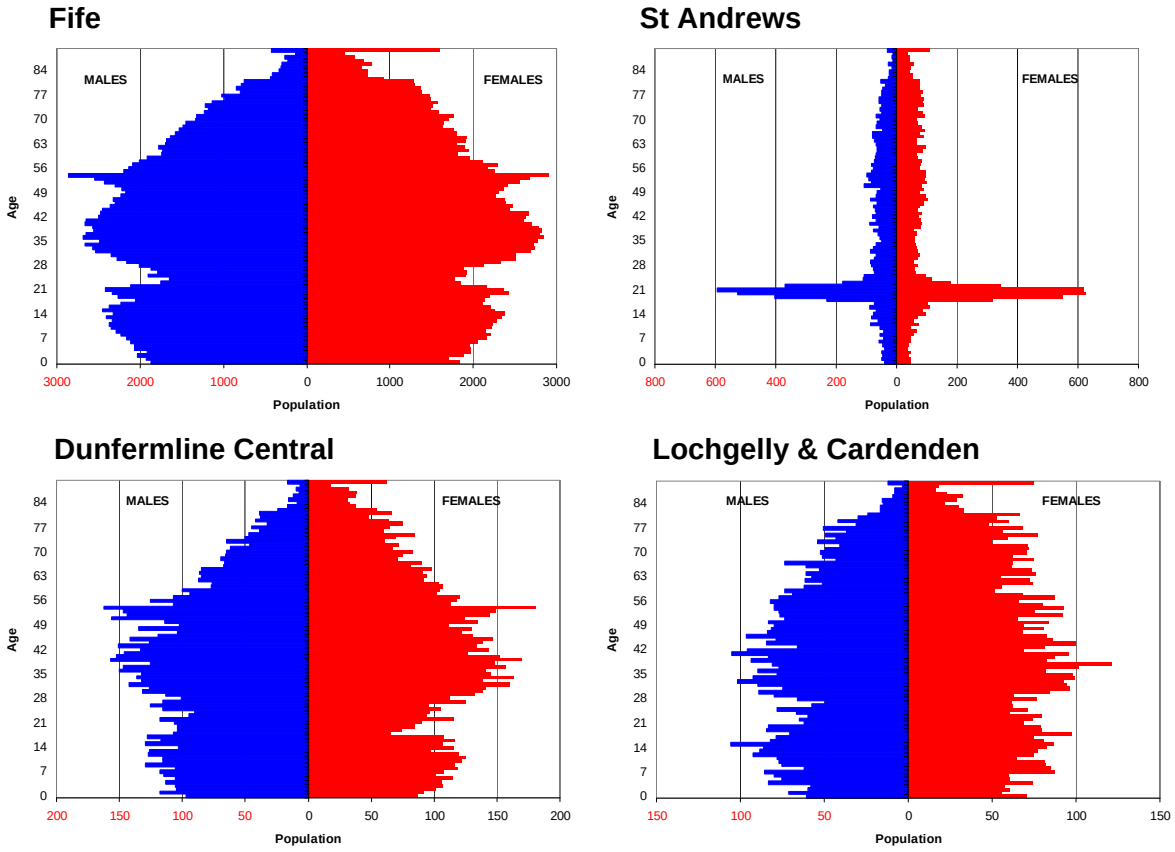
3. 'Main' Scenario

This section summarises the data used in the 'Main' scenario, the approach taken by CCSR to produce the multi-member ward population projections for Fife Council.

3.1 Population base

The population base for this scenario was the 2001 mid-year estimates for each ward in Fife, by single year of age and sex. Figure 3.1 shows the population structure of Fife and selected wards in 2001 by age and sex. The population pyramid for St Andrews highlights the peak in the 18-25 age group caused by the large number of university students in this ward.

Figure 3.1: Population pyramid of Fife and selected wards, 2001



3.2 Constraints

The forecast was constrained by the ward mid-year population estimates for 2002 to 2007, by single year of age and sex.

3.3 Fertility

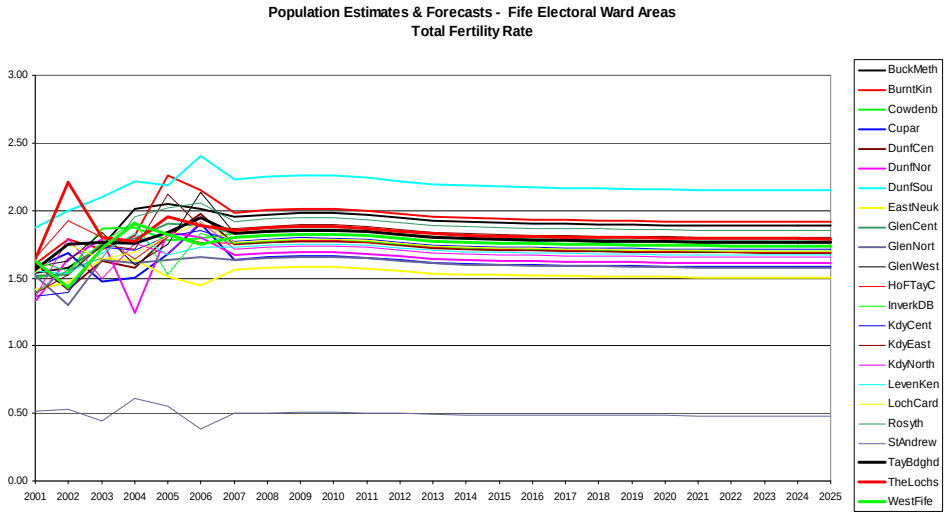
Scotland-level fertility rates were used in the 'Main' scenario, to which MMW-level differentials were applied to obtain the annual number of births for each MMW in Fife for the period 2001-2026. A combination of ASFRs, TFRs and fertility differentials were used. The fertility assumptions used in the 'Main' scenario are outlined in Table 3.1.

Table 3.1: Fertility assumptions used in the 'Main' scenario

POPGROUP worksheet	Data provided	Comments
Sched	ASFR per 1,000 women for Scotland (2007/8). TFR for Scotland (2007/8). Boys / 1,000 girls for Scotland	Annex B. Annex B. = 1,060 (POPGROUP default)
Fife	Fertility differentials for each year for 2006 onwards, by age groups 15-19, …, 45-49.	Annex B. These reflect the fertility change projected for Scotland, and are used for the fertility change in each MMW.
Ward	Births (male and female) for mid-2001 to mid-2007. Fertility differential = (average of MMW TFRs for 2003/4 to 2006/7) / (standard TFR for Scotland)	Derived from data zone births. The TFRs used in the numerator are taken from the 'Training' scenario.

The 'Main' scenario gives relatively stable TFRs for each ward for 2007 onwards. The TFR for St Andrews is much lower than the other wards throughout the period (Figure 3.2).

Figure 3.2: Total fertility rates for Fife wards, 2001-2026, Main scenario



3.4 Mortality

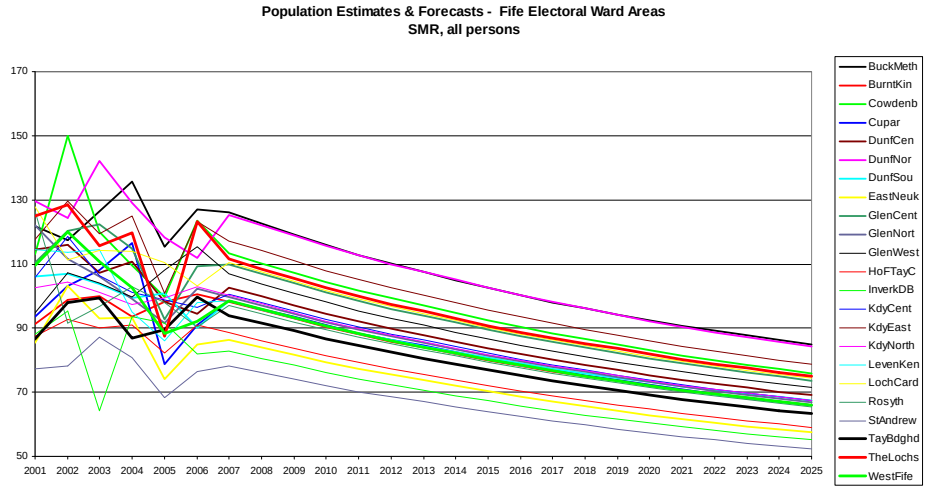
Scotland-level mortality rates were used in the 'Main' scenario, to which MMW-level differentials were applied to obtain the annual number of deaths for each MMW in Fife for the period 2001-2026. A combination of age-specific mortality rates (ASMRs) and mortality differentials were used. The mortality assumptions used in the 'Main' scenario are outlined in Table 3.2

Table 3.2: Mortality assumptions used in the 'Main' scenario

POPGROUP worksheet	Data provided	Comments
Sched	ASMR per 1,000 population for Scotland (2007/8).	Annex C.
Fife	Mortality differentials for each year for 2006 onwards, by age groups newborn/0, 1-4, 5-9, … , 80-84, 85+.	Annex C. These reflect the mortality change projected for Scotland, and are used for the mortality change in each MMW.
Ward	Deaths (male and female) for mid-2001 to mid-2007, by age group and sex. Mortality differential = (average of MMW Standardised Mortality Rates (SMR)'s for 2003/4 to 2006/7) / 100	Derived from data zone deaths. The SMRs used in the numerator are taken from the 'Training' scenario.

The 'Main' scenario gives declining Standardised Mortality Rates (SMRs) for each ward from 2007 onwards (Figure 3.3).

Figure 3.3: Standardised mortality rates for Fife wards, 2001-2026, Main scenario



3.5 Migration

In the 'Main' scenario, the age-sex rates of migration for Britain from the 2001 Census were initially scaled up or down to be consistent with each ward's migration to the rest of the UK and from the rest of the UK, in each of four age bands (0-17, 18-29, 30-44, and 45+, for males and females separately), also from the 2001 Census. International immigration age-specific rates were tailored to census flows to each MMW in the same way, while emigration rates for all wards were initially set to the GB level.

The migration flows implied by these rates were then adjusted after the 'Training' run to be consistent with the age-specific population estimates for wards for each of mid-2002 to mid-2007. The adjustment was made by POPGROUP, in this case to the international migration flows which are usually the least robust of the initial estimates. These adjusted

estimates of migration were then used for future migration flows, from mid-2007, taking the average of the four years mid-2003 to mid-2007.

The migration in the 'Main' scenario is therefore expected to reflect recent experience in its overall net impact on population. Its division into in- and out-flows, and between UK and overseas migration, is not expected to be robust.

The 'Main' scenario uses projected counts of migrants as described, for 5-year age-sex groups. The schedule of rates described above is therefore used only to distribute the counts of migrants to single years of age. The migration assumptions used in the 'Main' scenario are outlined in Table 3.3.

Table 3.3: Migration assumptions used in the 'Main' scenario

POPGROUP worksheet	Data provided	Comments
Sched	Age Specific Migration Rates (ASMigR) per 1,000 males and females for Britain from the 2001 Census. ASMigRs per 1,000 males and females for each MMW in Fife.	Annex D. Derived from the 2001 Census for in-migration from the rest of the UK; out-migration to the rest of the UK; in-migration from overseas. Area factors are applied to the Britain ASMigRs, based on observed and expected numbers of migrants in four broad age sex groups.
Fife	Nil.	
Ward	Migrants (by 5-year age group and sex) for 2007 onwards.	Derived from the 'Training' scenario. The age-sex breakdown is obtained from the average of the latest four years from file 'fore_1st_dump.xls' (file 'migrantcountreport.xls').

4. Fertility

The scenarios discussed in this section differ from the 'Main' scenario only in the fertility rates used. The main impact will be on the projected number of births for each year, so the only comparisons done here relate to the births. (The total population projections will be affected at the younger age groups, but any differences should be mainly a consequence of the difference in the number of births in any particular year and in the preceding years).

4.1 Scenario '6-year(F)'

This scenario is the same as 'Main' except that fertility differentials have been improved. One of the main purposes of this scenario is to use it as a comparison with other fertility scenarios. (It gives a more valid comparison than the 'Main' scenario because it uses data from the same period as the other scenarios.)

The MMW fertility differentials (on the MMW worksheets) are based on the average of a 6-year period (2001/2 – 2006/7) rather than a 4-year period (2003/4 – 2006/7).

The ward fertility differential as calculated by CCSR is dependent on level of fertility for recent years, which is always related to that projected for Scotland in 2007/8. The differential would be better calculated by comparing the recent local TFR to the TFR for Scotland in the same recent years. So, an additional fertility differential at Fife level has been added to take account of the rise in fertility between 2001/2 and 2007/8.

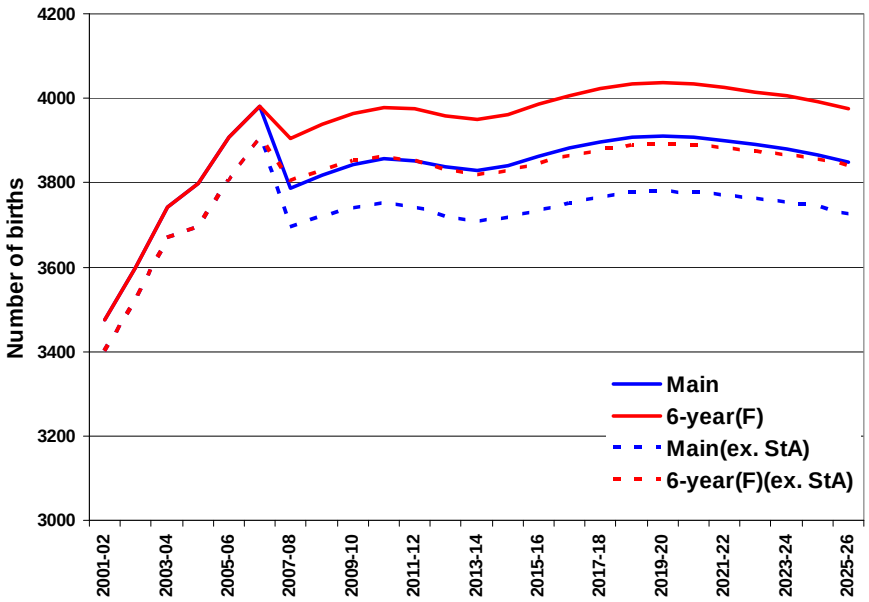
The new fertility differentials used in this scenario are as follows:

MMW fertility differential = (average of MMW TFRs for 2001/2 to 2006/7) / (standard TFR for Scotland), where the TFRs used in the numerator are taken from the 'Training' scenario.

Fife fertility differential = (standard TFR for Scotland) / (average TFR for 2001 to 2007 from Vital Events Reference Table 3.6) = 1.71 / 1.59 = 1.07

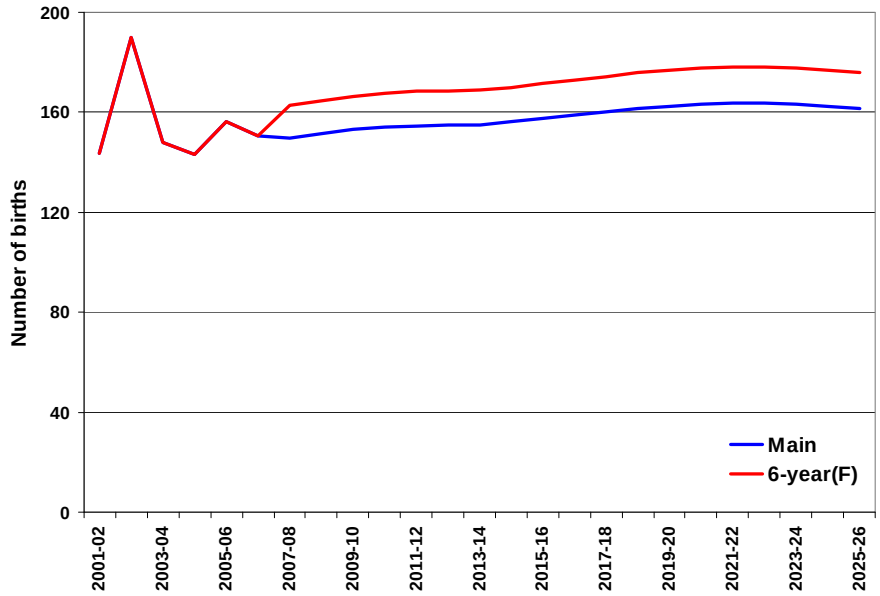
For Fife the projected number of births is higher than in the 'Main' scenario (Figure 4.1). This discrepancy in births is reflected in the projection for the total population. The higher number of births in the '6-year(F)' scenario is to be expected since this scenario uses fertility rates that reflect the increased fertility in recent years. (The dotted lines represent the projected number of births when St Andrews is excluded. In this case, the projected number of births for St Andrews is similar for both scenarios. Therefore, it makes little difference to the outcome if St Andrews is excluded.)

Figure 4.1: Projected births for Fife 2001-2026: Main v 6-year(F) scenarios



At MMW level, most wards show a pattern similar to Fife for the projected number of births. Figure 4.2 illustrates this for The Lochs ward.

Figure 4.2: Projected births for The Lochs 2001-2026: Main v 6-year(F) scenarios



For the MMW in Figure 4.2, the maximum difference between the projected number of births for these scenarios in any year is 14 (a 9.1 per cent relative difference). This is the maximum absolute difference for all the MMWs in Fife, while the maximum relative difference is 9.3 per cent, in St Andrews.

There are three MMWs (Rosyth, Kirkcaldy East and Kirkcaldy Central), where the projected number of births is lower in the '6-year(F)' scenario. However, the discrepancy for these MMWs is less than 2 births in any year.

This scenario is used as a comparison with the other alternative fertility scenarios discussed in later sections, rather than the 'Main' scenario.

4.2 Scenario 'ASFR1'

This scenario differs from '6-year(F)' in that, instead of using Scotland-level age-specific fertility rates and then applying a differential at MMW level, it uses ASFRs for each ward, calculated from population and birth data for each MMW for mid-2001 to mid-2007.

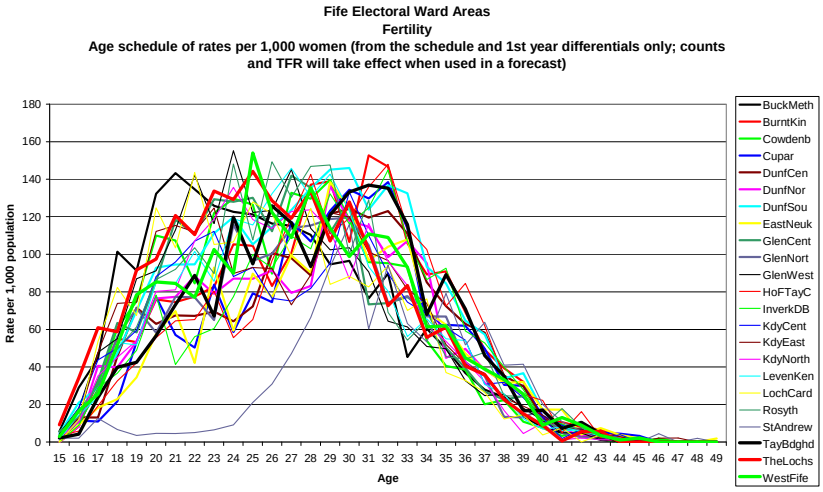
Table 4.1: Fertility assumptions used in the 'ASFR1' scenario

POPGROUP worksheet	Data provided	Comments
Sched	ASFR per 1,000 women for Scotland (2007/8).	Annex B.
	ASFRs per 1,000 women for each MMW in Fife.	Annex B.
	TFR for Scotland (2007/8) and for each MMW.	Annex B.
	Boys / 1,000 girls for Scotland	= 1,060 (POPGROUP default)
Fife	Fertility differential based on average of Scotland rates for 2001 to 2007.	

	Fertility differentials for each year for 2006 onwards, by age groups 15-19, …, 45-49.	Annex B. These reflect the fertility change projected for Scotland, and are used for the fertility change in each MMW.
Ward	Births (male and female) for mid-2001 to mid-2007.	Derived from data zone births.

Figure 4.3 shows that the curves of the ASFRs for the wards are not very smooth, so it is probably not sensible to use this scenario. For this reason, no further investigation was done for this scenario. However, the rates can be smoothed and the following two sections look at alternative scenarios using ASFRs at MMW level ('ASFR2' and 'ASFR3'). The influence of the low fertility of students is clear for St Andrews. The 'Main' scenario correctly estimates the lower fertility for St Andrews overall, but not its particularly low fertility for the young adult ages.

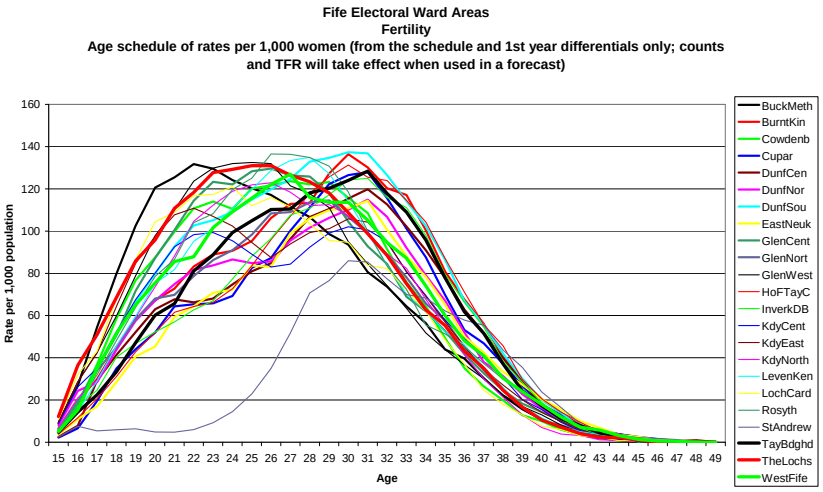
Figure 4.3: Age-specific fertility rates for MMWs in Fife, ASFR1 scenario



4.3 Scenario 'ASFR2'

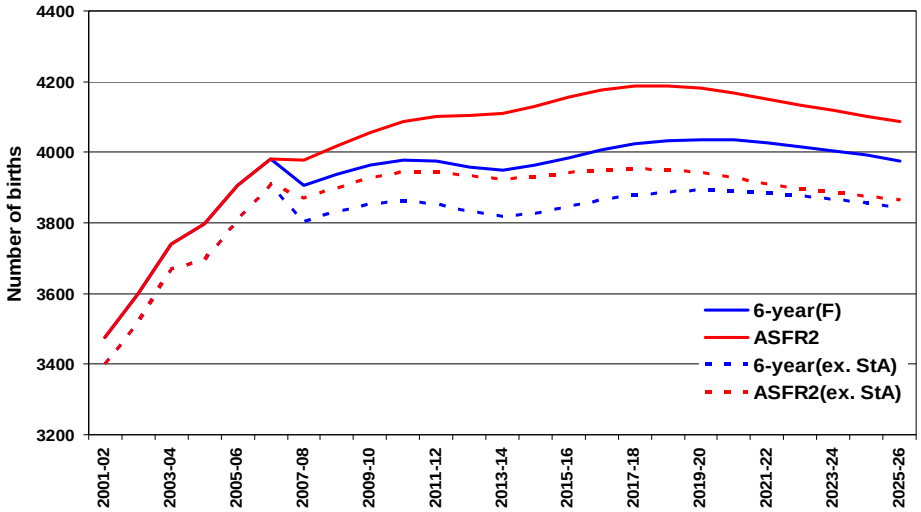
This is the same as the previous scenario ('ASFR1'), but with smoothed fertility rates, using a moving-average smoothing method. Figure 4.4 shows the effect of smoothing the rates in this way.

Figure 4.4: Age-specific fertility rates for MMWs in Fife, ASFR2 scenario



The projected total number of births for 'ASFR2', compared with the '6-year(F)' scenario is shown in Figure 4.5. (The dotted lines show the corresponding figures when St Andrews is omitted.) This shows that the projected number of births is higher for the 'ASFR2' scenario throughout the period.

Figure 4.5: Projected births for Fife 2001-2026: 6-year(F) v ASFR2 scenarios



At MMW level, the projected number of births is either the same or slightly higher in the 'ASFR2' scenario than in the '6-year(F)' scenario for the majority of wards. Excluding St Andrews, in any year differences range from 16 in Glenrothes West to -17 in Dunfermline South (where a positive difference indicates that 'ASFR2' is higher than '6-year(F)'). In terms of relative differences, these range from 8.5 per cent in Glenrothes Central to -4.5 per cent in Dunfermline South.

In St Andrews, the projected number of births is higher in the 'ASFR2' scenario, with differences of up to 96 (and a maximum relative difference of 68 per cent). Figure 4.6 shows the projected number of births for St Andrews for scenarios '6-year(F)' and 'ASFR2'. Scenario 'ASFR2' is likely to over-estimate the number of births in St Andrews because of the 'ageing on' process that takes place. Although the fertility rates for 18-25 year olds are very low (Figure 4.4), when the large female population in this age group is 'aged on' they will inflate the number of females in the older, more fertile age groups and, consequently, inflate the number of births. The cause of the ageing-on may lie in the age structure of the population in the years 2001 to 2006. Figure 4.7 shows how the population of the 15-30 female age group changed between 2001 and 2006. The total population for St Andrews is likely to be reasonably accurate and the number of students registered at St Andrews University increased during this period, which will account for rise in some of the age groups. Other increases, such as those from age 22 onwards, may be evidence that we do not have the correct age structure in later years. This apparent ageing-on in the period 2001-2006 may have an effect on the projected age structure for 2007 and onwards. As a result, POPGROUP may be overestimating the female population in the 25 and over age groups, based on the data from the 'lead-in' period of 2001-2006. We may need to restrict the 'ageing-on' of the student population and maintain the high numbers in the 18-25 year age group, where the fertility rates are low.

Figure 4.6: Projected births for St Andrews 2001-2026: 6-year(F) v ASFR2 scenarios

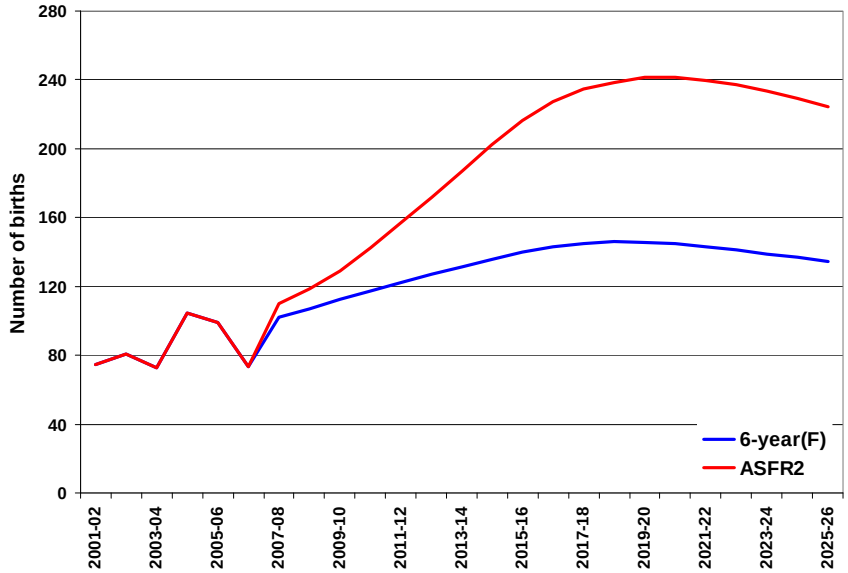
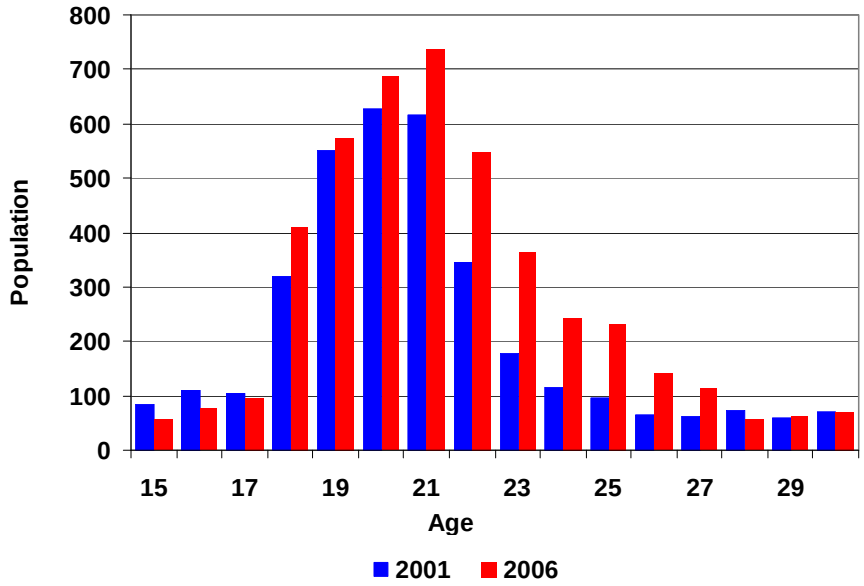


Figure 4.7: Population estimates for 15-30 year-old females, St Andrews 2001 and 2006



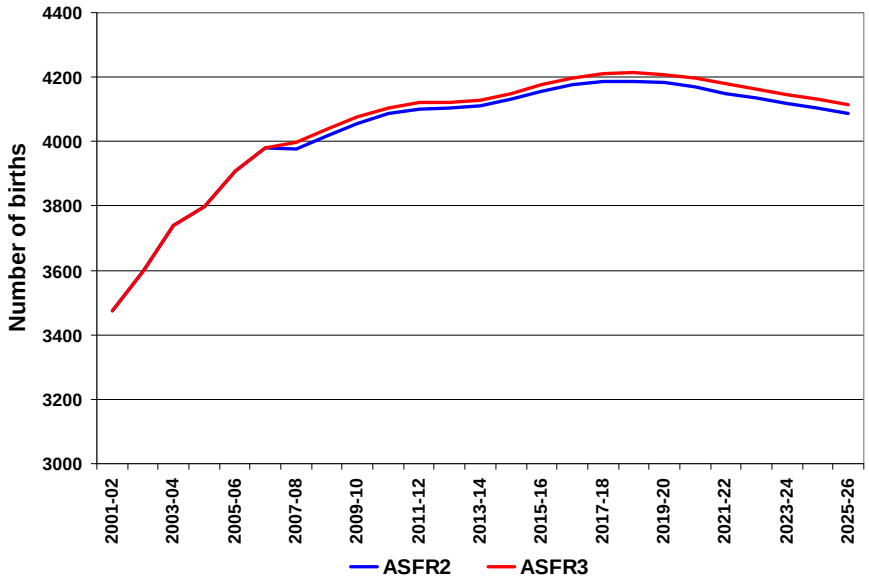
4.4 Scenario 'ASFR3'

This scenario is the same as 'ASFR2', except that here the age of mother data is more consistent with CCSR. The 'Main' scenario uses the age of mother at the start of the year (1 July), scenario 'ASFR2' (and other GROS scenarios) uses the age of mother at the time of the birth. This scenario calculates

Schedule age a = 1000*(births to mothers age a) / ((women at start of year aged a or a-1)/2)

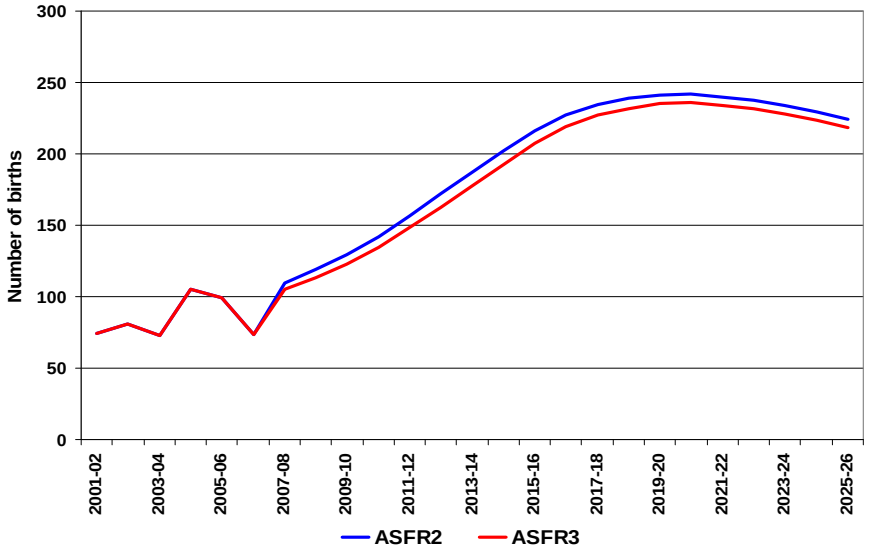
This scenario produces results that differ little from 'ASFR2' – Figure 4.8 showing projected births. For Fife as a whole, the maximum difference between the projected number of births for any year is 28 (less than 1 per cent relative difference).

Figure 4.8: Projected births for Fife 2001-2026: ASFR2 v ASFR3 scenarios



At MMW level, maximum absolute differences in the projected number of births for any year range from 5 in Dunfermline South (where 'ASFR3' is higher than 'ASFR2') to -9 in St Andrews (where 'ASFR3' is lower than 'ASFR2'). The maximum relative differences in the projected number of births for any year range from 2.1 per cent in Howe of Fife & Tay Coast (where 'ASFR3' is higher than 'ASFR2') to -5.5 per cent in St Andrews (where 'ASFR3' is lower than 'ASFR2'). Figure 4.9 shows the projected number of births for St Andrews for scenarios 'ASFR2' and 'ASFR3'.

Figure 4.9: Projected births for St Andrews 2001-2026: ASFR2 v ASFR3 scenarios



4.5 Scenario 'TFR1'

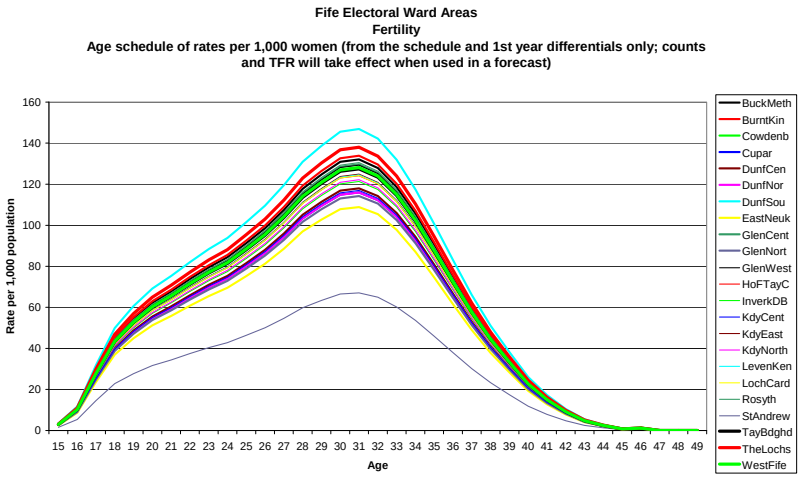
This scenario uses the same fertility assumptions as 'Main' except for the fertility differentials (on each MMW worksheet). Scenario 'TFR1' derives the fertility differential using the total fertility rate (TFR) for each MMW, calculated from the age-specific fertility rates used in scenario 'ASFR1'.

Table 4.2: Fertility assumptions used in the 'TFR1' scenario

POPGROUP worksheet	Data provided	Comments
Sched	ASFR per 1,000 women for Scotland (2007/8). TFR for Scotland (2007/8). Boys / 1,000 girls for Scotland	Annex B. Annex B. = 1,060 (POPGROUP default)
Fife	Fertility differentials for each year for 2006 onwards, by age groups 15-19, …, 45-49.	Annex B. These reflect the fertility change projected for Scotland, and are used for the fertility 'change' in each MMW.
Ward	Births (male and female) for mid-2001 to mid-2007. Fertility differential = (TFRs for MMW) / (TFR for Fife)	Derived from data zone births. Annex B.

The fertility rates for each MMW are shown in Figure 4.10.

Figure 4.10: Fertility rates for MMWs in Fife, TFR1 scenario



The projected number of births for Fife for 'TFR1', compared with the '6-year(F)' scenario, is shown in Figure 4.11. (The dotted lines show the corresponding figures when St Andrews is omitted.) The projected number of births is higher for the 'TFR1' scenario throughout the period.

At MMW level, most wards show that there is either no difference between the 'TFR1' and '6-year(F)' scenarios, or the 'TFR1' scenario is slightly higher. In these cases, the maximum absolute difference in the projected number of births for any year is 12 in Leven, Kennoway & Largo, while the maximum relative difference is 7.3 per cent in West Fife. There are two exceptions – Dunfermline South and St Andrews. In Dunfermline South, the number of births in the 'TFR1' scenario is lower in each year of the period, but by no more than 7 in any year. In St Andrews, the 'TFR1' scenario predicts a much higher

number of births in each year (up to 129, or relative difference of 89 per cent). Figure 4.12 shows the projected number of births for St Andrews for the 'TFR1' and 'Main' scenarios.

Figure 4.11: Projected births for Fife 2001-2026: 6-year(F) v TFR1 scenarios

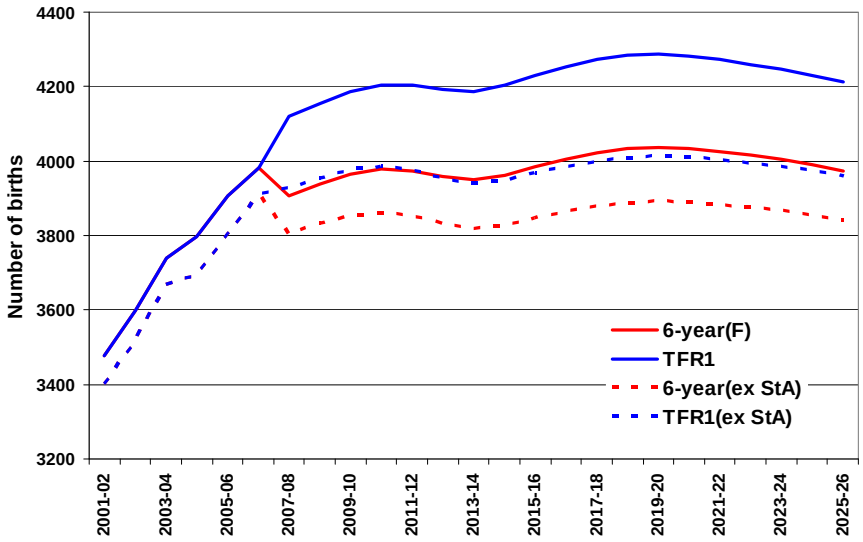
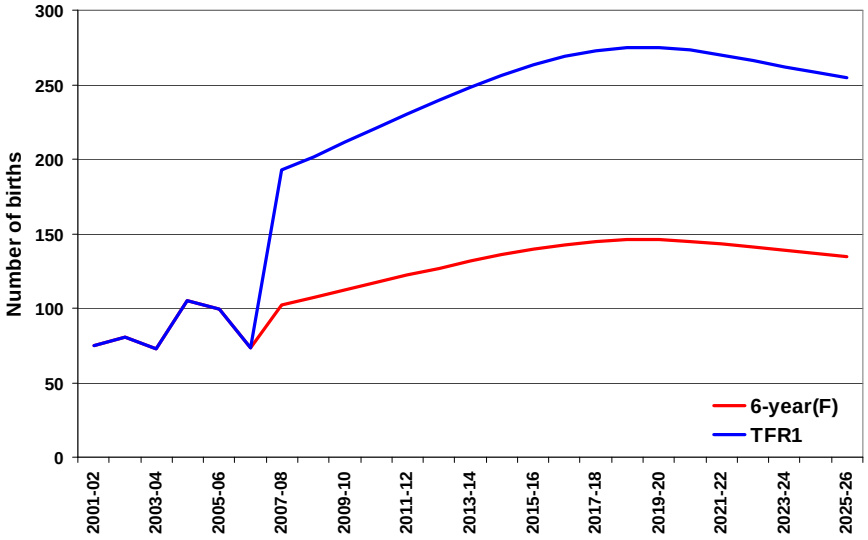


Figure 4.12: Projected births for St Andrews 2001-2026: 6-year(F) v TFR1 scenarios



4.6 Scenario 'TFR2'

This scenario is the same as 'TFR1', but the fertility differentials are obtained from rates that have been smoothed using a moving-average method.

The fertility rates for each MMW are shown in Figure 4.13.

Figure 4.13: Fertility rates for MMWs in Fife, TFR2 scenario

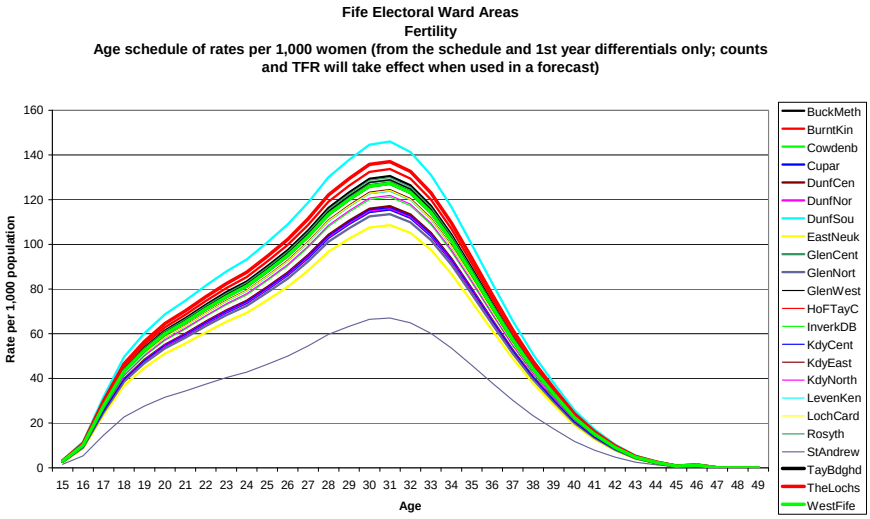
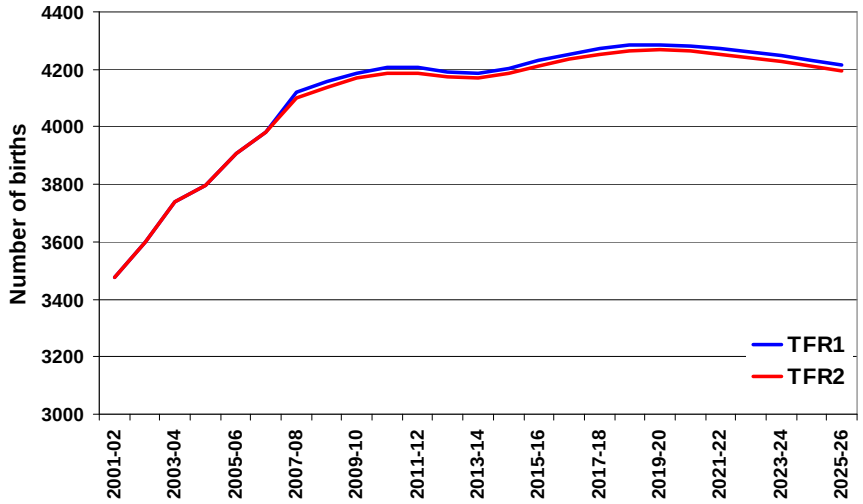


Figure 4.14 shows the effect that the smoothing has, by comparing the projected number of births for Fife from this scenario with those from 'TFR1'. There are slightly fewer births in the scenario that used the smoothed fertility rates ('TFR2').

Figure 4.14: Births for Fife 2001-2026: TFR1 v TFR2 scenarios



At MMW level, there is little or no difference between scenarios 'TFR1' and 'TFR2'. No ward has a difference of 3 or more births in any year over the period. So, the '6-year(F) v TFR2' comparison is similar to that discussed in the previous section.

4.7 Scenario 'TFR3'

This scenario is the same as 'TFR1' and 'TFR2', but the fertility differentials have been set to 1 for each ward. So each ward will have same fertility curve. The fertility rates for each MMW are shown in Figure 4.15 (with each curve being exactly the same).

Figure 4.15: Fertility rates for MMWs in Fife, TFR3 scenario

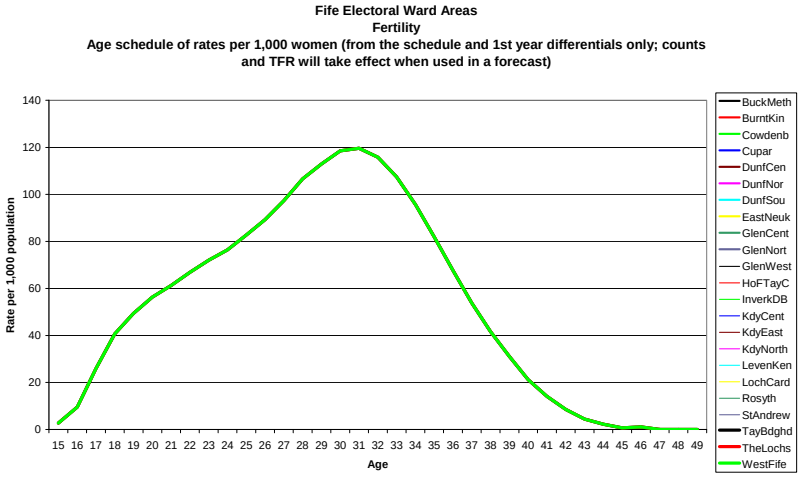
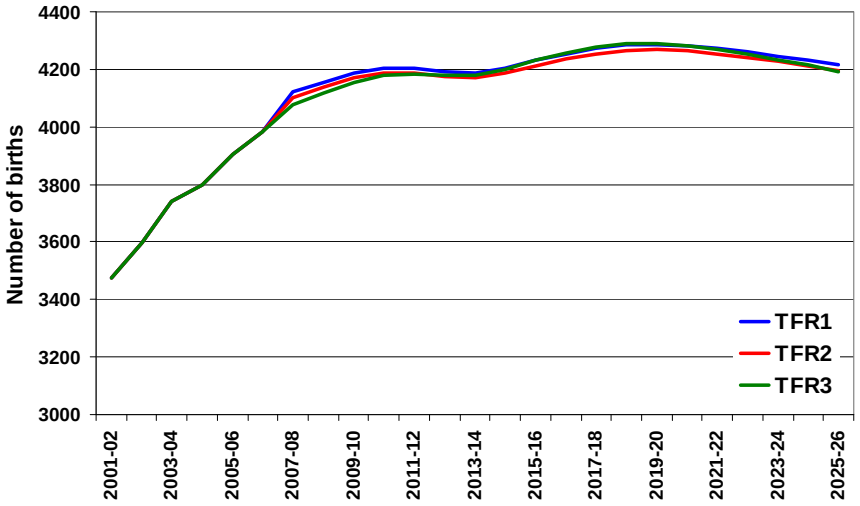


Figure 4.16 shows that for Fife as a whole the projected number of births for scenarios 'TFR1', 'TFR2' and 'TFR3' are similar.

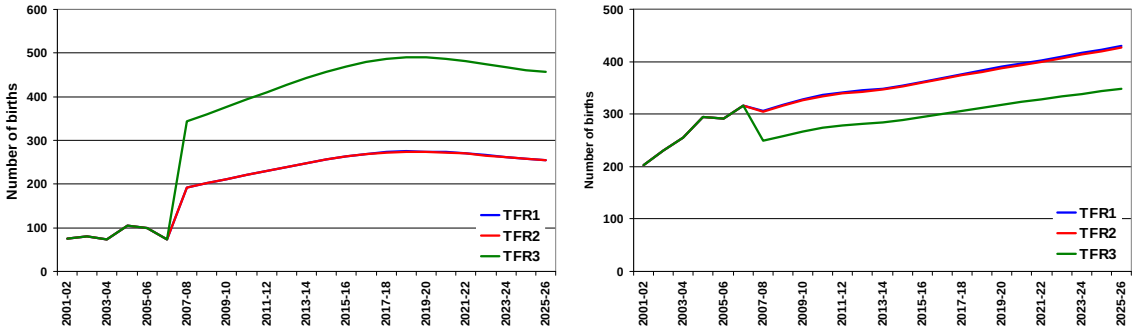
Figure 4.16: Projected births for Fife 2001-2026: TFR1 v TFR2 v TFR3 scenarios



At ward level, scenario 'TFR3' will give a higher estimate of the number of births in some wards, such as St Andrews. In other wards, such as Dunfermline South, the estimated number of births will be lower (Figure 4.17). This is not surprising. Using the same fertility rates for each ward will result in the number of births in some wards being underestimated and others being overestimated.

Differences in the number births in any year between scenarios 'TFR1' and 'TFR3' range from an underestimate (that is, 'TFR3' < 'TFR1') of 81 in Dunfermline South to an over-estimate of 215 in St Andrews. The mean absolute difference between these two scenarios is 15.

Figure 4.17: Projected births for St Andrews (left) and Dunfermline South (right) 2001-2026: TFR1 v TFR2 v TFR3 scenarios

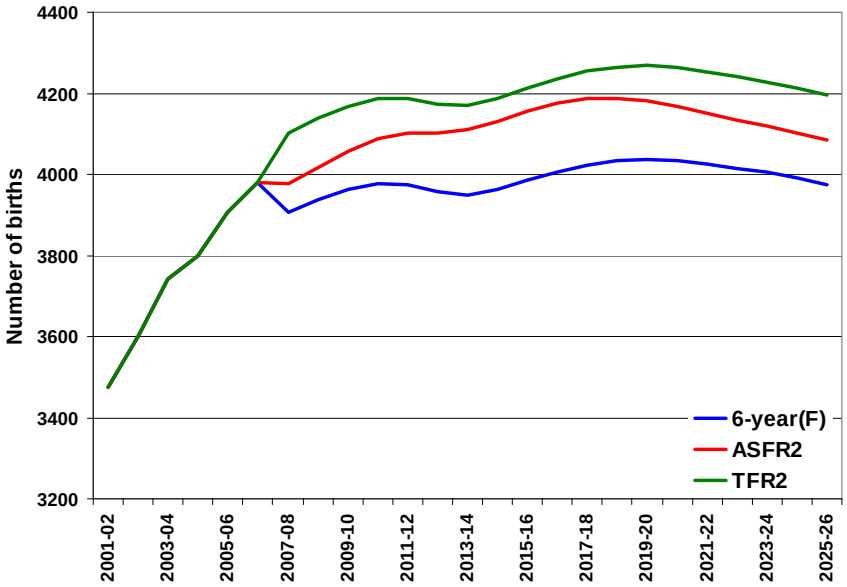


4.8 Comparison of different scenarios

This section summarises the differences in the projected number of births for Fife and the multi-member wards for some of the scenarios discussed above – '6-year(F)', 'ASFR2' and 'TFR2'.

Figure 4.18 shows that for Fife, the lowest number of births is projected for the '6-year(F)' scenario, while the 'TFR2' scenario gives the highest projected number of births.

Figure 4.18: Projected births for Fife 2001-2026: 6-year(F) v ASFR2 v TFR2 scenarios



At MMW level the situation is similar. Where there are differences, the '6-year(F)' scenario tends to predict a lower number of births, while the 'TFR2' scenario predicts the highest number of births. The exceptions are St Andrews and Dunfermline South. In St Andrews the situation is similar to the other wards except that the scale of the differences is much higher. In Dunfermline South the '6-year(F)' scenario predicts the highest number of births each year, followed by 'TFR2' then 'ASFR2'. Figure 4.19 shows the fertility rates used in each of the scenarios for St Andrews, while Figure 4.20 shows the projected number of births.

Figure 4.19: Fertility rates used in 6-year(F), ASFR2 and TFR2 scenarios for St Andrews

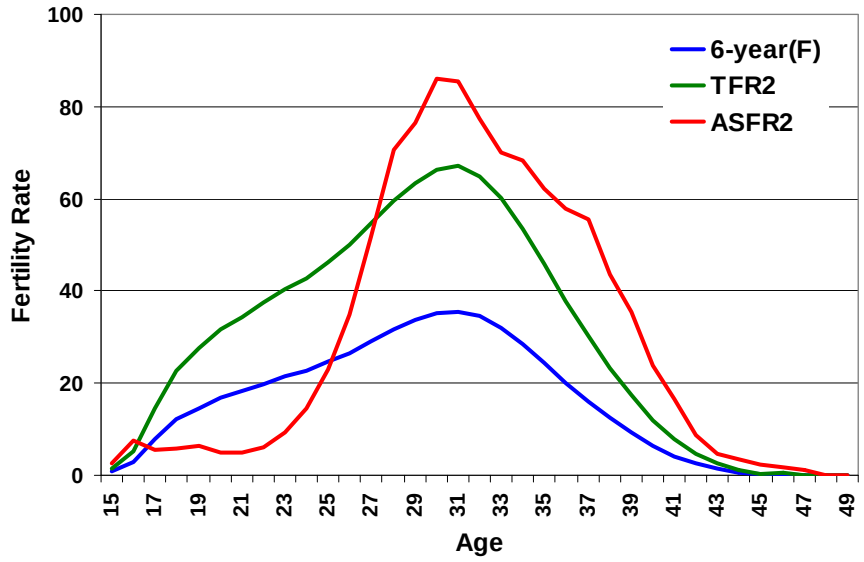
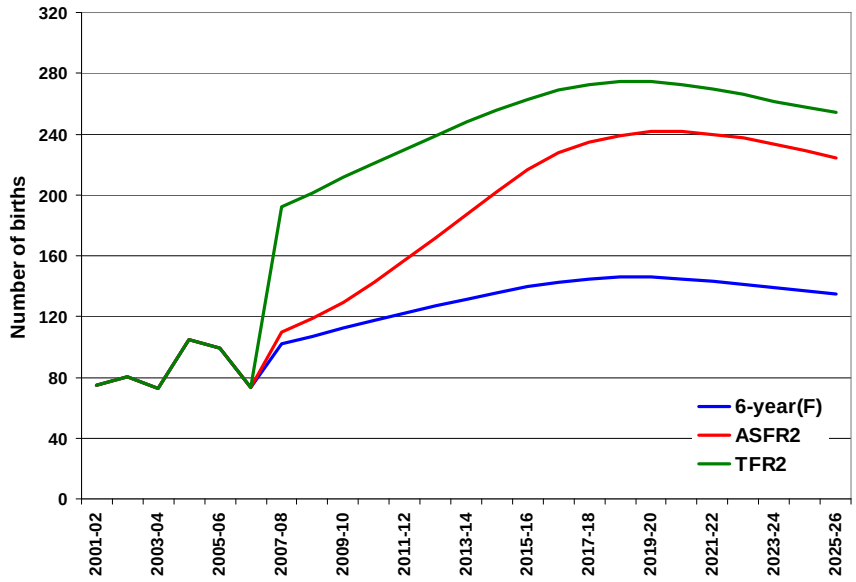


Figure 4.20: Projected births for St Andrews 2001-2026: 6-year(F) v ASFR2 v TFR2 scenarios



The different fertility rates used in St Andrews help explain the projected number of births for each scenario. St Andrews has an extremely high proportion of young adults because of its large student population. The student population has low fertility. This combination affects the different approaches to estimating fertility and projecting the number of births, shown in Figure 4.19 and Figure 4.20.

'6-year(F)' (CCSR strategy with ward TFR from number of births). The low number of births for 2001 to 2007, when compared with the high number of young adults, results in a very low estimated TFR. The strategy assumes a low fertility rate at all ages, wrongly and therefore the TFR is also estimated wrongly low. But the strategy estimates the correct total number of births because its low TFRs compensate for the high number of low-fertile young women.

'ASFR2' (ward ASFRs, smoothed). The correct set of ASFRs is estimated. The correct total number of births is estimated. However, the projected number of births is sensitive to

any change in the age structure: if a shift to older adults is wrongly projected then this will wrongly result in a higher number of births.

'TFR2' (ward TFR taken from smoothed ASFRs). The TFR is correctly estimated, higher than that estimated in the '6-year(F)' estimate. Like the CCSR approach, the TFR is wrongly allocated to age groups. Because of the high proportion of young adults, the number of births is over-estimated.

In summary, the CCSR strategy estimates the births correctly but not the TFR or ASFRs. The 'ASFR2' approach estimates the TFR and ASFRs correctly, but is more sensitive to population age-structure than the CCSR strategy. It therefore depends on getting a correct future age-pattern of migration. The 'TFR2' approach is biased because it does not take into account the population age-structure, and it should not be used.

Figure 4.21 shows an example of a ward (Cowdenbeath) which has a similar pattern to Fife as a whole. In some wards there is very little difference between the number of births predicted by the different scenarios - for example, Cupar and Howe of Fife & Tay Coast. Figure 4.22 shows how the scenarios compare in Cupar, and also for Dunfermline South.

Figure 4.21: Projected births for Cowdenbeath 2001-2026: 6-year(F) v ASFR2 v TFR2 scenarios

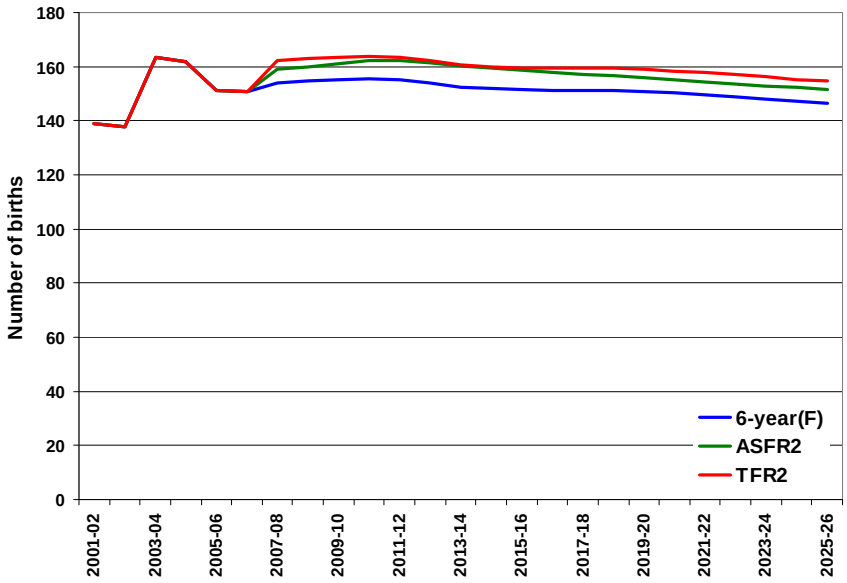


Figure 4.22: Projected births for Cupar (left) and Dunfermline South (right) 2001-2026: 6-year(F) v ASFR2 v TFR2 scenarios

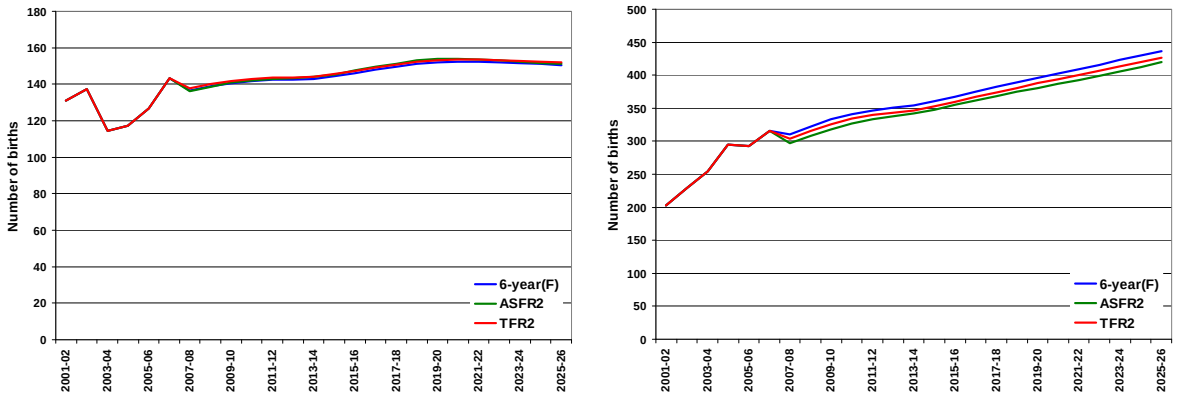
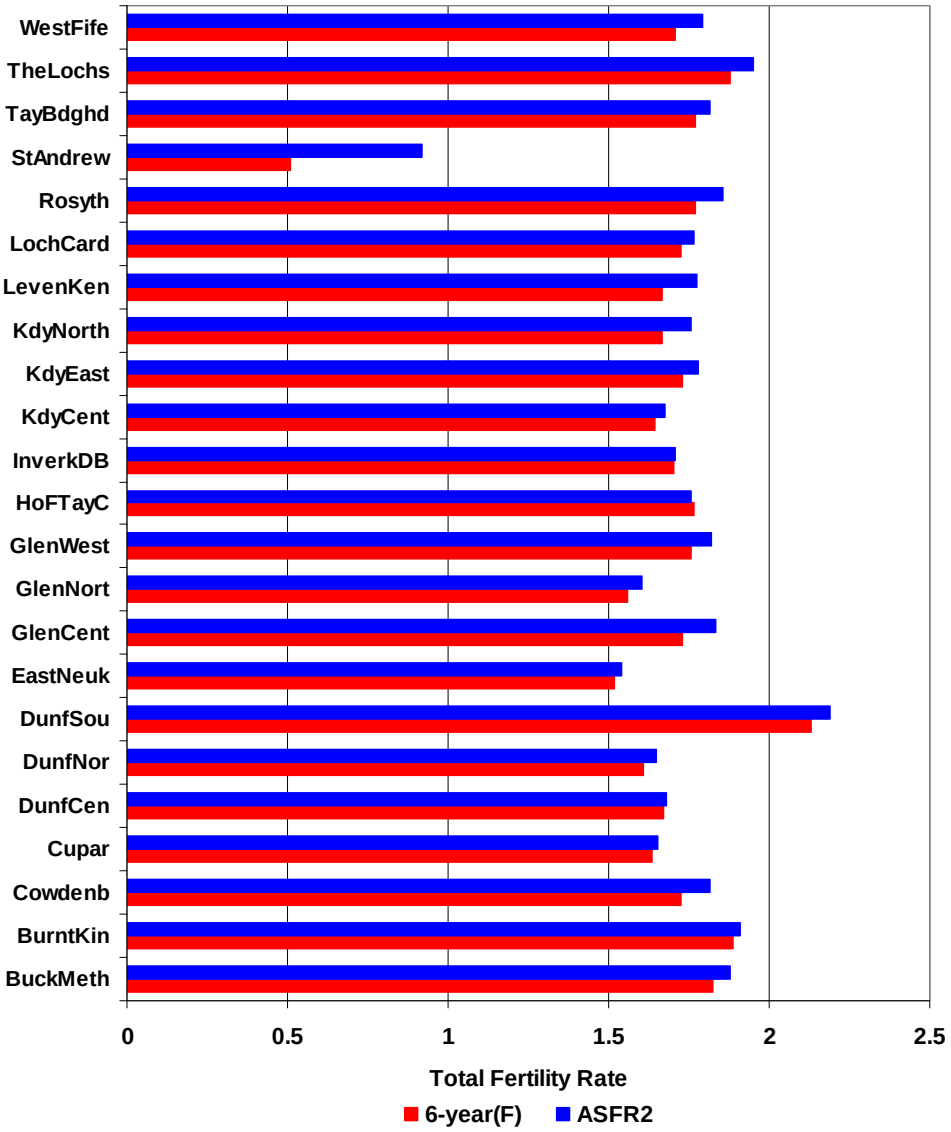


Figure 4.23 shows the average total fertility rates for each ward for the period 2001/2 to 2006/7 for the '6-year(F)' and 'ASFR2' scenarios. In nearly every case, the 'ASFR2' fertility rate is slightly higher. For St. Andrews, the difference is much greater, which would explain the far higher number of births in this ward for the 'ASFR2' scenario. (The average total fertility rate for this period for the 'TFR2' scenario is the same as the '6-year(F)' scenario.)

Figure 4.23: Average total fertility rate 2001/2-2006/7: 6-year(F) v ASFR2 scenarios



We can compare the scenario which is the most sensitive to local information ('ASFR2') with other scenarios to determine how much of the difference that local fertility information can make is captured by the CCSR approach. This is done by comparing scenario 'ASFR2' with (i) 'TFR2', which uses TFRs based on recent births in wards (i.e. the CCSR approach), and (ii) 'TFR3', which uses TFRs equal to that for Fife.

Table 4.3 contains the mean absolute difference in the annual number of births between scenario 'ASFR2' and scenarios 'TFR2' and 'TFR3'. The differences between 'ASFR2' and 'TFR2' are smaller than those from 'ASFR2' and 'TFR3' for most wards (the exceptions are Kirkcaldy East and Kirkcaldy North).

The figures suggest that scenario ‘TFR2’ captures much of the local fertility information and that the more detailed fertility information provided in scenario ‘ASFR2’ does not make a big difference to the final projections.

Table 4.3: Mean absolute difference in number of births 2001-2026

Multi Member Ward	Mean absolute difference	
	ASFR2 v TFR2	ASFR2 v TFR3
Buckhaven, Methil and Wemyss Villages	3.8	15.4
Burntisland, Kinghorn and Western Kirkcaldy	0.4	14.1
Cowdenbeath	1.7	5.8
Cupar	0.4	4.2
Dunfermline Central	0.3	3.8
Dunfermline North	0.8	3.6
Dunfermline South	5.1	45.5
East Neuk and Landward	0.2	7.5
Glenrothes Central and Thornton	1.4	8.9
Glenrothes North, Leslie and Markinch	2.3	9.2
Glenrothes West and Kinglassie	3.1	12.5
Howe of Fife and Tay Coast	0.3	3.8
Inverkeithing and Dalgety Bay	0.4	1.9
Kirkcaldy Central	2.2	5.8
Kirkcaldy East	3.1	2.4
Kirkcaldy North	5.7	2.6
Leven, Kennoway and Largo	2.2	2.9
Lochgelly and Cardenden	1.4	2.8
Rosyth	4.4	6.4
St Andrews	38.1	186.9
Tay Bridgehead	0.7	6.8
The Lochs	2.5	17.3
West Fife and Coastal Villages	1.7	5.3

4.9 Conclusions

The fertility differential, whether computed by the user as in the CCSR approach, or provided by GROS, should be based on a comparison of recent experience with the Scotland experience for the same period.

There is little difference between scenarios ‘ASFR2’ and ‘ASFR3’, where ‘ASFR2’ uses the age of the mother at the time of the birth and ‘ASFR3’ estimates the age of the mother at the start of the year (1 July). If we are able to provide councils with ‘age of mother’ data, then it may be simpler to use the age at time of birth and to recommend smoothing the ASFRs (possibly 5-year moving average, although a 3-year moving average might be adequate).

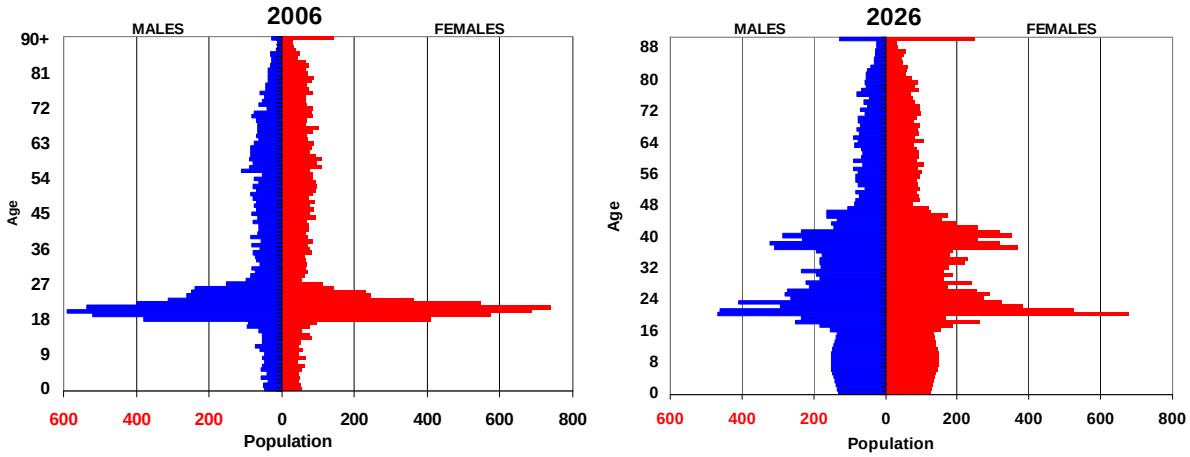
The use of total fertility rates (TFRs) estimated from births is sufficient for most purposes. Age-specific fertility rates (ASFRs) can add more detailed information and some accuracy to the projections, but we have shown that scenario ‘TFR2’ captures much of the local fertility information.

In student areas, such as St Andrews, the choice of fertility rate can make a big difference to the projected number of births and, consequently, the total population of the area.

There is also a problem with 'ageing on' in student areas (Figure 4.24). We do not really want to age-on the 18-25 age group. In POPGROUP this can be achieved by:

- Improved estimates of migration, or
- Separate projections of the student population in student areas, and estimates of fertility, mortality and migration which exclude the population separately projected.

Figure 4.24: Population pyramids for St Andrews, 2006 and 2026, Scenario TFR2



Data requirements for the fertility assumptions discussed above are:

- Births by sex, at data zone level.
- Births by age of mother, at data zone level.

It is unlikely that we will be able to provide non-aggregated 'age of mother' data at data zone level. At data zone/sex level, for any particular year the number of births is likely to be quite small (the majority will have < 10 births), so there may be possible disclosure issues about releasing the data at this level of detail. Options include aggregation for a 5-year period and/or geographic aggregation. For example, a possible solution may be to provide births aggregated for the latest 5-year period, single year of age for mother (except < 16 and > 45) at intermediate zone level. This would involve users having to allocate intermediate zone counts to the appropriate data zones somehow before aggregating back up to the required geography. But users may have to do some apportioning in any case (e.g. Fife Council apportioned data zones that crossed MMW boundaries), so this may not be a major additional piece of work for users.

The use of total fertility rates (TFRs) estimated from births should be sufficient for most purposes. Age–specific fertility rates (ASFRs) can add some accuracy to the projections, so the provision of 'age of mother' data at some level of detail would be beneficial.

ASFRs will only make an appreciable difference to population projections where there are large student, armed forces or other special populations with low fertility, and even then only when a change in the population age structure is occurring and is predictable. In these areas, it is important that the age structure of the small area is accurate, otherwise the POPGROUP methodology may over- or under-estimate the number of births in future years.

5. Mortality

The scenarios discussed in this section differ from the 'Main' scenario only in the mortality rates used. The main impact will be on the projected number of deaths for each year, so the only comparisons done here relate to the deaths. (The total population projections will be affected, especially at the older age groups, but any differences should be a consequence of the difference in the number of deaths in any particular year and in the preceding years.)

5.1 Scenario '6-year(M)'

This scenario is the same as 'Main' except that the mortality differentials have been improved. One of the main purposes of this scenario is to use it as a comparison with other mortality scenarios. (It gives a more valid comparison than the 'Main' scenario because it uses data from the same period as the other scenarios.)

The MMW mortality differentials (on the MMW worksheets) are based on the average of a 6-year period (2001/2 – 2006/7) rather than a 4-year period (2003/4 – 2006/7).

The ward mortality differential as calculated by CCSR is dependent on level of mortality for recent years, which is always related to that projected for Scotland in 2007/8. The differential would be better calculated by comparing the recent local rates to the rates for Scotland in the same recent years. So, an additional mortality differential at Fife level has been added to take account of the fall in mortality between 2001-2007 and 2007/8.

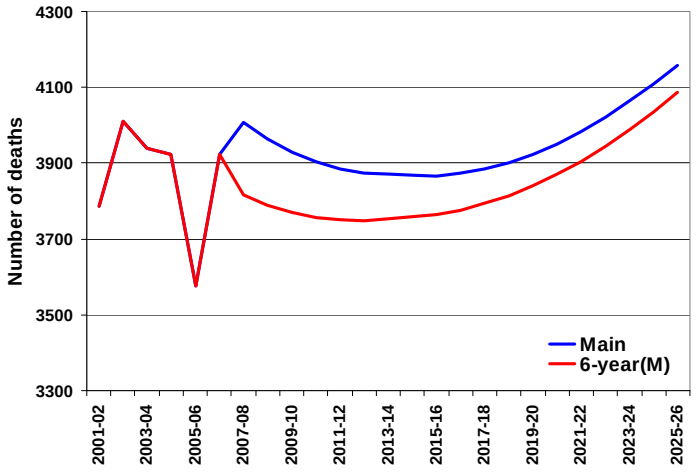
The new mortality differentials used in this scenario are as follows:

MMW mortality differential = (average of MMW standardised mortality rates (SMRs) for 2001/2 to 2006/7), where the SMRs used are taken from the 'Training' scenario ('comp_1st.xls.').

Fife mortality differential = (average death rate for 2008) / (average death rate for 2001 to 2007) = 22.0 / 23.6 = 0.932 (Death rates taken from Vital Events Reference Table 5.1.)

For Fife, the projected number of deaths is lower than in the 'Main' scenario (Figure 5.1). The highest difference (191 or 4.8 per cent) occurs in 2007/8, declining to a difference of 72 in 2025/26.

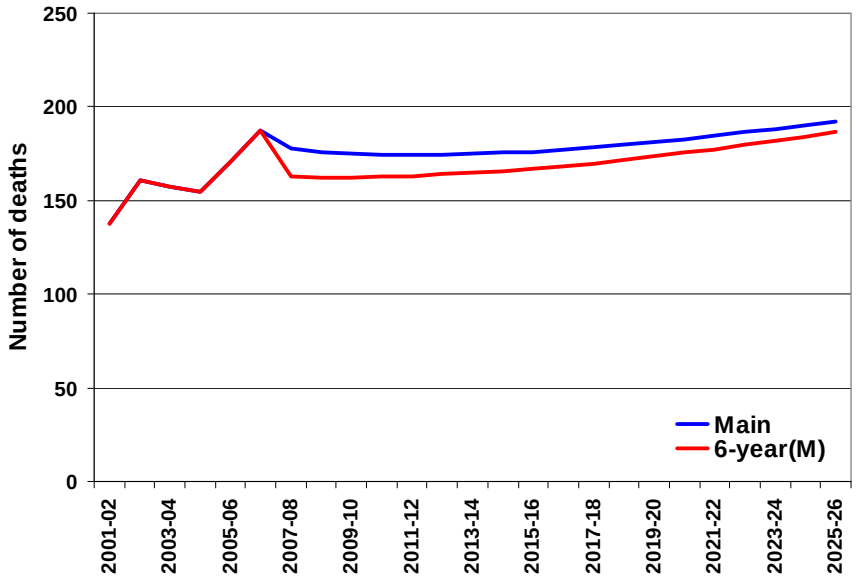
Figure 5.1: Projected deaths for Fife 2001-2026: Main v 6-year(M) scenarios



At MMW level, there are no wards where the number of deaths is higher in the '6-year(M)' scenario. The maximum absolute difference in the projected number of deaths for any year is 21 in Buckhaven, Methil and Wemyss Villages. The maximum relative difference in the projected number of deaths for any year is 8.5 per cent in Glenrothes West and Kinglassie. Figure 5.2 shows the projected number of deaths for Glenrothes West and Kinglassie for scenarios '6-year(M)' and 'Main'.

In fact, the 'Main' scenario suffers from a bias, in that the projection after mid-2007 uses a differential that wrongly relates recent ward mortality to the standard which is for 2007/8. This is improved in '6-year(M)' and the other scenarios in this section by relating recent ward mortality to that for Scotland in the same years. It is for this reason that the projected deaths for 2007/8 in 'Main' are higher than in recent years. Since the '6-year(M)' and subsequent mortality scenarios are based on the same recent years mid-2001 to mid-2007, the comparison between '6-year(M)' and the other scenarios will be more valid than other comparisons.

Figure 5.2: Projected deaths for Glenrothes West & Kinglassie 2001-2026: Main v 6-year(M) scenarios



5.2 Scenario 'ASMR1'

This scenario differs from 'Main' in that, instead of using Scotland-level age-specific mortality rates and then applying a differential at MMW level, it uses ASMRs for each ward, calculated from population and death data for each MMW

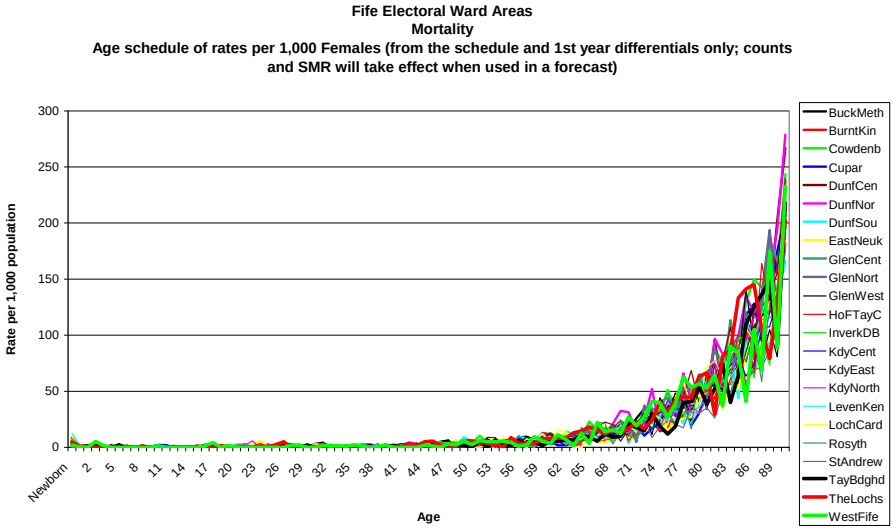
Table 5.1: Mortality assumptions used in the 'ASMR1' scenario

POPGROUP worksheet	Data provided	Comments
Sched	ASMR per 1,000 population for Scotland (2007/8). ASMRs per 1,000 population for each MMW in Fife.	Annex C. Annex C.
Fife	Mortality differential based on average of Scotland rates for 2001 to 2006. Mortality differentials for each year for	 Annex C.

	2006 onwards, by age groups newborn/0, 1-4, 5-9, … , 80-84, 85+.	These reflect the mortality change projected for Scotland, and are used for the mortality 'change' in each MMW.
Ward	Deaths (male and female) for mid-2001 to mid-2007, by age group and sex.	Derived from data zone deaths.

Figure 5.3 shows that the ASMR curves for the wards are not very smooth (females shown, males very similar), so it is probably not sensible to use this scenario. For this reason, no further investigation was done for this scenario. However, the rates can be smoothed and the following section looks at an alternative scenario using ASMRs at MMW level ('ASMR2').

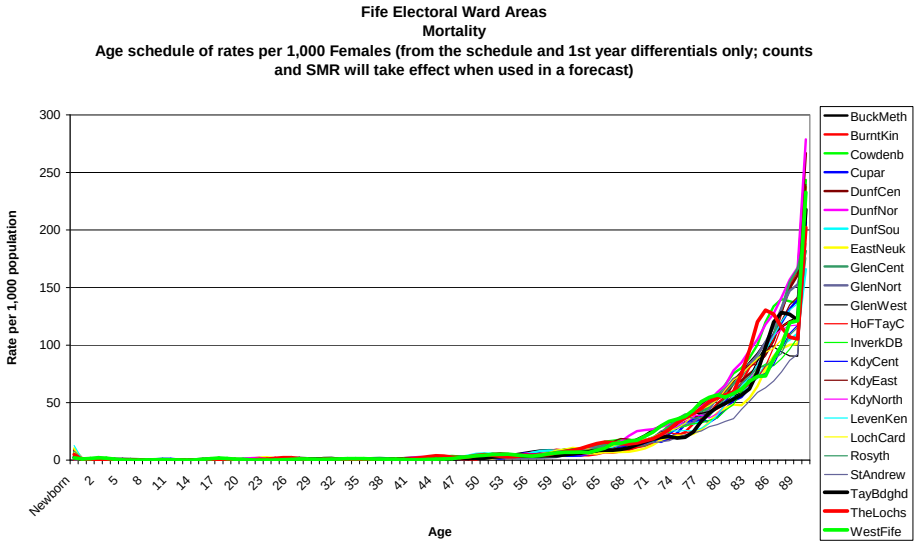
Figure 5.3: Age-specific mortality rates (females) for MMWs in Fife, ASMR1 scenario



5.3 Scenario 'ASMR2'

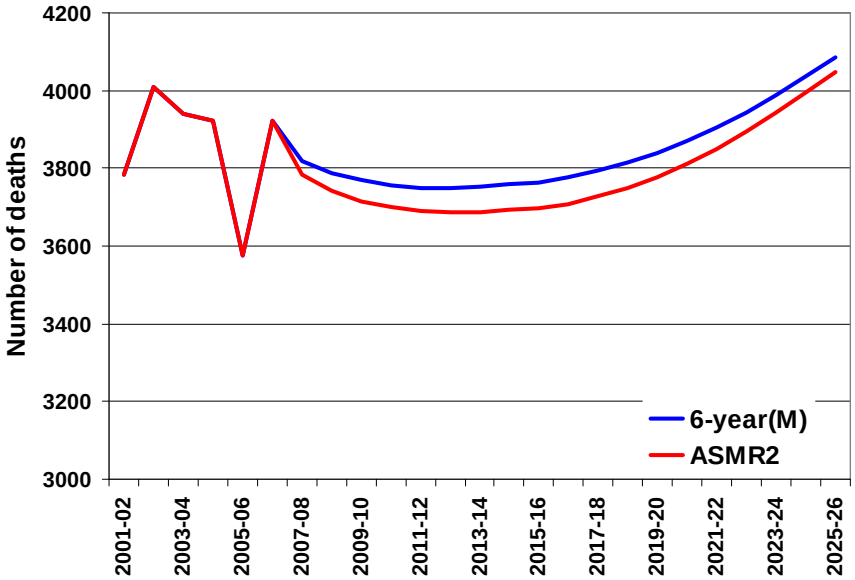
This is the same as the previous scenario ('ASMR1'), but with smoothed mortality rates, using a moving-average smoothing method. Figure 5.4 shows the effect of smoothing the rates for females (similar results for males).

Figure 5.4: Age-specific mortality rates (females) for MMWs in Fife, ASMR2 scenario



The projected number of deaths in Fife for 'ASMR2' is lower than that for the '6-year(M)' scenario throughout the period (Figure 5.5). The difference between the two scenarios is never more than 67 deaths (a 1.8 per cent relative difference) in any year for Fife as a whole.

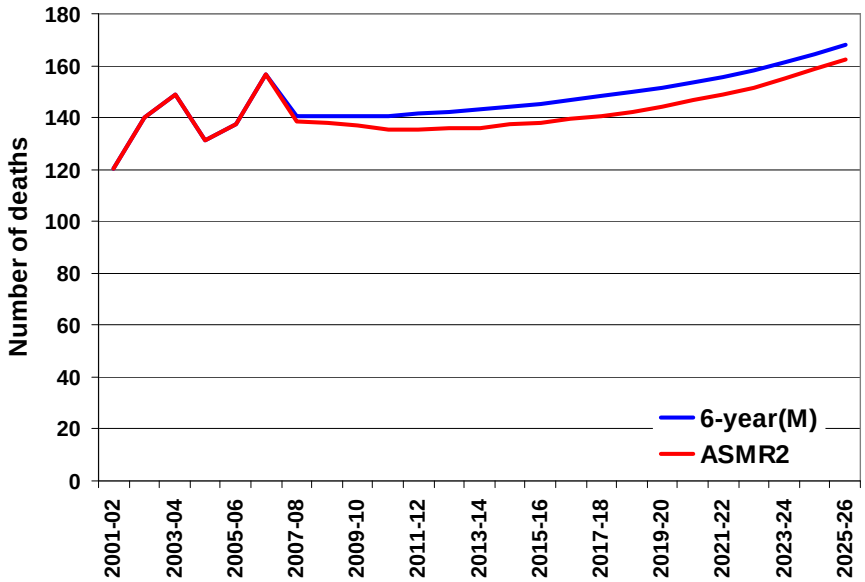
Figure 5.5: Projected deaths for Fife 2001-2026: 6-year(M) v ASMR2 scenarios



At MMW level, there is little difference between the projected number of deaths in the 'ASMR2' and '6-year(M)' scenarios. Usually, the '6-year(M)' scenario is slightly higher. The maximum difference in the projected number of deaths for any year is 8 (5.3 per cent difference), in Tay Bridgehead. Figure 5.6 shows the projected number of deaths for Tay Bridgehead for scenarios '6-year(M)' and 'ASMR2'.

In one ward (Buckhaven, Methil and Wemyss Villages), the 'ASMR2' scenario consistently produces more deaths than the '6-year(M)' scenario over the projection period, but the differences between the scenarios are small (less than 5 per year).

Figure 5.6: Projected deaths for Tay Bridgehead 2001-2026: 6-year(M) v ASMR2 scenarios



5.4 Conclusions

As with fertility, the mortality differential, whether computed by the user as in the CCSR approach, or provided by GROS, should be based on a comparison of recent experience with the Scotland experience for the same period.

Data requirements for the mortality assumptions discussed above are:

- Deaths by sex and age, at data zone level.

It is unlikely that we will be able to provide non-aggregated data at data zone level. At data zone/sex/age level, for any particular year, the number of deaths is likely to be quite small (the majority will have < 10 deaths), so there may be possible disclosure issues about releasing the data at this level of detail. Options include aggregation for a 5-year period and/or geographic aggregation. For example, a possible solution may be to provide deaths aggregated for the latest 5-year period, for 5-year age groups at intermediate zone level. This would involve users having to allocate intermediate zone counts to the appropriate data zones somehow before aggregating back up to the required geography. But users may have to do some apportioning in any case (e.g. Fife Council apportioned data zones that crossed MMW boundaries), so this may not be a major additional piece of work for users.

The use of standardised mortality rates (SMRs) estimated from deaths should be sufficient for most purposes. Age–specific mortality rates (ASMRs) can add some accuracy to the projections, so the provision 'age at death' data at some level of detail would be beneficial.

6. Migration

6.1 Scenario 'ASMigR1'

This scenario differs from 'Main' in that, instead of using age-specific migration rates based on data from the 2001 Census, it uses rates based on migration flows at data zone level (aggregated to wards) for the period 2002/3 to 2006/7. Migration flows are constrained to be consistent with the population estimates up to mid-2007, as with the 'Main' scenario.

For early years, there is no distinction between 'rest of UK' (RUK) and 'overseas' (OV) migration, but using information from 2006/7 and 2007/8 we can obtain a rough estimate of the RUK/OV split for each ward.

Before we can run this scenario it is necessary to run a version of the 'Training' scenario ('Scenario_Mig1st') to obtain a forecast of the migration estimates for 2007. The 2007 in/out migration counts from/to the rest of UK and overseas from the 'Mig_1st' scenario for each ward are then used in the 'ASMigR1' scenario for 2007 and kept constant in subsequent years.

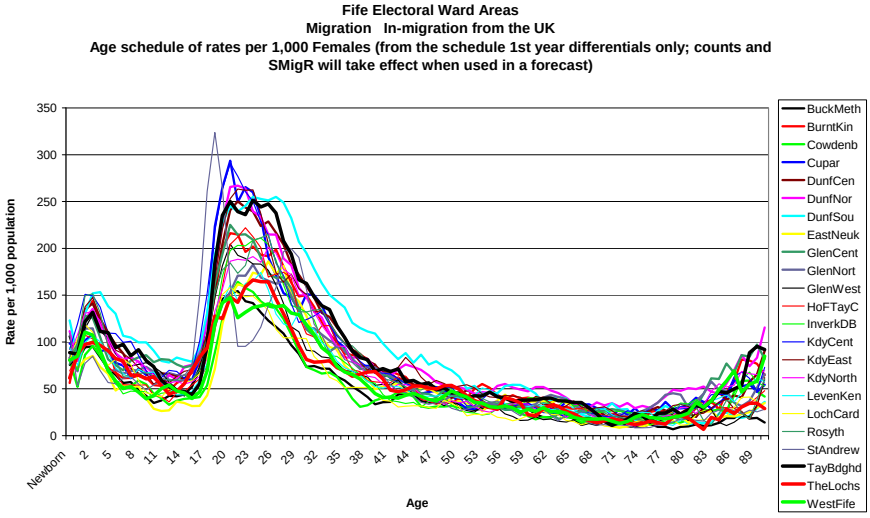
Table 6.1: Migration assumptions used in the 'ASMigR1' scenario

POPGROUP worksheet	Data provided	Comments
Sched	ASMigR per 1,000 males and females for Britain from the 2001 Census.	Annex D.

	ASMigRs per 1,000 males and females for each MMW in Fife.	Derived from the 2001 Census for in-migration from the rest of the UK; out-migration to the rest of the UK; in-migration from overseas. Area factors are applied to the Britain ASMigRs, based on observed and expected numbers of migrants in four broad age sex groups.
Fife	Nil.	
Ward	Migrant count (by 5-year age group and sex) for 2007 onwards.	Derived from the 'Training' scenario. The age-sex breakdown is obtained from the average of the latest four years from file 'fore_1st_dump.xls' (file 'migrantcountreport.xls').

Figure 6.1 illustrates the in-migration rates for females from the rest of the UK. The rates for males and for out-migration are similar.

Figure 6.1: Age-specific migration rates (in-migration from UK, females) for MMWs in Fife, ASMigR1 scenario

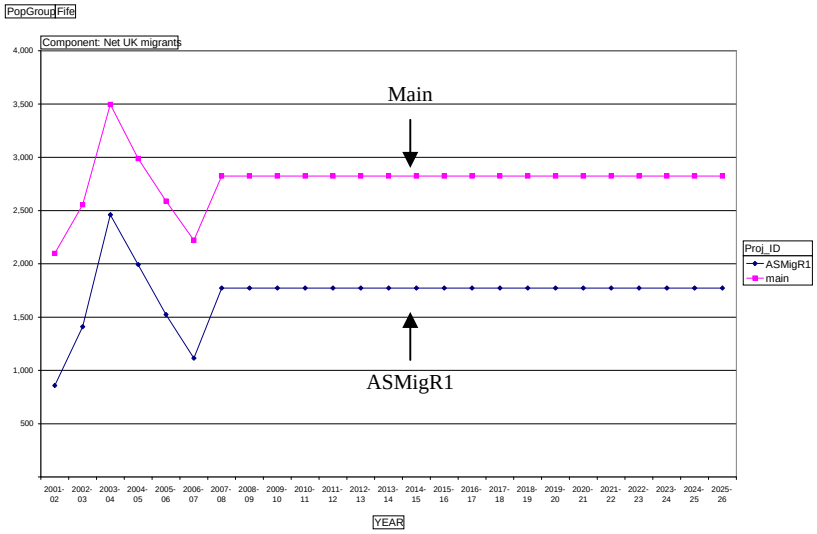


For Fife, the projected population, the number of births and the number of deaths differ little from that obtained in the 'Main' scenario. Similarly, at ward level, there are very small differences, if any, between the 'Main' scenario and 'ASMigR1' for the forecasts of population, births and deaths.

There are differences in the migration flows for Fife and for many of the wards (refer to Figure 6.2 for net in-migration to Fife). But in all cases where there is a difference in, for example, the in-migration from the rest of the UK, there is a corresponding inverse difference in the out-migration to the rest of the UK which cancels out the other difference. Therefore, we end up with both the 'Main' and 'ASMigR1' scenarios giving the same net

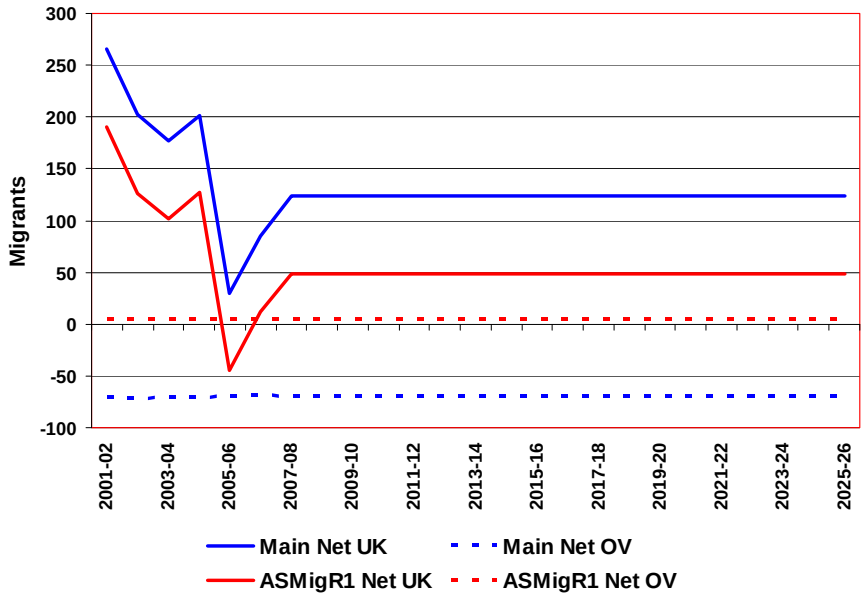
migration in and out of the wards. The only difference is the split between 'rest of UK' and 'overseas'.

Figure 6.2: Projected net in-migration from UK to Fife 2001-2026: Main v ASMigR1 scenarios



From Figure 6.3 we see that for Dunfermline North, the 'ASMigR1' scenario gives a lower net migration from the UK, but a higher net migration from overseas. The differences cancel each other out and the net migration for Dunfermline North is the same for both scenarios.

Figure 6.3: Projected net migration for Dunfermline North, 2001-2026: Main v ASMigR1 scenarios



As explained when describing the 'Main' scenario, future migration is set as the average of the past four years, after taking into account the population estimates for mid-2002 to mid-2007. The constraint to the same population estimates is also made in the new scenario. Therefore, although the migration flows are based on the different estimates of migration rates, the net impact of migration on population at each age and sex is determined by the population estimates. Since the assumptions for fertility and mortality have not been changed, the number of projected births and deaths also remains the same.

The projected migration flows are for 5-year age-sex groups (POPGROUP does not allow single year of age information on counts of deaths or migrants). Slight differences in the fine age-structure of migration are introduced where the age-structure of migration within each 5-year age-sex groups differs between the 'Main' and the 'ASMigR1' scenarios, which will affect the projected number of births and deaths minimally.

6.2 Scenario 'ASMigR2'

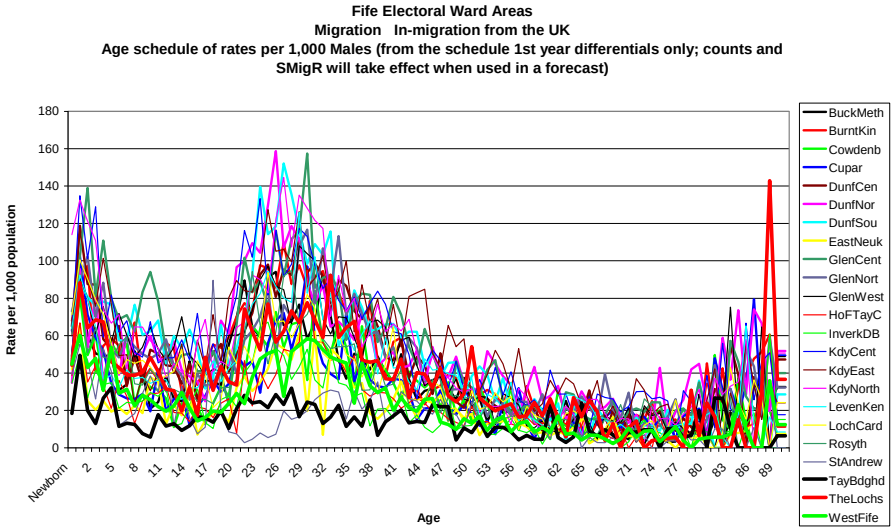
This scenario is a variation of 'ASMigR1'. Like 'ASMigR1' it uses age-specific migration rates based on migration flows at data zone level (aggregated to wards) for the period 2002/3 to 2006/7. But it differs in that instead of using 'rest of UK' and 'overseas' migration flows, this scenario uses migration to/from 'rest of Fife' and 'outside Fife'. The other difference from 'ASMigR1' is that this scenario does not provide migration counts for each year from 2007 onwards. It does not use the constraints of the population estimates for mid-2002 to mid-2007 to produce projected migration estimates; it assumes that the ASMigR rates will apply in future years.

Table 6.2: Migration assumptions used in the 'ASMigR2' scenario

POPGROUP worksheet	Data provided	Comments
Sched	ASMigR per 1,000 males and females for Britain from the 2001 Census. ASMigRs per 1,000 males and females for each MMW in Fife.	Annex D. Derived from the 2001 Census for in-migration from the rest of the UK; out-migration to the rest of the UK; in-migration from overseas. Area factors are applied to the Britain ASMigRs, based on observed and expected numbers of migrants in four broad age sex groups.
Fife	Nil.	
Ward	Nil.	

The curves of the age-specific migration rates for the wards are not very smooth (Figure 6.4), so it is probably not sensible to use this scenario. For this reason, no further investigation was done for this scenario. However, the rates can be smoothed and the next section looks at alternative scenarios using ASMigRs at MMW level ('ASMigR3').

Figure 6.4: Age-specific migration rates (in-migration from rest of Fife, males) for MMWs in Fife, ASMigR2 scenario



6.3 Scenario 'ASMigR3'

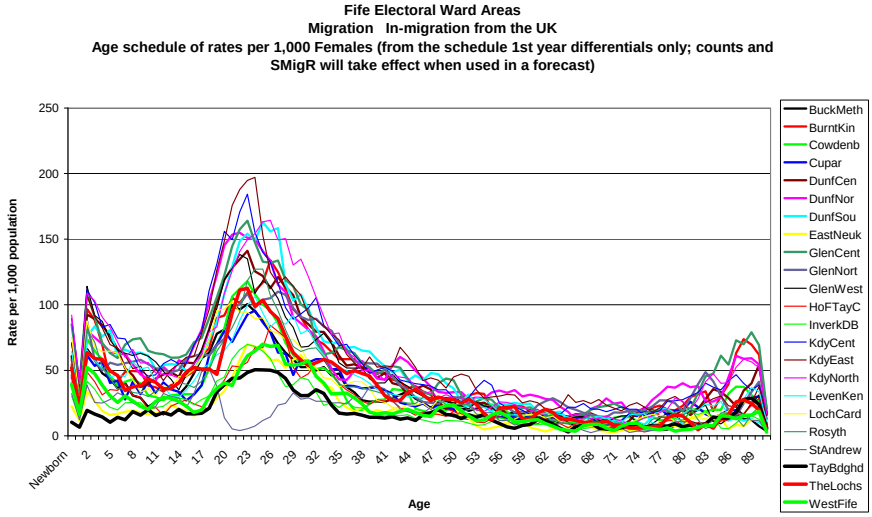
This scenario is a smoothed version of 'ASMigR2'. Like 'ASMigR2' it uses age-specific migration rates based on migration flows at data zone level (aggregated to wards) for the period 2002/3 to 2006/7 and uses migration to/from 'rest of Fife' and 'outside Fife'. As for 'ASMigR2', this scenario does not provide migration counts for each year from 2007 onwards.

Table 6.3: Migration assumptions used in the 'ASMigR3' scenario

POPGROUP worksheet	Data provided	Comments
Sched	ASMigR per 1,000 males and females for Britain from the 2001 Census. ASMigRs per 1,000 males and females for each MMW in Fife.	Annex D. Derived from the 2001 Census for in-migration from the rest of the UK; out-migration to the rest of the UK; in-migration from overseas. Area factors are applied to the Britain ASMigRs, based on observed and expected numbers of migrants in four broad age sex groups.
Fife	Nil.	
Ward	Nil.	

The age-specific migration rates used in this scenario still show some 'noise' but there is some sort of pattern for most wards (Figure 6.5).

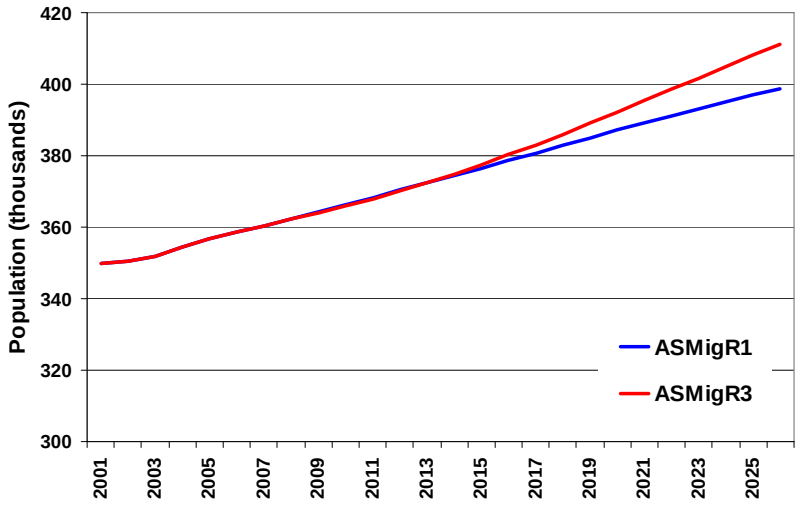
Figure 6.5: Age-specific migration rates (in-migration from rest of Fife, males) for MMWs in Fife, ASMigR3 scenario



When the results from this scenario are compared with 'ASMigR1' (where migration data referred to moves to/from UK and overseas and the net impact of future migration was based on recent movements in the population estimates), there are differences in population totals, births, deaths and net migration.

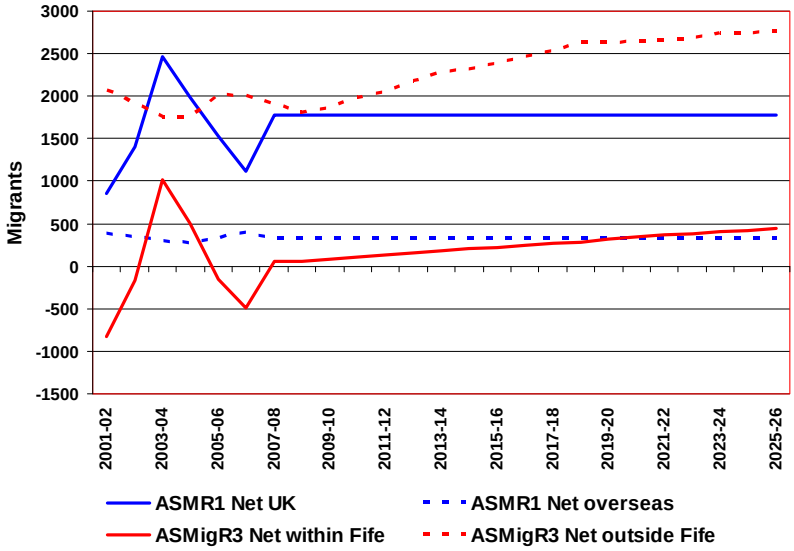
Up until around 2015 there is little difference in the total population of Fife between the two scenarios. Then the population starts to increase at a more rapid rate for scenario 'ASMigR3' until 2026 when the difference is over 12,000 (Figure 6.6).

Figure 6.6: Projected population for Fife, 2001-2026: ASMigR1 v ASMigR3



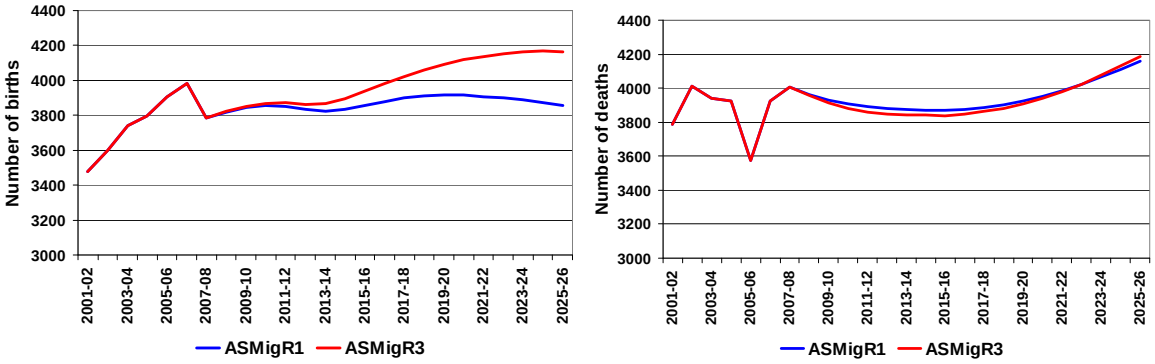
The main reasons for the higher projected population estimates in scenario 'ASMigR3' are the higher net migration and the higher number of births in this scenario over the period. Figure 6.7 shows the net migration for Fife as a whole for 'ASMigR3' compared with 'ASMigR1'. While the migration flows are kept constant from 2007 onwards in 'ASMigR1', there is a steady increase in net migration over the period for scenario 'ASMigR3', for both migration within Fife and outside Fife. (Note that ASMigR1 and ASMigR3 use different migration areas – rest of UK/overseas and within Fife/outside Fife – so Figure 6.7 cannot be used to compare the output from one scenario with the other. It is included only to show that the migration for one scenario remains constant over the period while in the other there is a steady increase.)

Figure 6.7: Projected net migration for Fife, 2001-2026: ASMigR1 v ASMigR3 scenarios



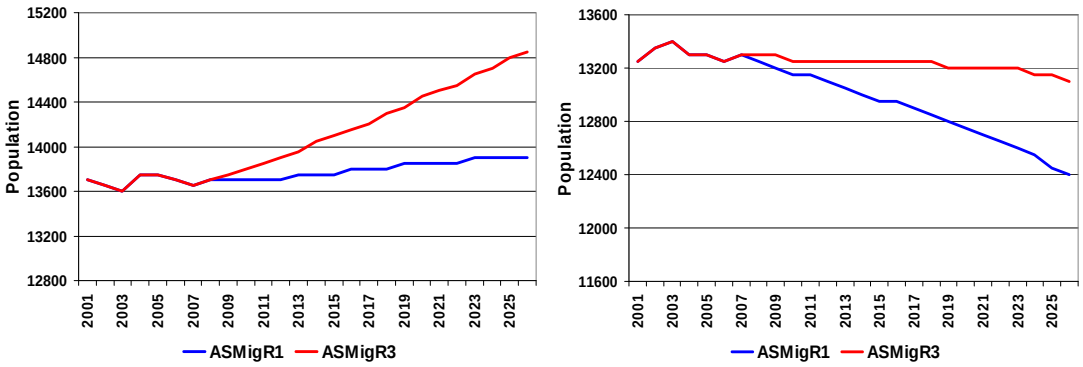
The number of births also contributes to higher population estimates for scenario 'ASMigR3'. There is a much lower difference in the number of deaths over the period (Figure 6.8).

Figure 6.8: Projected births (left) and deaths (right) for Fife, 2001-2026: ASMigR1 v ASMigR3 scenarios



At ward level, the differences vary from area to area. In some areas the projected population estimates are higher in 'ASMigR1' than in 'ASMigR3', in some it is the other way round, and in others there is little difference between the two scenarios. For example, Figure 6.9 shows how the population estimates differ for Cowdenbeath and East Neuk & Landward. The differences are due to a combination of the discrepancies between the projected number of births and deaths and the net migration for the wards.

Figure 6.9: Projected population for Cowdenbeath (left) and East Neuk & Landward (right), 2001-2026: ASMigR1 v ASMigR3 scenarios



6.4 Scenario 'ASMigR4'

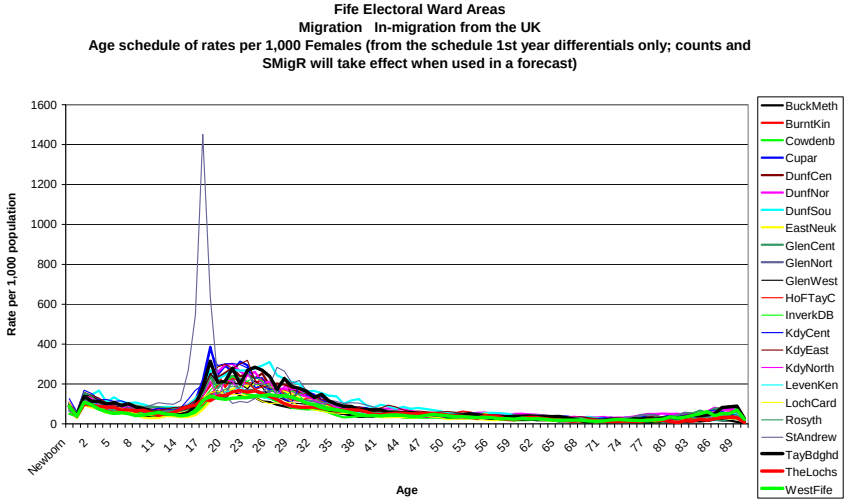
This scenario is similar to 'ASMigR1' and 'ASMigR3' except that it does not identify the external area for migration flows. In other words, while 'ASMigR1' distinguished between moves to/from a ward from/to the rest of the UK and from/to overseas, this scenario is only interested in moves to/from a ward. It uses age-specific migration rates based on migration flows at data zone level (aggregated to wards) for the period 2002/3 to 2006/7. As for 'ASMigR3', this scenario uses these rates directly in the projection, and does not provide migration counts for each year from 2007 onwards. The rates are not smoothed.

Table 6.4: Migration assumptions used in the 'ASMigR4' scenario

POPGROUP worksheet	Data provided	Comments
Sched	ASMigR per 1,000 males and females for Britain from the 2001 Census. ASMigRs per 1,000 males and females for each MMW in Fife.	Annex D. Derived from the 2001 Census for in-migration from the rest of the UK; out-migration to the rest of the UK; in-migration from overseas. Area factors are applied to the Britain ASMigRs, based on observed and expected numbers of migrants in four broad age sex groups.
Fife	Nil.	
Ward	Nil.	

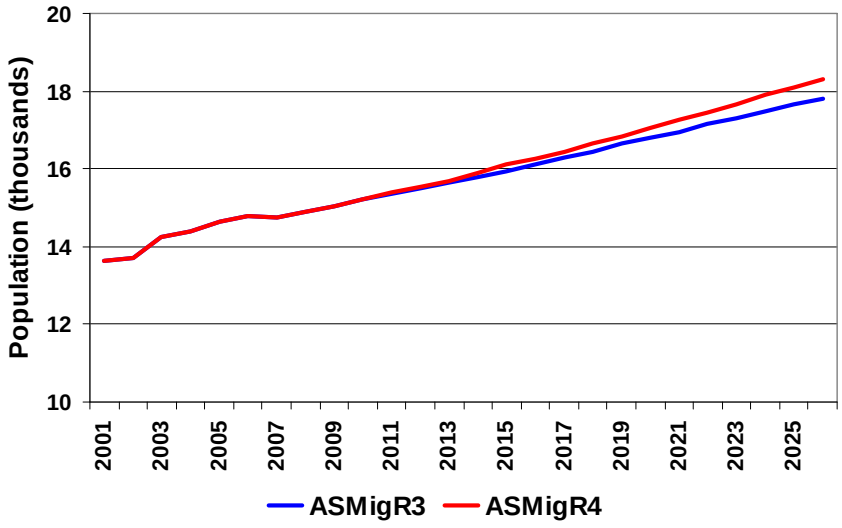
The age-specific migration rates used in this scenario are shown in Figure 6.10.

Figure 6.10: Age-specific migration rates (in-migration, females) for MMWs in Fife, ASMigR4 scenario



This scenario gives very similar population projections to the previous scenario ('ASMigR3'). At ward level, the biggest difference between scenarios 'ASMigR3' and 'ASMigR4' in the projected population count is in Tay Bridgehead where the discrepancy rises to 500 (2.7 per cent relative difference) in 2026 (Figure 6.11). The overall difference in Tay Bridgehead is mainly due to differences in the projected number of births and the net migration each year in this ward. Otherwise, differences between these two scenarios are small.

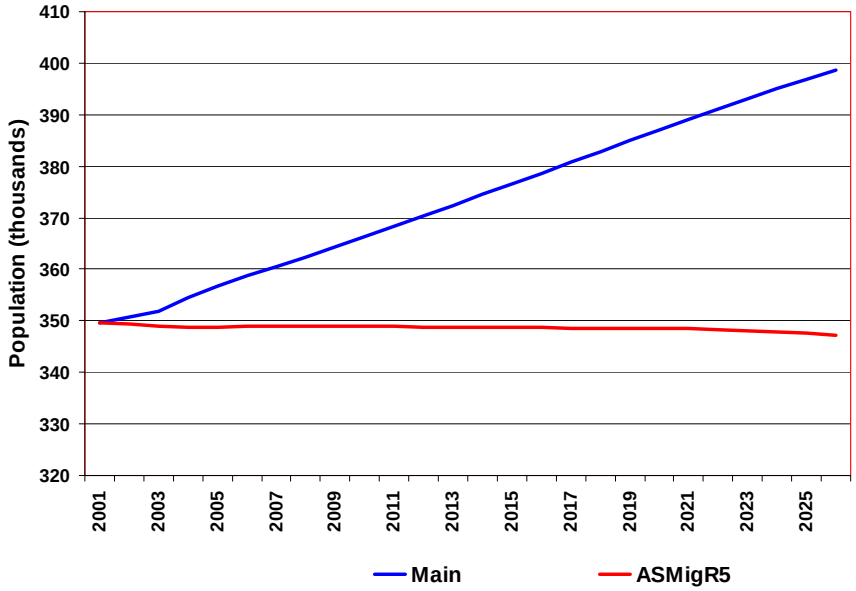
Figure 6.11: Projected population for Tay Bridgehead, 2001-2026: ASMigR3 v ASMigR4 scenarios



6.5 Scenario 'ASMigR5'

This scenario has no migration data, so it projects what would happen in a 'natural change' scenario. Because there is no migration the projected population estimates for this scenario remain relatively constant over time. Figure 6.12 shows how the total population compares with the 'Main' scenario (where there is a positive net migration over time).

Figure 6.12: Projected population for Fife, 2001-2026: Main v ASMigR5 scenarios



At ward level, the situation is similar to varying degrees for each area. The results from scenario 'ASMigR5' are much as expected and not discussed any further here.

6.6 Indirect estimates of migration

Instead of using migration data from CHI, the approach in the 'Main' scenario was to use indirect estimates of migration. These are derived from annual changes in population estimates after taking into account births and deaths in each area throughout the year.

Annex F shows the net impact of migration for each age group and sex for Fife and selected MMWs, averaged over a four-year period. The Fife pattern of net gains in the 15-19 age group and net losses in the 20-24 age group is largely set by the students in St Andrews. Outside the 15-29 age group, migration has little net effect on the population of St Andrews.

The other wards shown in Annex F highlight some of the different patterns of migration taking place throughout Fife. Cupar and Dunfermline Central have net in-migration of young families (children and adults aged 20-39) but out-migration of late teenagers. Dunfermline North has family out-migration but in-migration of the 15-24 age group. The housing developments in Dunfermline South have led to net in-migration at all ages except older people. West Fife is a rural area losing population through migration at most ages, but with more loss of women than men in the years 2003 to 2007.

The use of indirect estimates of migration in POPGROUP correctly sets the net impact of migration for wards but it does not estimate well the disaggregation of migration between in- and out-flows or between short- and long-distance migration.

6.7 Conclusions

GROS is restricted in what small area migration data can be provided to POPGROUP users.

Use of migration rates computed directly for data zones are unlikely to be of use in small area projections because of the small numbers involved for individual years of age or for

age groups. The CCSR approach that does not require updated migration data copes robustly with 5-year age-sex groups for users' areas which will be larger than data zones.

Since the CCSR approach uses population estimates to adjust each small area's migration flows in each 5-year age-sex group, the schedules of migration rates are only used to set the single year of age pattern within each 5-year group. There is no gain from applying census or any other estimates of small area migration patterns for age groups in the schedules of migration rates.

However, in areas where the single year of age pattern may be quite different from other areas – such as areas of armed forces or higher education students – the information of updated migration rates may be very useful to consider changes in migration schedules for those areas.

The use of schedules of migration rates based on small numbers may cause projections to 'ratchet' up or down, because new migrants are added in proportion not only to the starting population but to all the new migrants in earlier years of the projection. This may be why the population increases more rapidly in the later years of scenario 'ASMigR3'.

The CCSR approach uses recent population estimates to determine the net impact of migration at 5-year age-sex groups, and provides counts of migrants for each future year that reflects this net impact. This approach does not provide robust decomposition of the migration flows into in and out flows, or local and distance migrants. This decomposition could be improved with migrant rates based on more recent and more detailed data than available from the previous census.

If GROS provides counts of migrants in and out of data zones, it is not possible to derive flows for other areas by straightforward aggregation, as the aggregated counts will include flows between the zones in a larger area. But it would be possible to identify cases where migration within a larger area is taking place and these could be discarded before aggregation.

While these considerations taken together suggest that population projections will not be significantly helped by standard migration data for data zones, it may be that migration data would nonetheless be useful for other purposes, and could be defined with other purposes in mind, including flows between data zones so that aggregated data could be properly derived.

Migration from CHI for each local area is unlikely to improve the population projections but would better disaggregate the migration between in- and out-flows and between short- and long-distance migration (within council areas and from outside council areas, for example, or within UK and overseas). It could also help the estimation of population by single year of age where migration peaks are atypical (for example, at age 18 for areas with many students in higher education).

Unlike births and deaths, migration cannot be straightforwardly summed across data zones without flows between zones which would be subject to restrictions on release. Thus a standard release for small areas would not be possible, nor is it necessary for small area population projections.

Access to small area migration data is important for understanding population change in unusually dynamic areas and could be the subject of negotiation outside this project.

7. Data Zone Apportionment

The projections that CCSR produced for Fife Council were based on data zone counts (population estimates, number of births and deaths, etc.). Each data zone was initially allocated to a ward, based on the lookup tables used in Scottish Neighbourhood Statistics (SNS). However, data zones do not fit exactly into ward boundaries, and some data zones cross the boundaries of two or more wards. To deal with these situations and to provide more accurate data at ward level, some data zone counts were apportioned to different wards, based on weights provided by Fife Council. Annex E shows how the apportionment was done for Glenrothes West and Kinglassie.

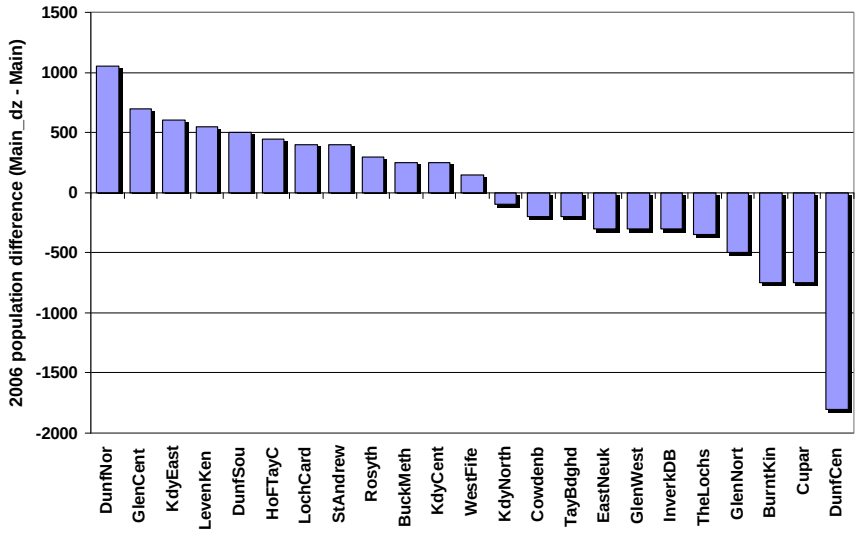
It may be that this apportionment is not easy in some cases, or the data zone to ward fit is very good and it is not required. This section compares the projections from a 'non-apportioned' scenario ('Main_dz') with the 'Main' scenario.

7.1 'Main_dz' Scenario

This scenario is the same as 'Main' except that the figures used in the population base, births, deaths and constraints files were based on whole data zones, with no apportionment done for data zones that cross ward boundaries. The differences in the figures varied from one MMW to another, depending on the goodness-of-fit of the data zones to the ward boundaries. The migration data used in this scenario was the same as for 'Main'.

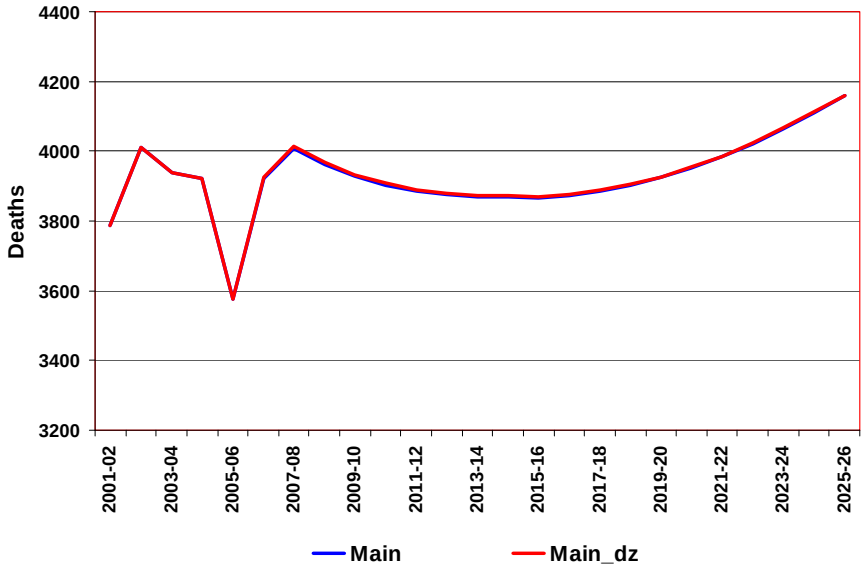
Figure 7.1 shows how the 2006 population estimates differed for these two scenarios. In Dunfermline North, the 2006 population estimate was over 1,000 higher in the 'Main_dz' scenario (where no apportionment was done). In Dunfermline Central, the population estimate for the 'Main_dz' scenario was over 1,500 lower. These maximum discrepancies amount to around 8 per cent of the wards' population. Adjacent wards are likely to be affected in opposite ways, since whole data zones taken wrongly into one ward, will be excluded from a neighbouring ward. Similar results are obtained when we look at the births and deaths for the period 2001-2006.

Figure 7.1: Difference in population estimates: Main v Main_dz scenarios, 2006



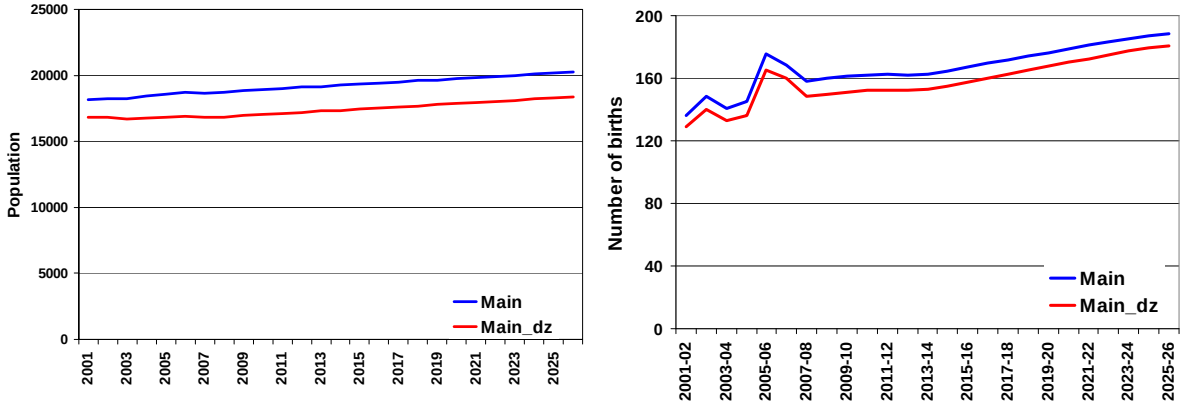
At Fife level, the projections for population, births and deaths are almost exactly the same for both 'Main' and 'Main_dz' scenarios. Figure 7.2 shows the projected number of deaths in Fife for both scenarios. There may be some very small differences due to rounding.

Figure 7.2: Projected deaths for Fife 2001-2026: Main v Main_dz scenarios



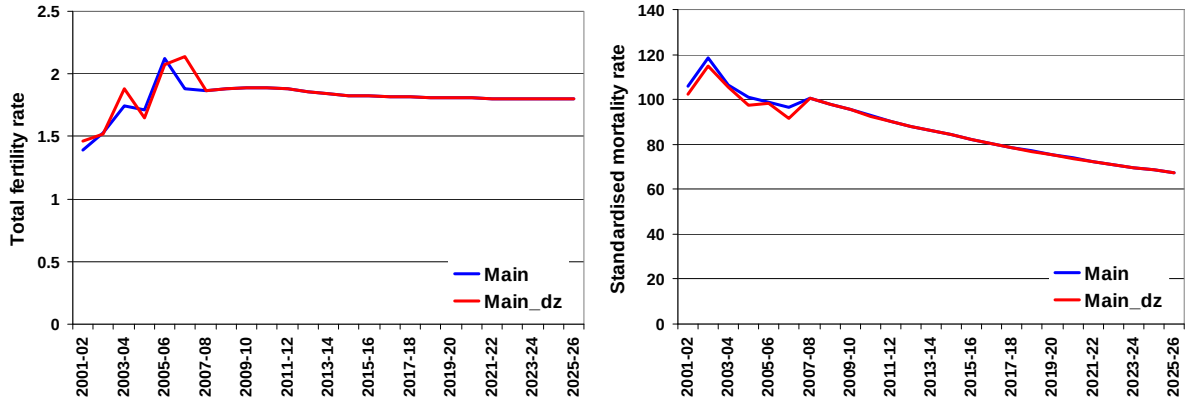
At MMW level, the projections for population, births and deaths for the 'Main_dz' scenario are different from the 'Main' scenario, but the trend over the period is the same for both scenarios. The size of the differences between the projections for the scenarios will depend on the discrepancies that result from not apportioning the data. For example, Figure 7.3 shows the population projections for Dunfermline Central, and the projected number of births for Burntisland, Kinghorn and Western Kirkcaldy.

Figure 7.3: Projected population for Dunfermline Central (left) and projected births for Burntisland, Kinghorn & Western Kirkcaldy (right) 2001-2026: Main v Main_dz scenarios



The total fertility rates (TFR) for the 'Main_dz' scenario are mostly the same as for the 'Main' scenario. Any differences in TFR are usually small. The ward with the most pronounced differences is Kirkcaldy East (Figure 7.4). (Kirkcaldy East is one of the two wards with a bimodal fertility curve.) Similarly, the standardised mortality rate produce by scenario 'Main_dz' differs little from that produced by the 'Main' scenario. The ward with the biggest differences is Kirkcaldy Central (Figure 7.4).

Figure 7.4: Total fertility rates for Kirkcaldy East (left) and standardised mortality rates for Kirkcaldy Central (right) 2001-2026: Main v Main_dz scenarios



These examples show the effect that doing the data zone apportionment has on the projections at ward level. It makes no difference to the general trend but there are differences between the two scenarios, depending on how well the data zones fit the ward boundaries. Similar results are obtained for all wards for population projections and the projected number of births and deaths.

7.2 Conclusion

The 'Main_dz' scenario produced no unusual results. The differences at ward level between this scenario and the 'Main' scenario can be explained by how well the data zones fit the ward boundaries. Counts will be affected more than rates.

The main disadvantage with not doing the data zone apportionment is that the input data (population estimates, births, deaths, etc.) are less accurate. Consequently, the resulting projections will reflect this inaccuracy. The scale of the inaccuracy varies from ward to ward. However, if apportionment is done it must be done for all input data (population, births, deaths, migration, etc.).

GROS has no information on how data zones should be apportioned for the various geographies that might be used by local authorities. Therefore, if data zone apportionment is desired, it is up to each local authority to do this.

GROS can provide data zone population estimates for 2001 and subsequent years, by single year of age and sex. Any apportionment must be done by the local authorities.

Annex A - Definitions

Multi-member ward names
In certain places in the text and in the tables and charts, abbreviated names for the multi-member wards in Fife were used. The full names of the wards are as follows:

Abbreviated MMW name	Full MMW name
BuckMeth	Buckhaven, Methil and Wemyss Villages
BurntKin	Burntisland, Kinghorn and Western Kirkcaldy
Cowdenb	Cowdenbeath
Cupar Cupar	
DunfCen	Dunfermline Central
DunfNor	Dunfermline North
DunfSou	Dunfermline South
EastNeuk	East Neuk and Landward
GlenCent	Glenrothes Central and Thornton
GlenNort	Glenrothes North, Leslie and Markinch
GlenWest	Glenrothes West and Kinglassie
HoFTayC	Howe of Fife and Tay Coast
InverkDB	Inverkeithing and Dalgety Bay
KdyCent	Kirkcaldy Central
KdyEast	Kirkcaldy East
KdyNorth	Kirkcaldy North
LevenKen	Leven, Kennoway and Largo
LochCard	Lochgelly and Cardenden
Rosyth	Rosyth
StAndrew	St Andrews
TayBdghd	Tay Bridgehead
TheLochs	The Lochs
West Fife	West Fife and Coastal Villages

Other abbreviations

ASFR	Age-specific fertility rate
ASMR	Age-specific mortality rate
ASMigR	Age-specific migration rate
CCSR	Centre for Census and Survey Research
FC	Fife Council
GROS	General Register Office for Scotland
MMW	Multi-member ward
OV	Overseas
RUK	Rest of the United Kingdom
SMR	Standardised mortality rate
SNS	Scottish Neighbourhood Statistics
TFR	Total fertility rate

Annex B – Fertility Rates

Fertility rates (Scotland)

Total fertility rate (TFR) = 1.71
Age-specific fertility rates (ASFR)

Age	ASFR
15	2.55
16	8.86
17	24.13
18	37.82
19	45.92
20	52.41
21	57.08
22	62.21
23	67.02
24	71.12
25	76.96
26	83.07
27	90.60
28	99.19
29	105.15
30	110.31
31	111.35
32	107.79
33	100.00
34	89.02
35	76.21
36	62.88
37	50.12
38	38.69
39	28.99
40	19.71
41	13.09
42	7.93
43	4.13
44	2.13
45	0.66
46	1.00
47	0
48	0
49	0

Source: 2006-based Population Projections for Scottish Areas (Annex A, page 37), or GADSCOTLAND06.xls on POPGROUP website.

Fertility differentials by age, 2006-2030 (Fife)

	Age of mother						
Year	15-19	20-24	25-29	30-34	35-39	40-44	45-49
2006	1.05	1.01	1.01	0.97	0.97	0.94	0.93
2007	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2008	0.97	0.99	1.00	1.02	1.03	1.04	1.05
2009	0.96	0.99	1.01	1.03	1.05	1.06	1.07
2010	0.96	0.99	1.01	1.03	1.05	1.06	1.07
2011	0.96	0.99	1.01	1.02	1.03	1.04	1.05
2012	0.96	0.99	1.01	1.00	1.00	1.00	1.00
2013	0.96	0.99	1.01	0.98	0.97	0.96	0.96
2014	0.96	0.99	1.01	0.97	0.95	0.95	0.93
2015	0.96	0.99	1.01	0.97	0.95	0.94	0.92
2016	0.96	0.99	1.01	0.97	0.94	0.93	0.91
2017	0.96	0.99	1.01	0.96	0.93	0.92	0.91
2018	0.96	0.99	1.01	0.96	0.93	0.92	0.90
2019	0.96	0.99	1.01	0.96	0.93	0.91	0.89
2020	0.96	0.99	1.01	0.96	0.92	0.91	0.89
2021	0.96	0.99	1.01	0.95	0.92	0.90	0.88
2022	0.96	0.99	1.01	0.95	0.92	0.90	0.88
2023	0.96	0.99	1.01	0.95	0.91	0.90	0.88
2024	0.96	0.99	1.01	0.95	0.91	0.90	0.88
2025	0.96	0.99	1.01	0.95	0.91	0.90	0.88
2026	0.96	0.99	1.01	0.95	0.91	0.90	0.88
2027	0.96	0.99	1.01	0.95	0.91	0.90	0.88
2028	0.96	0.99	1.01	0.95	0.91	0.90	0.88
2029	0.96	0.99	1.01	0.95	0.91	0.90	0.88
2030	0.96	0.99	1.01	0.95	0.91	0.90	0.88

Source: GADSCOTLAND06.xls on POPGROUP website.

Age-specific fertility rates for MMWs, scenario 'ASFR1' (extract)

The unsmoothed age-specific fertility rates (per 1,000 women) for scenario 'ASFR1', using
- age of mother at the time of the birth,
- total births,
- total population

for the 6-year period 1 July 2001 to 30 June 2007 are as follows:

Data

Age specific fertility rates (per 1,000 women)

			Population Group ……..				
	Age	***Standard***	BuckMeth	BurntKin	Cowdenb	Cupar	DunfCen
TFR		*1.71*	*1.89*	*1.91*	*1.83*	*1.66*	*1.68*
female	15	2.5	5.2	0.0	1.9	0.2	2.8
female	16	8.9	27.0	7.7	15.1	10.7	12.3
female	17	24.1	41.6	30.5	28.5	10.2	12.2
female	18	37.8	94.4	51.2	56.5	20.2	42.5
female	19	45.9	85.0	49.5	69.8	49.7	66.6
female	20	52.4	123.1	70.7	102.4	71.9	58.6
female	21	57.1	133.4	69.4	99.9	53.1	62.8
female	22	62.2	125.3	72.1	78.7	46.8	62.6
female	23	67.0	117.1	77.0	113.5	78.0	64.7
female	24	71.1	114.1	98.0	120.7	54.5	59.8
female	25	77.0	112.9	97.3	117.7	73.7	67.3
female	26	83.1	108.3	77.4	83.5	69.4	93.7
female	27	90.6	107.2	93.7	123.6	109.1	91.2
female	28	99.2	102.7	127.6	120.7	99.4	82.7
female	29	105.2	88.1	129.3	130.0	114.6	113.2
female	30	110.3	89.8	99.3	110.2	125.1	115.6
female	31	111.4	71.2	142.2	89.2	120.8	111.3
female	32	107.8	83.6	136.5	88.7	129.0	114.5
female	33	100.0	42.2	98.6	87.0	105.9	103.3
female	34	89.0	56.1	83.1	50.2	56.9	79.2
female	35	76.2	46.3	84.6	37.7	58.1	67.4
female	36	62.9	34.2	64.5	35.9	57.6	58.6
female	37	50.1	25.9	45.7	18.8	46.2	54.2
female	38	38.7	22.2	36.6	20.8	28.4	32.9
female	39	29.0	12.8	29.8	10.1	27.9	27.6
female	40	19.7	7.3	11.5	7.1	12.9	11.8
female	41	13.1	4.6	9.9	3.0	8.6	6.4
female	42	7.9	3.5	7.3	5.8	5.6	2.5
female	43	4.1	1.2	6.1	1.6	4.7	3.1
female	44	2.1	0.0	2.8	0.0	4.2	3.2
female	45	0.7	0.0	0.0	0.0	3.0	0.3
female	46	1.0	0.0	1.5	1.7	0.0	0.0
female	47	0.0	0.0	0.0	0.0	0.0	0.0
female	48	0.0	0.0	0.0	0.0	0.0	0.0
female	49	0.0	0.0	0.0	0.0	0.0	0.0

Age-specific fertility rates for MMWs, scenario 'ASFR2' (extract)

The smoothed (using a 5-year moving average) age-specific fertility rates (per 1,000 women) for scenario 'ASFR1', using

- age of mother at the time of the birth,
- total births,
- total population

for the 6-year period 1 July 2001 to 30 June 2007 are as follows:

Data **Age specific fertility rates (per 1,000 women)**

		Population Group ……..					
	Age	*Standard*	BuckMeth	BurntKin	Cowdenb	Cupar	DunfCen
TFR		*1.71*	*1.86*	*1.91*	*1.82*	*1.65*	*1.67*
female	15	2.5	8.3	6.1	5.7	2.0	2.4
female	16	8.9	24.9	18.3	17.1	6.1	7.3
female	17	24.1	50.6	27.8	34.4	18.2	27.3
female	18	37.8	74.2	41.9	54.5	32.5	38.4
female	19	45.9	95.5	54.3	71.4	41.0	48.5
female	20	52.4	112.3	62.6	81.5	48.3	58.6
female	21	57.1	116.8	67.7	92.9	59.9	63.1
female	22	62.2	122.6	77.4	103.0	60.9	61.7
female	23	67.0	120.6	82.8	106.1	61.2	63.4
female	24	71.1	115.5	84.4	102.8	64.5	69.6
female	25	77.0	111.9	88.7	111.8	76.9	75.3
female	26	83.1	109.0	98.8	113.3	81.2	78.9
female	27	90.6	103.8	105.1	115.1	93.2	89.6
female	28	99.2	99.2	105.4	113.6	103.5	99.3
female	29	105.2	91.8	118.4	114.7	113.8	102.8
female	30	110.3	87.1	127.0	107.8	117.8	107.5
female	31	111.4	75.0	121.1	101.0	119.1	111.6
female	32	107.8	68.6	111.9	85.1	107.5	104.8
female	33	100.0	59.9	109.0	70.6	94.1	95.2
female	34	89.0	52.5	93.5	59.9	81.5	84.6
female	35	76.2	41.0	75.3	45.9	65.0	72.6
female	36	62.9	37.0	62.9	32.7	49.5	58.5
female	37	50.1	28.3	52.2	24.7	43.6	48.1
female	38	38.7	20.5	37.6	18.5	34.6	37.0
female	39	29.0	14.6	26.7	11.9	24.8	26.6
female	40	19.7	10.1	19.0	9.3	16.7	16.2
female	41	13.1	5.9	12.9	5.5	11.9	10.3
female	42	7.9	3.3	7.5	3.5	7.2	5.4
female	43	4.1	1.8	5.2	2.1	5.2	3.1
female	44	2.1	0.9	3.6	1.8	3.5	1.8
female	45	0.7	0.2	2.1	0.7	2.4	1.3
female	46	1.0	0.0	0.9	0.3	1.4	0.7
female	47	0.0	0.0	0.3	0.3	0.6	0.1
female	48	0.0	0.0	0.0	0.0	0.0	0.0
female	49	0.0	0.0	0.0	0.0	0.0	0.0

Age-specific fertility rates for MMWs, scenario 'ASFR3' (extract)

The smoothed (using a 5-year moving average) age-specific fertility rates (per 1,000 women) for scenario 'ASFR1', using

- age of mother at the start of the year (1 July),
- total births,
- total population

for the 6-year period 1 July 2001 to 30 June 2007 are as follows:

Data **Age specific fertility rates (per 1,000 women)**

		Population Group ……..					
	Age	***Standard***	BuckMeth	BurntKin	Cowdenb	Cupar	DunfCen
TFR		*1.71*	*1.86*	*1.93*	*1.83*	*1.67*	*1.69*
female	15	2.5	8.5	6.1	5.8	2.0	2.4
female	16	8.9	25.4	18.2	17.3	5.9	7.3
female	17	24.1	50.7	26.4	33.8	17.6	26.4
female	18	37.8	73.7	39.9	53.3	31.5	37.3
female	19	45.9	93.8	51.8	70.3	40.1	47.3
female	20	52.4	110.7	60.5	80.6	47.3	57.7
female	21	57.1	115.4	66.9	92.5	59.3	62.8
female	22	62.2	121.2	76.3	102.2	60.4	61.7
female	23	67.0	119.8	82.1	106.4	61.2	63.8
female	24	71.1	116.0	84.5	103.2	64.8	70.6
female	25	77.0	112.0	89.0	111.4	77.6	75.9
female	26	83.1	108.2	99.0	112.9	81.9	80.1
female	27	90.6	102.9	105.4	115.5	93.8	91.0
female	28	99.2	98.6	107.2	114.0	105.2	101.3
female	29	105.2	91.6	120.9	115.6	115.9	105.2
female	30	110.3	87.6	129.5	109.5	120.5	110.3
female	31	111.4	76.4	124.8	103.3	122.5	114.5
female	32	107.8	70.7	116.4	87.2	111.7	107.6
female	33	100.0	61.6	112.7	72.4	97.3	97.6
female	34	89.0	54.0	96.6	61.3	83.8	86.3
female	35	76.2	41.8	78.1	47.0	66.7	73.7
female	36	62.9	37.7	64.6	33.3	50.6	59.0
female	37	50.1	28.5	53.4	25.0	44.2	48.4
female	38	38.7	20.7	38.4	18.7	35.0	37.0
female	39	29.0	14.6	26.9	12.0	25.2	26.6
female	40	19.7	10.1	18.9	9.3	16.8	16.3
female	41	13.1	5.9	12.8	5.5	12.2	10.3
female	42	7.9	3.3	7.5	3.4	7.3	5.5
female	43	4.1	1.8	5.2	2.0	5.2	3.1
female	44	2.1	0.9	3.5	1.8	3.5	1.8
female	45	0.7	0.2	2.1	0.6	2.3	1.3
female	46	1.0	0.0	0.9	0.3	1.4	0.7
female	47	0.0	0.0	0.3	0.3	0.6	0.1
female	48	0.0	0.0	0.0	0.0	0.0	0.0
female	49	0.0	0.0	0.0	0.0	0.0	0.0

Fertility differentials for MMWs, scenario 'TFR1'

The fertility differentials for scenario 'TFR1' are derived from the TFR for Fife (1.71) and the TFRs for each ward in Fife (which are taken from the 'ASFR1' scenario).

For example, the fertility differential for Buckhaven, Methil and Wemyss Villages = MMW TFR / Fife TFR = 1.89 / 1.71 = 1.10

Multi Member Ward	Total fertility rate	Fertility differential
Buckhaven, Methil and Wemyss Villages	1.89	1.10
Burntisland, Kinghorn and Western Kirkcaldy	1.91	1.12
Cowdenbeath	1.83	1.07
Cupar	1.66	0.97
Dunfermline Central	1.68	0.99
Dunfermline North	1.66	0.97
Dunfermline South	2.10	1.23
East Neuk and Landward	1.55	0.91
Glenrothes Central and Thornton	1.85	1.08
Glenrothes North, Leslie and Markinch	1.63	0.95
Glenrothes West and Kinglassie	1.85	1.08
Howe of Fife and Tay Coast	1.77	1.04
Inverkeithing and Dalgety Bay	1.73	1.01
Kirkcaldy Central	1.67	0.98
Kirkcaldy East	1.78	1.04
Kirkcaldy North	1.74	1.02
Leven, Kennoway and Largo	1.78	1.04
Lochgelly and Cardenden	1.77	1.04
Rosyth	1.86	1.09
St Andrews	0.96	0.56
Tay Bridgehead	1.82	1.07
The Lochs	1.97	1.15
West Fife and Coastal Villages	1.83	1.07

Fertility differentials for MMWs, scenario 'TFR2'

The fertility differentials for scenario 'TFR2' are derived from the TFR for Fife (1.71) and the TFRs for each ward in Fife (which are taken from the 'ASFR2' scenario).

For example, the fertility differential for Buckhaven, Methil and Wemyss Villages = MMW TFR / Fife TFR = 1.86 / 1.71 = 1.09

Multi Member Ward	Total fertility rate	Fertility differential
Buckhaven, Methil and Wemyss Villages	1.86	1.09
Burntisland, Kinghorn and Western Kirkcaldy	1.91	1.12
Cowdenbeath	1.82	1.07
Cupar	1.65	0.97
Dunfermline Central	1.67	0.98
Dunfermline North	1.66	0.97
Dunfermline South	2.08	1.22
East Neuk and Landward	1.55	0.91
Glenrothes Central and Thornton	1.84	1.08
Glenrothes North, Leslie and Markinch	1.62	0.95
Glenrothes West and Kinglassie	1.84	1.08
Howe of Fife and Tay Coast	1.77	1.04
Inverkeithing and Dalgety Bay	1.73	1.01
Kirkcaldy Central	1.66	0.97
Kirkcaldy East	1.78	1.04
Kirkcaldy North	1.74	1.02
Leven, Kennoway and Largo	1.77	1.03
Lochgelly and Cardenden	1.77	1.04
Rosyth	1.85	1.09
St Andrews	0.96	0.56
Tay Bridgehead	1.82	1.06
The Lochs	1.96	1.15
West Fife and Coastal Villages	1.82	1.06

Annex C – Mortality Rates

Mortality rates (Scotland) - extract

Age-specific mortality rates (ASMR) per 1,000

Age	Age-specific mortality rate	
	Males	Females
Newborn	4.5	3.7
0	1.0	0.8
1	0.3	0.2
2	0.2	0.2
3	0.2	0.1
4	0.2	0.1
5	0.1	0.1
6	0.1	0.1
7	0.1	0.1
8	0.1	0.1
9	0.1	0.1
.	.	.
.	.	.
.	.	.
71	31.1	19.8
72	34.4	22.3
73	38.2	25.2
74	42.7	28.7
75	47.7	32.4
76	53.2	36.3
77	58.8	40.4
78	64.9	44.9
79	71.6	49.9
80	78.5	55.5
81	85.0	61.5
82	91.6	67.9
83	99.3	75.4
84	108.4	84.2
85	119.7	93.8
86	133.3	105.8
87	148.2	119.8
88	162.5	133.6
89	173.6	146.9
90 +	227.9	213.0

Source: 2006-based Population Projections for Scottish Areas (Annex B, page 38), or GADSCOTLAND06.xls on POPGROUP website.

Age-specific mortality rates for MMWs, scenario 'ASMR1' (extract)

The unsmoothed age-specific mortality rates (per 1,000 population) for scenario 'ASMR1', using

- sex/age of person at the time of the death,
- total deaths,
- total population

for the 6-year period 1 July 2001 to 30 June 2007, are as follows:

Data

Age specific mortality rates (per 1,000 population)

		Population Group ……					
Sex	**Age**	***Standard***	*BuckMeth*	*BurntKin*	*Cowdenb*	*Cupar*	*DunfCen*
male	Newborn	4.5	10.2	6.1	10.3	8.9	2.5
male	0	1.0	1.1	1.2	1.5	1.5	0.5
male	1	0.3	6.0	0.0	0.0	2.2	0.0
male	2	0.2	1.5	0.0	0.0	0.0	0.0
male	3	0.2	0.0	0.0	0.0	0.0	0.0
male	4	0.2	0.0	0.0	0.0	0.0	1.6
male	5	0.1	0.0	0.0	0.0	0.0	0.0
male	6	0.1	0.0	0.0	2.2	0.0	0.0
male	7	0.1	0.0	0.0	0.0	0.0	0.0
male	8	0.1	1.4	0.0	2.1	0.0	0.0
male	9	0.1	0.0	0.0	0.0	0.0	0.0
male	10	0.1	0.0	0.0	0.0	0.0	0.0
male	11	0.1	0.0	0.0	0.0	0.0	0.0
male	12	0.2	1.3	1.9	3.4	0.0	0.0
male	13	0.2	0.0	0.0	0.0	0.0	0.0
male	14	0.2	0.0	0.0	1.8	0.0	0.0
male	15	0.3	0.0	1.7	0.0	0.0	0.0
male	16	0.5	1.3	0.1	0.0	0.0	0.1
male	17	0.7	0.0	1.9	1.8	0.2	0.8
male	18	0.8	1.4	0.0	3.8	0.7	2.1
male	19	0.9	1.4	0.0	2.0	1.9	0.0
male	20	0.9	3.0	0.5	2.2	0.0	0.0
male	21	0.9	0.0	0.1	0.0	0.3	0.0
male	22	1.0	4.5	2.5	0.0	0.9	3.0
male	23	1.0	0.0	2.7	2.2	0.0	1.8
male	24	1.0	3.1	0.0	2.3	0.0	1.5
male	25	1.1	0.0	0.0	2.3	0.0	1.1
male	26	1.1	0.0	2.4	0.0	3.1	0.1
male	27	1.1	5.3	0.0	0.0	0.0	1.0
male	28	1.2	3.5	0.2	0.0	0.0	0.4
male	29	1.3	3.6	0.1	0.0	0.0	0.0
male	30	1.3	3.5	4.7	4.6	0.2	1.4

Age-specific mortality rates for MMWs, scenario 'ASMR2' (extract)

The smoothed age-specific mortality rates (per 1,000 population) for scenario 'ASMR2', using
- sex/age of person at the time of the death,
- total deaths,
- total population

for the 6-year period 1 July 2001 to 30 June 2007, are as follows:

Data

Age specific mortality rates (per 1,000 population)

		Population Group ……..					
Sex	**Age**	***Standard***	*BuckMeth*	*BurntKin*	*Cowdenb*	*Cupar*	*DunfCen*
male	Newborn	4.5	10.2	6.1	10.3	8.9	2.5
male	0	1.0	3.2	0.5	0.6	1.5	0.2
male	1	0.3	3.0	0.3	0.4	1.3	0.1
male	2	0.2	1.9	0.1	0.2	0.7	0.2
male	3	0.2	1.0	0.0	0.0	0.2	0.4
male	4	0.2	0.2	0.0	0.2	0.0	0.5
male	5	0.1	0.0	0.0	0.5	0.0	0.4
male	6	0.1	0.2	0.0	1.0	0.0	0.2
male	7	0.1	0.3	0.0	1.0	0.0	0.0
male	8	0.1	0.5	0.0	1.0	0.0	0.0
male	9	0.1	0.3	0.0	0.5	0.0	0.0
male	10	0.1	0.3	0.2	0.6	0.0	0.0
male	11	0.1	0.3	0.4	0.8	0.0	0.0
male	12	0.2	0.4	0.6	1.3	0.0	0.0
male	13	0.2	0.3	0.6	1.2	0.0	0.0
male	14	0.2	0.3	0.6	1.0	0.0	0.0
male	15	0.3	0.3	0.8	0.6	0.0	0.1
male	16	0.5	0.6	0.8	1.0	0.1	0.4
male	17	0.7	0.8	0.8	1.7	0.4	0.8
male	18	0.8	1.3	0.5	2.4	0.7	0.9
male	19	0.9	1.5	0.3	2.2	0.8	0.6
male	20	0.9	2.0	0.5	1.6	0.7	0.6
male	21	0.9	1.8	1.0	1.0	0.5	0.9
male	22	1.0	2.2	1.5	1.0	0.4	1.6
male	23	1.0	1.7	1.5	1.5	0.2	1.7
male	24	1.0	1.5	1.2	1.7	0.4	1.5
male	25	1.1	1.3	0.8	1.5	0.7	1.0
male	26	1.1	1.9	0.8	0.8	1.0	0.7
male	27	1.1	2.9	0.6	0.3	0.7	0.6
male	28	1.2	3.5	0.9	0.5	0.4	0.5
male	29	1.3	3.5	1.1	1.3	0.1	0.6
male	30	1.3	3.2	1.7	2.0	0.1	0.6

Annex D – Migration Rates

Migration rates (GB) for scenario 'ASMigR1' – extract

The age-specific migration rates (per 1,000 population) for scenario 'ASMigR1', using
- sex/age of migrant,
- total migrants to/from rest of the UK,
- total migrants to/from overseas,
- total population

for the 5-year period 1 July 2002 to 30 June 2007, are as follows:

In-migration from UK (males)

Data

Age specific migration rates (per 1,000 population)

Population Group ……..

Sex	Age	*Standard*	*BuckMeth*	*BurntKin*	*Cowdenb*	*Cupar*	*DunfCen*
male	Newborn	88.0	95.7	67.3	78.9	93.5	78.3
male	0	144.5	70.9	88.1	59.2	90.3	102.5
male	1	126.6	89.6	116.3	75.1	132.0	137.2
male	2	111.1	88.6	113.2	80.5	147.6	144.0
male	3	101.4	74.3	92.1	70.4	132.0	111.6
male	4	91.8	68.1	76.1	72.9	111.8	98.7
male	5	87.5	61.7	79.3	69.1	87.1	81.7
male	6	83.6	57.8	73.8	72.9	69.2	71.9
male	7	79.9	54.4	74.8	55.7	64.5	66.6
male	8	75.4	57.0	63.7	50.6	62.1	57.6
male	9	71.9	51.7	67.2	43.0	56.5	59.6
male	10	68.1	42.7	61.7	43.7	60.6	57.5
male	11	66.2	39.9	64.6	39.6	55.7	62.6
male	12	63.6	42.2	68.2	31.0	51.8	60.9
male	13	62.6	41.4	66.6	30.2	40.1	52.6
male	14	54.6	43.8	63.8	29.4	39.1	53.2
male	15	58.8	44.6	52.2	31.9	42.8	46.7
male	16	69.4	52.5	54.0	31.8	50.6	53.1
male	17	113.0	57.0	64.9	37.6	74.5	58.6
male	18	177.5	74.9	96.7	55.9	119.9	92.3
male	19	203.2	88.7	111.4	64.5	145.7	105.2
male	20	205.0	106.2	124.4	75.6	161.3	118.1
male	21	212.6	114.4	118.3	75.3	151.6	117.2
male	22	212.6	119.2	132.1	93.7	158.5	136.5
male	23	203.0	122.1	143.4	100.9	148.3	144.7
male	24	194.8	125.0	158.6	109.1	156.8	156.1
male	25	186.6	133.7	151.3	106.9	155.3	152.0
male	26	175.6	124.1	153.2	102.1	158.7	164.2
male	27	162.1	110.9	151.6	100.7	145.3	163.1
male	28	150.6	104.1	149.1	91.5	129.3	175.5
male	29	138.6	96.0	142.0	81.8	134.5	162.7
male	30	146.8	96.3	133.9	86.3	123.7	163.8

Migration rates for scenario 'ASMigR2' – extract

The unsmoothed age-specific migration rates (per 1,000 population) for scenario 'ASMigR2', using

- sex/age of migrant,
- total migrants to/from rest of the UK,
- total migrants to/from overseas,
- total population

for the 5-year period 1 July 2002 to 30 June 2007, are as follows:

In-migration from UK (males)

Data

Age specific migration rates (per 1,000 population)

Population Group ……..

Sex	Age	***Standard***	*BuckMeth*	*BurntKin*	*Cowdenb*	*Cupar*	*DunfCen*	*DunfNor*
male	Newborn	88.0	48.9	68.0	47.7	46.4	64.9	34.7
male	0	144.5	88.9	81.4	80.6	102.2	118.8	95.6
male	1	126.6	60.1	97.4	49.6	71.2	87.6	53.7
male	2	111.1	50.4	40.9	60.1	59.0	87.4	81.7
male	3	101.4	49.4	54.5	36.6	52.0	58.2	34.7
male	4	91.8	49.1	58.5	56.4	34.5	53.2	56.4
male	5	87.5	30.9	54.7	49.0	28.5	65.3	39.1
male	6	83.6	33.9	32.9	55.7	26.5	33.4	60.5
male	7	79.9	51.6	67.0	23.1	26.0	48.7	49.9
male	8	75.4	40.5	35.7	38.3	28.7	35.0	50.3
male	9	71.9	20.9	42.4	32.3	19.5	52.4	59.8
male	10	68.1	24.5	36.4	30.9	41.9	50.3	46.9
male	11	66.2	38.1	56.0	26.5	19.8	44.2	47.6
male	12	63.6	26.3	53.4	11.1	26.0	43.5	57.0
male	13	62.6	24.9	30.2	23.9	29.5	34.3	41.7
male	14	54.6	46.3	44.1	21.9	12.1	44.8	38.2
male	15	58.8	26.2	33.6	22.2	21.9	25.0	35.6
male	16	69.4	35.8	44.0	12.7	27.8	43.4	24.9
male	17	113.0	35.4	55.2	23.8	36.1	50.5	42.0
male	18	177.5	33.5	53.5	32.7	30.0	55.6	68.0
male	19	203.2	55.1	59.1	27.9	34.2	40.7	61.1
male	20	205.0	69.5	70.2	51.4	50.0	48.9	96.7
male	21	212.6	89.6	77.4	38.7	43.6	62.8	100.0
male	22	212.6	64.3	73.2	65.2	46.5	72.0	109.5
male	23	203.0	59.3	97.6	59.9	29.4	92.7	104.3
male	24	194.8	91.4	96.0	54.2	56.0	98.0	129.8
male	25	186.6	94.1	85.7	72.7	68.0	80.6	158.7
male	26	175.6	65.5	109.7	53.7	72.2	95.4	107.1
male	27	162.1	67.8	87.5	66.1	52.4	92.5	118.7
male	28	150.6	76.6	97.7	67.3	67.9	112.0	111.4
male	29	138.6	58.3	85.4	36.3	97.1	93.8	88.0
male	30	146.8	66.8	91.5	84.0	59.2	98.7	77.3

Migration rates for scenario 'ASMigR3' – extract

The smoothed age-specific migration rates (per 1,000 population) for scenario 'ASMigR3', using

- sex/age of migrant,
- total migrants to/from rest of Fife,
- total migrants to/from outside Fife,
- total population

for the 5-year period 1 July 2002 to 30 June 2007, are as follows:

In-migration from UK (males)

Data

Age specific migration rates (per 1,000 population)

Population Group ……..

Sex	Age	*Standard*	*BuckMeth*	*BurntKin*	*Cowdenb*	*Cupar*	*DunfCen*	*DunfNor*
male	Newborn	88.0	48.9	68.0	47.7	46.4	64.9	34.7
male	0	144.5	20.0	32.5	16.5	23.7	29.2	17.9
male	1	126.6	66.5	73.2	63.5	77.5	97.9	77.0
male	2	111.1	53.3	64.3	48.8	60.7	77.7	56.7
male	3	101.4	49.6	51.3	51.0	48.5	66.2	57.6
male	4	91.8	43.1	55.9	47.3	38.3	58.9	43.4
male	5	87.5	37.9	48.7	53.7	29.8	50.6	52.0
male	6	83.6	38.8	51.5	42.6	27.0	49.1	49.8
male	7	79.9	42.0	45.2	39.0	27.1	39.0	53.5
male	8	75.4	37.7	48.4	31.2	24.8	45.4	53.3
male	9	71.9	28.6	38.2	33.8	30.0	45.9	52.3
male	10	68.1	27.8	44.9	29.9	27.1	49.0	51.4
male	11	66.2	29.6	48.6	22.8	29.2	46.0	50.5
male	12	63.6	29.8	46.5	20.5	25.1	40.7	48.8
male	13	62.6	32.5	42.5	19.0	22.5	40.9	45.6
male	14	54.6	32.4	36.0	22.7	21.2	34.7	38.5
male	15	58.8	36.1	40.6	18.9	20.6	37.7	32.9
male	16	69.4	32.4	44.3	19.5	28.6	39.6	34.2
male	17	113.0	34.9	50.9	23.0	31.3	49.8	45.0
male	18	177.5	41.3	55.9	28.1	33.4	48.9	57.0
male	19	203.2	52.7	60.9	37.3	38.1	48.4	75.3
male	20	205.0	71.4	68.9	39.3	42.6	50.8	85.9
male	21	212.6	74.5	73.6	51.7	46.7	61.2	102.0
male	22	212.6	71.1	82.7	54.6	39.8	75.8	104.6
male	23	203.0	71.7	88.9	59.8	44.0	87.6	114.5
male	24	194.8	81.6	93.1	62.3	51.1	90.5	130.9
male	25	186.6	83.7	97.2	60.2	65.4	91.4	131.8
male	26	175.6	75.8	94.3	64.1	64.2	89.5	128.1
male	27	162.1	70.0	98.3	62.3	64.2	100.0	112.4
male	28	150.6	67.6	90.2	56.5	72.5	99.4	106.0
male	29	138.6	67.2	91.5	62.5	74.7	101.5	92.2
male	30	146.8	73.1	90.5	58.9	67.2	94.7	84.1

Migration rates for scenario 'ASMigR4' – extract

The age-specific migration rates (per 1,000 population) for scenario 'ASMigR4', using
- sex/age of migrant,
- total migrants to/from ward,
- total population

for the 5-year period 1 July 2002 to 30 June 2007, are as follows:

In-migration (males)

Data

Age specific migration rates (per 1,000 population)

Population Group ……..

Sex	Age	*Standard*	*BuckMeth*	*BurntKin*	*Cowdenb*	*Cupar*	*DunfCen*
male	Newborn	88.0	67.5	97.6	61.0	96.0	103.4
male	0	144.5	32.2	51.6	25.2	56.9	45.4
male	1	126.6	90.7	129.1	83.0	167.0	154.3
male	2	111.1	76.3	104.8	70.5	156.2	121.2
male	3	101.4	69.6	82.5	76.9	129.9	105.5
male	4	91.8	63.7	87.3	73.2	97.7	88.5
male	5	87.5	59.6	80.8	80.4	78.3	76.1
male	6	83.6	57.3	82.8	59.8	72.8	71.3
male	7	79.9	60.6	70.3	56.7	69.9	60.2
male	8	75.4	55.7	75.8	47.5	63.2	63.9
male	9	71.9	45.3	67.2	48.2	67.6	61.8
male	10	68.1	41.4	72.2	42.0	61.5	67.5
male	11	66.2	42.9	77.5	32.4	57.8	65.0
male	12	63.6	42.6	76.4	31.5	44.2	55.2
male	13	62.6	45.8	70.8	30.7	42.2	54.7
male	14	54.6	46.4	55.6	33.6	46.6	47.5
male	15	58.8	53.3	57.2	33.3	58.5	54.3
male	16	69.4	54.4	66.1	38.2	81.6	58.3
male	17	113.0	73.9	100.9	54.4	126.9	92.2
male	18	177.5	86.7	114.5	62.4	146.4	105.6
male	19	203.2	107.6	127.7	74.7	160.6	121.6
male	20	205.0	115.0	123.8	76.0	150.1	123.9
male	21	212.6	125.2	136.9	99.9	158.2	143.2
male	22	212.6	126.8	154.4	106.6	146.5	157.6
male	23	203.0	118.6	171.1	113.3	152.1	147.9
male	24	194.8	121.9	168.9	108.6	172.7	174.5
male	25	186.6	142.3	165.9	103.2	180.4	149.2
male	26	175.6	113.7	163.5	102.0	179.4	186.9
male	27	162.1	107.0	161.5	93.0	149.8	173.2
male	28	150.6	99.6	159.9	88.1	166.5	190.0
male	29	138.6	102.2	152.3	96.0	150.5	152.3
male	30	146.8	105.2	160.2	100.5	139.5	189.9

Annex E - Data zone apportionment

Example – Glenrothes West and Kinglassie

Data zone	Multi member ward	Weight [1]
S01002814	Glenrothes West and Kinglassie	0.111
S01002827	Glenrothes West and Kinglassie	1
S01002828	Glenrothes West and Kinglassie	1
S01002831	Glenrothes West and Kinglassie	0.963
S01002832	Glenrothes West and Kinglassie	1
S01002833	Glenrothes West and Kinglassie	1
S01002836	Glenrothes West and Kinglassie	0.966
S01002840	Glenrothes West and Kinglassie	0.104
S01002841	Glenrothes West and Kinglassie	1
S01002844	Glenrothes West and Kinglassie	0.228
S01002849	Glenrothes West and Kinglassie	0.173
S01002860	Glenrothes West and Kinglassie	1
S01002861	Glenrothes West and Kinglassie	1
S01002862	Glenrothes West and Kinglassie	1
S01002866	Glenrothes West and Kinglassie	0.012
S01002867	Glenrothes West and Kinglassie	0.674
S01002869	Glenrothes West and Kinglassie	1
S01002870	Glenrothes West and Kinglassie	0.017
S01002873	Glenrothes West and Kinglassie	1
S01002874	Glenrothes West and Kinglassie	1
S01002875	Glenrothes West and Kinglassie	1
S01002876	Glenrothes West and Kinglassie	0.229
S01002877	Glenrothes West and Kinglassie	1
S01002878	Glenrothes West and Kinglassie	0.952
S01002879	Glenrothes West and Kinglassie	1
S01002884	Glenrothes West and Kinglassie	1
S01002889	Glenrothes West and Kinglassie	1
S01002890	Glenrothes West and Kinglassie	1
S01002891	Glenrothes West and Kinglassie	1
S01002896	Glenrothes West and Kinglassie	1
S01002900	Glenrothes West and Kinglassie	0.928

1. Figures shown here have been rounded.
Source: Fife Council

Annex F - Average net migration

This table shows the net annual migration, averaged from mid-2003 to mid-2007 for Fife and selected wards, by sex and age groups.

Sex	Age at start of year	Fife	Cupar	DunfCen	DunfNor	DunfSou	StAndrew	WestFife
Total persons		2,099	157	71	53	461	322	-40
F	_nb-0	30	3	1	-4	3	3	0
	01-04	59	5	2	-7	6	5	-1
	05-09	46	-2	5	-1	18	11	-8
	10-14	30	6	7	6	6	8	-8
	15-19	365	-10	-10	6	2	568	-25
	20-24	-219	13	13	14	32	-379	-13
	25-29	120	5	4	-3	50	-73	-1
	30-34	163	22	14	-6	36	7	9
	35-39	81	7	7	0	32	8	-4
	40-44	60	5	2	1	5	10	2
	45-49	59	-4	-4	1	11	4	1
	50-54	47	0	-6	5	8	0	2
	55-59	84	5	-2	3	12	7	1
	60-64	64	5	1	5	2	2	-2
	65-69	12	5	0	-1	2	3	-5
	70-74	-15	-1	-4	4	-2	-4	1
	75-79	20	5	0	5	-3	-1	1
	80-84	26	7	1	6	-3	-1	1
	85+	41	11	1	10	-3	-2	2
F Total		1,071	87	32	42	217	175	-46
M	_nb-0	45	5	3	-3	11	3	2
	01-04	85	9	6	-5	21	5	4
	05-09	46	4	-5	2	16	7	4
	10-14	31	-1	14	-3	15	7	-1
	15-19	317	-7	-17	-1	4	448	-14
	20-24	-146	-9	18	7	11	-240	-3
	25-29	70	13	8	2	43	-81	0
	30-34	129	17	13	-4	36	-9	3
	35-39	110	15	4	-13	39	4	4
	40-44	51	4	1	-3	16	1	5
	45-49	50	0	-6	8	14	3	-1
	50-54	47	-1	4	1	6	6	4
	55-59	50	2	-6	5	8	0	1
	60-64	59	3	1	0	1	5	1
	65-69	19	6	-1	1	0	-4	-3
	70-74	-1	-2	-2	1	1	-4	0
	75-79	23	5	1	4	1	-1	-1
	80-84	23	4	1	5	1	-1	-1
	85+	20	4	1	5	0	-2	-1
M Total		1,028	70	39	11	244	147	5