

Statistical Bulletin

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2011 Census: First Results on Population Estimates for Scotland - Release 1A

Contents

1. Introduction	2
2. Main points	2
3. Why do we need a census?	3
4. Taking the 2011 Census	3
5. 2011 Census Day population estimates	5
6. Population change over time	6
6.1 Long-term trends	6
6.2 The last 100 years	7
6.3 Trends in dependency and sex ratios	12
7. Population density	14
8. Scotland's population in an international context	16
Background Notes	19
Further results	22
Appendix 1 How the 2011 Census population estimates were obtained	24
Appendix 2 Quality Assurance Process	26
Appendix 3 2011 Census Day Population Estimates	28
Appendix 4 Relative Confidence Intervals of 2011 Census population estimates	30
Appendix 5 2011 Census - Person Response Rates	33

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1. Introduction

This bulletin presents the first results from the 2011 Census in Scotland, which was held on 27 March 2011. The statistics provide estimates (rounded to the nearest thousand) of the usually resident population of Scotland on Census Day, broken down by five-year age bands and sex, together with estimates of the total usually resident population in each council area.

Other topics covered include population density, changes in the size and profile of Scotland's population over time and comparisons with other parts of the UK and EU countries.

2. Main points

- The population of Scotland on Census Day in 2011 was estimated to be 5,295,000 – the highest ever.
- There were 2,567,000 men and 2,728,000 women.
- The population per square kilometre ranged from 9 in Eilean Siar and Highland to 3,395 in Glasgow City.

Comparisons with 10 years ago

- Since the 2001 Census, the population has increased by 233,000 (5 per cent). This represents the fastest growth rate between two census years in the last century.
- In 2011 there were 293,000 children aged under 5, an increase of 6 per cent from 2001.
- The number of children aged 5 to 14 saw a decrease of 69,000 (11 per cent) in the last 10 years.
- The number of people aged 65 and over increased by 85,000 (11 per cent) since 2001 and now represents 17 per cent of the population.
- There were 230,000 people aged 80 and over in 2011 compared with 193,000 in 2001 (which is an increase of 19 per cent).
- Compared with 2001, the population aged 15 to 64 has increased by 200,000 (6 per cent). Within this total the population aged 15 to 39 decreased by 32,000 (2 per cent), whilst the population amongst older working ages (40 to 64) increased by 233,000 (14 per cent).

Comparisons with 100 years ago

- Scotland's population in 2011 was just over half a million (11 per cent) higher than in 1911.
- Scotland's population has become older over the last 100 years: the proportion aged under 15 has fallen from 32 per cent to 16 per cent, while the proportion aged 65 and over has increased from 5 per cent to 17 per cent.
- The 2011 Census was the first ever where the number of people aged 65 and over was higher than the number aged under 15.

3. Why do we need a census?

The census has collected information about the population every 10 years since 1801 (except in 1941 when no census was taken due to the Second World War). It is widely acknowledged as playing a fundamental and unique role in the provision of comprehensive and robust population statistics. Census information is needed to help government develop policies and initiatives, and for local authorities to plan services and to make effective use of resources that benefit the people of Scotland.

Key users of census information include both central and local government, academia, organisations undertaking research, the private, business and voluntary sectors and the general public.

Detailed statistics from the census describe the characteristics of an area, such as how many men and women there are and their ages, ethnic group, education level and a broad range of other characteristics. The statistics are used to understand the increasingly diverse nature of Scotland's population by capturing the similarities and differences in the populations' characteristics locally and nationally. This information underpins the allocation of billions of pounds of public money each year to provide services like education, transport and health.

Decisions are taken every day using census statistics. For example, the numbers of school spaces, houses, care homes, hospitals and fire services are all influenced by the census.

4. Taking the 2011 Census

The latest census in Scotland took place on 27 March 2011. Approximately 2.5 million census questionnaires were delivered to households and communal establishments (e.g. university halls of residence, prisons and care homes).

Just under 95 per cent of households had their questionnaire hand-delivered by a field force of over 6,000 census takers, with the remainder (mainly in the more rural, remote areas) receiving their questionnaire by post.

Households had the option to complete their census online (around 20 per cent chose this option), or to complete and post back a paper questionnaire. Households completing online could do so in either English or Gaelic. Information to help households understand and complete their questionnaire was provided online and through a census helpline.

Although a high return rate (95 per cent) from the public was achieved during the census, inevitably some people were missed. The issue of missing people in a census is one that affects censuses internationally. A Census Coverage Survey (CCS) was carried out to help estimate the number of people missed by the census and, based on this and rigorous estimation methods, the National Records of Scotland (NRS) is now confident that the census population estimates for all areas represent 100 per cent of people usually resident there.

The Office for National Statistics (ONS) commissioned an independent peer review of the underlying estimation methods. That review concluded that 'the further procedures for [Quality Assurance \(QA\) and adjustment](#) significantly strengthen ONS's strategy for successful population estimation'. NRS used methods and processes consistent with those applied by the other UK census offices to address this. An overview of these is included at Appendix 1.

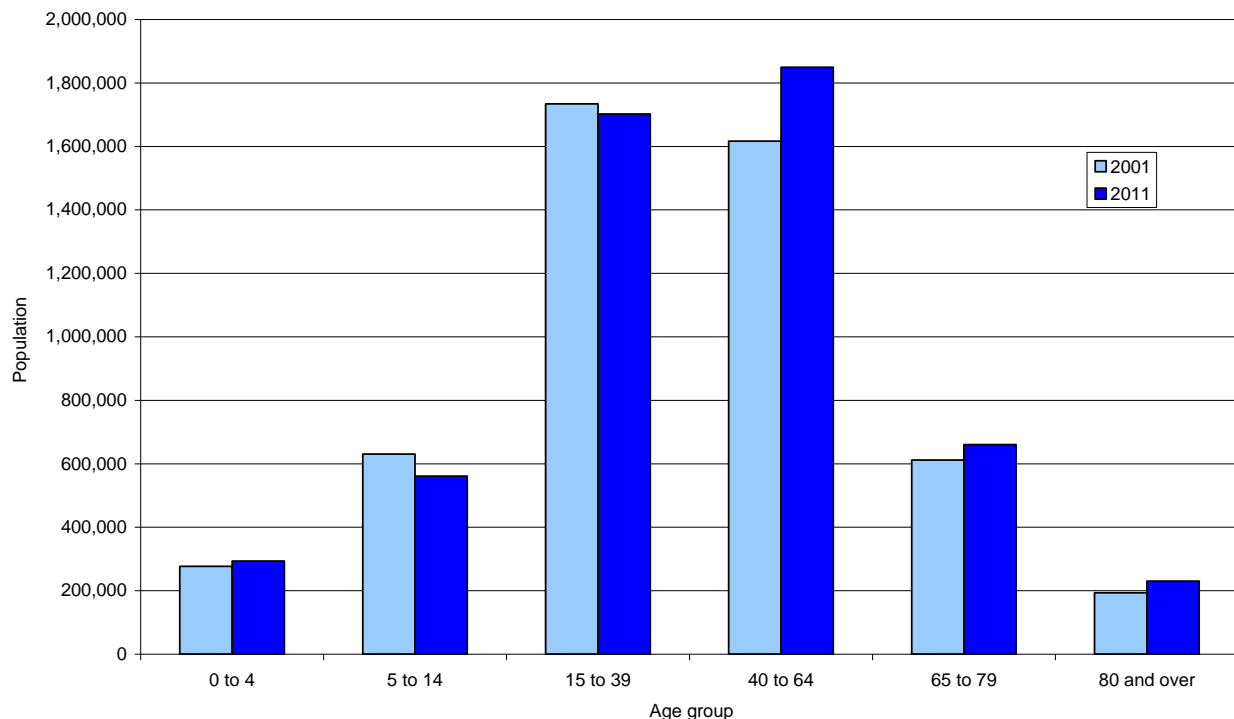
The 2011 Census achieved an overall response rate of 94 per cent of the usually resident population of Scotland. The population estimate for Scotland of 5.3 million is estimated with 95 per cent confidence to be accurate to within +/- 23,000 (0.44 per cent). Further information on response rates and associated confidence intervals is included at Appendices 4 and 5.

All census estimates have been quality assured extensively, using other national and local sources of information for comparison. The estimates have also been reviewed by a series of quality assurance panels which gives confidence that the 2011 Census provides a high quality estimate of Scotland's population. An overview of the quality assurance process is included at Appendix 2.

A range of quality assurance, evaluation and methodology reports, including quality assurance packs on the census population and household estimates for each council area in Scotland, will be published with later releases of census results.

5. 2011 Census Day population estimates

Figure 1 Census Day population estimates by age, 2001 and 2011



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The usually resident population of Scotland on Census Day (27 March 2011) was 5,295,000, comprising 2,567,000 (48 per cent) males and 2,728,000 (52 per cent) females. This represented an increase of 233,000 people (5 per cent) compared with the previous census in 2001.

The 854,000 children in Scotland aged under 15 accounted for 16 per cent of the population, whereas those aged 65 and over (890,000 people) accounted for 17 per cent. The remaining 67 per cent of the population (3,550,000 people) were aged between 15 and 64.

Over the past ten years the trend towards relatively more people in older groups and fewer people in younger age groups has generally continued. Figure 1 shows that since 2001, the number of children aged under 15 declined from 907,000 to 854,000 (a decrease of 6 per cent), when the population as a whole increased by 5 per cent. However, while the number of children aged 5 to 14 declined by 11 per cent since 2001, the number of pre-school children (aged under 5) increased by 6 per cent (from 277,000 to 293,000).

The population aged 15 to 64 increased by 200,000 (6 per cent) between 2001 and 2011. However as Figure 1 also shows, the number of people aged 15 to 39 decreased from 1,734,000 to 1,702,800 – a decrease of 2 per cent. In contrast, the number of people aged 40 to 64 increased by 14 per cent, from 1,616,000 to 1,849,000.

The population aged 65 and over increased by 85,000 (11 per cent). Within this group, the number of people aged 65 to 79 increased by 8 per cent and those aged 80 and over by 19 per cent.

The Census Day population in the United Kingdom was 63.2 million. Of this, 84 per cent were resident in England, 8 per cent in Scotland, 5 per cent in Wales and 3 per cent in Northern Ireland. Further information on the UK-wide census results can be found on the [UK census website](#).

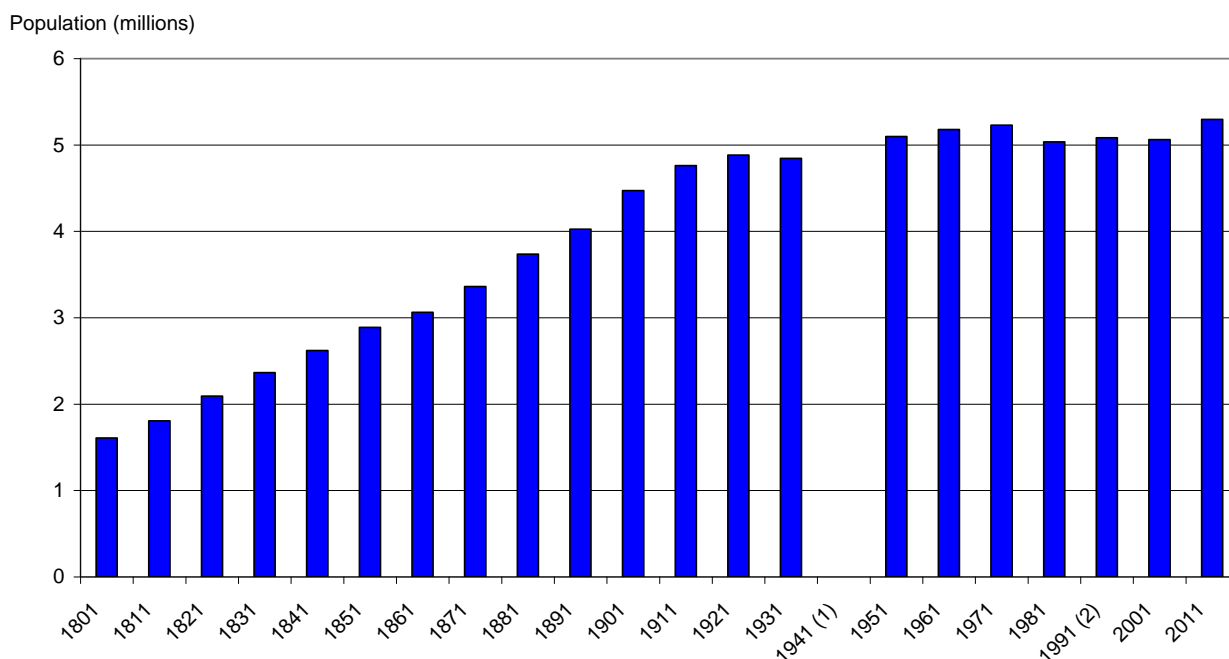
Information on the census in England & Wales can be found on the [Office for National Statistics \(ONS\) website](#).

Information on the census in Northern Ireland can be found on the [Northern Ireland Statistics and Research Agency \(NISRA\) website](#).

6. Population change over time

6.1 Long-term trends

Figure 2 Census Day population estimates, 1801 – 2011 ^{1,2}



1) No census was undertaken in 1941 due to the Second World War.

2) Mid-year population estimate for 1991; see background note 10.

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The 2011 Census Day population of 5,295,000 was the highest ever in Scotland. From an estimated 1.6 million in 1801, the population increased at a steady rate throughout the 19th

and early 20th centuries, reaching 4.9 million in 1921. A dip in the population was recorded in the 1931 Census, in part reflecting the impact of the First World War, the 1918-19 influenza epidemic and net out-migration. Thereafter the population generally increased, reaching 5.2 million in 1971 before dropping to just over 5.0 million in 1981. Since then the total population has risen again and has now overtaken the previous peak estimate of 5.24 million in 1974. The drivers for this latest period of population increase are attributed to natural growth (more births than deaths in the most recent years) and net in-migration.

6.2 The last 100 years

Table 1 Census Day population estimates, 1911 - 2011

Census Year	All persons ¹	Change between census	
		Period	Per cent ²
1911	4,761,000	-	-
1921	4,882,000	1911-1921	0.25
1931	4,843,000	1921-1931	-0.08
1941 ³	-	-	-
1951	5,096,000	1931-1951	0.26
1961	5,179,000	1951-1961	0.16
1971	5,229,000	1961-1971	0.10
1981	5,035,000	1971-1981	-0.38
1991 ⁴	5,083,000	1981-1991	0.09
2001	5,062,000	1991-2001	-0.04
2011	5,295,000	2001-2011	0.45

Footnotes

- 1) Figures rounded to the nearest thousand.
- 2) Percentage growth or decrease between censuses expressed as an annual rate over the period.
- 3) No census was undertaken in 1941 due to the Second World War.
- 4) Mid-year population estimate; see background note 10.

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The population of Scotland increased by 11 per cent between 1911 (4,761,000 people) and 2011 (5,295,000 people) – an increase of just over half a million people.

As shown in Table 1, the rate of increase in the size of the population was fairly stable up to the early 1970s before declining slightly in the last few decades of the 20th century. Since the 2001 Census, the population has increased by 233,000 (5 per cent). This represents the fastest growth in population between two census years in the last century.

Despite the overall growth in the total population in the last 100 years, the 2011 Census confirmed the pronounced change that has taken place in the age structure of Scotland's population. The number of children in Scotland has generally fallen since 1911. The census in that year recorded 1,537,000 children aged under 15 (32 per cent of the population). Apart from increases in the 1961 and 1971 Censuses, mainly reflecting the impact of the baby boom years of the 1960s, the number of children in this age group generally fell, reaching a low of 854,000 in 2011, 16 per cent of the population.

In contrast, the number of people aged 65 and over has more than trebled in the last 100 years, rising from 257,000 in 1911 to 890,000 in 2011 – an increase of 246 per cent. They

accounted for 17 per cent of the total population in 2011 compared with just 5 per cent in 1911. There were nearly eight times as many people aged 80 and over in 2011 (230,000, 4 per cent of the population) than were recorded in 1911 (30,000, 0.6 per cent of the population).

The number of people aged 15 to 64 has increased by 20 per cent, from 2,966,000 in 1911 to 3,550,000 in 2011. Within that group, the number of people aged 15-39 (i.e. mainly young working-age adults) fell during the first half of the 20th century, from a high of 1,948,000 in 1911 (when they represented 41 per cent of the population) to a low of 1,701,000 in 1971 (33 per cent of the population). Some upturn in their numbers was recorded in the next two censuses as the baby boomers from the 1960s became young adults, and they accounted for 37 per cent of the population in 1991. However, by 2011 the number of people aged 15 to 39 had dropped again to 1,702,000 (32 per cent of the population).

The number of older working-age adults (i.e. those aged 40 to 64) increased by 82 per cent over the past 100 years, from 1,018,000 in 1911 to 1,849,000 in 2011. This age group represented 21 per cent of the population in 1911, but accounted for over a third (35 per cent) in 2011. This growth has been marked over the last 30 years, with an increase of 32 per cent on the 1981 estimate of 1,404,000.

Table 2 Census Day population estimates by age, 1911-2011

Census Year	0 to 14	15 to 39	40 to 64	65 to 79	80 and over	All ages
Number (thousands) ¹:						
1911	1,537	1,948	1,018	228	30	4,761
1921	1,440	1,945	1,205	257	35	4,882
1931	1,305	1,916	1,269	315	38	4,843
1941 ²	-	-	-	-	-	-
1951	1,255	1,820	1,513	441	66	5,096
1961	1,339	1,714	1,577	464	85	5,179
1971	1,355	1,701	1,529	542	103	5,229
1981	1,078	1,842	1,404	587	124	5,035
1991 ³	958	1,881	1,474	597	174	5,083
2001	907	1,734	1,616	612	193	5,062
2011	854	1,702	1,849	660	230	5,295
% of total:						
1911	32	41	21	5	1	100
1921	29	40	25	5	1	100
1931	27	40	26	7	1	100
1941 ²	-	-	-	-	-	-
1951	25	36	30	9	1	100
1961	26	33	30	9	2	100
1971	26	33	29	10	2	100
1981	21	37	28	12	2	100
1991 ³	19	37	29	12	3	100
2001	18	34	32	12	4	100
2011	16	32	35	12	4	100

Footnotes

1) Figures rounded to the nearest thousand.

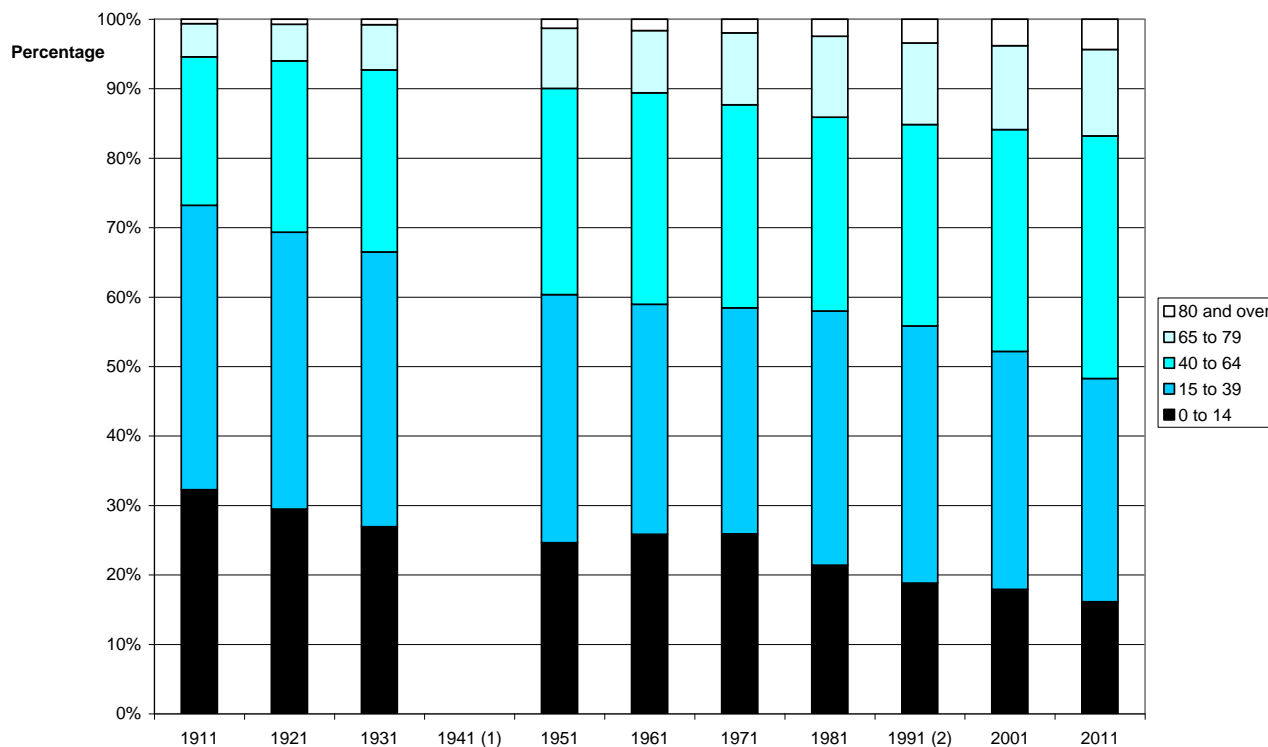
2) No census was undertaken in 1941 due to the Second World War.

3) Mid-year population estimate; see background note 10.

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Figure 3 illustrates how the age structure of the population has changed between census years since 1911.

Figure 3 Census Day population estimates: proportions by age, 1911 – 2011



1) No census was undertaken in 1941 due to the Second World War.

2) Mid-year population estimate for 1991; see background note 10.

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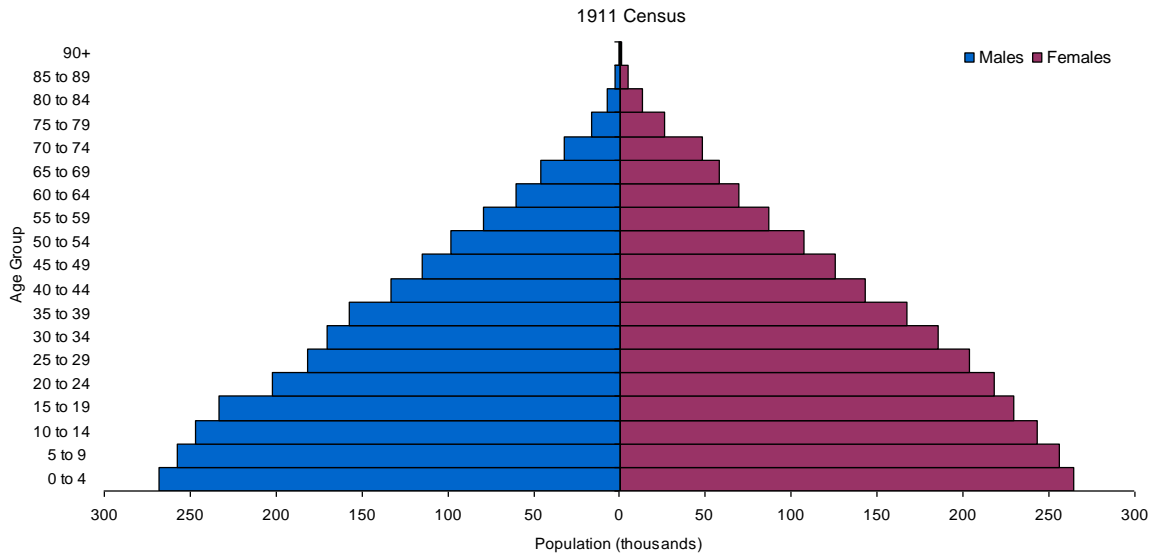
The population charts in Figures 4a and 4b provide another illustration of how the age structure of Scotland's population has changed between 1911 and 2011.

In 1911, the population chart was shaped like a pyramid, with a wide base (proportionately large numbers of very young children) that narrowed with increasing age, and proportionately very small numbers of elderly people. The almost continuous narrowing of the 1911 pyramid at all ages reflects high age-specific mortality rates that applied even in childhood at that time.

The 2011 population chart has a very different shape. The narrowing with increasing age, largely as a result of mortality, only starts to become apparent from age 60 onwards. Up to the age of 60, there are broadly similar numbers at each age band, with variations driven by historic fertility and migration trends. For example, the larger numbers in the 0 to 4 age groups than the 5 to 9 and 10 to 14 age groups reflect the recent increase in fertility seen in the last decade after a period of reducing fertility. The 1960s 'baby boom' (a period of high fertility in the 1960s) is still visible on the chart (people now in their forties). The charts

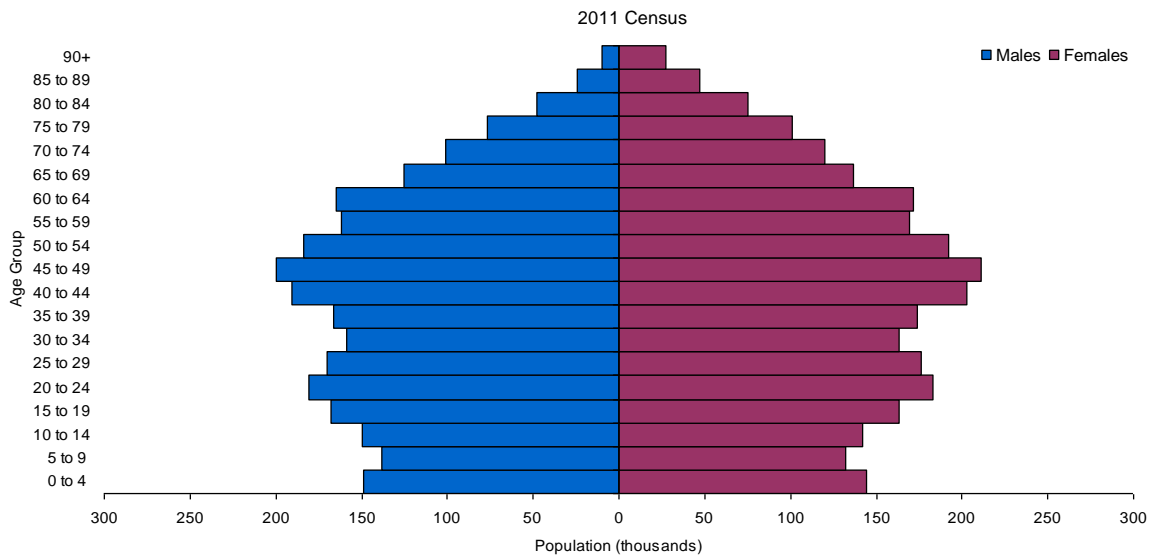
also show differences in gender, as women tend to live longer than men. A full series of [population charts](#) for every census year since 1911 is available.

Figure 4a Census Day population estimates by age and sex, 1911



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Figure 4b Census Day population estimates by age ¹ and sex, 2011

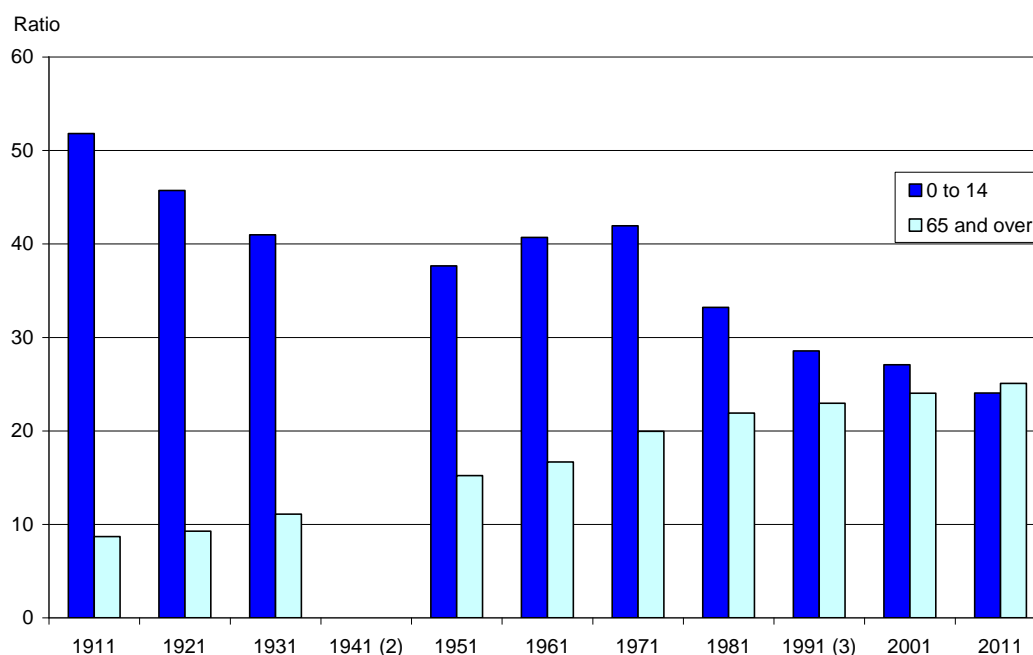


1) For the purposes of this figure, a split of the Census Day population estimate for persons aged 80 and over into 80 to 84, 85 to 89 and 90 and over age groups has been derived on the basis of the current (2001 Census-based) mid-year population estimates for 2011.

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6.3 Trends in dependency and sex ratios

Figure 5 Dependency ratios ¹, 1911-2011



- 1) The number of children aged under 15 and people aged 65 and over per 100 people aged 15 to 64.
- 2) No census was undertaken in 1941 due to the Second World War.
- 3) Mid-year population estimate for 1991; see background note 10.

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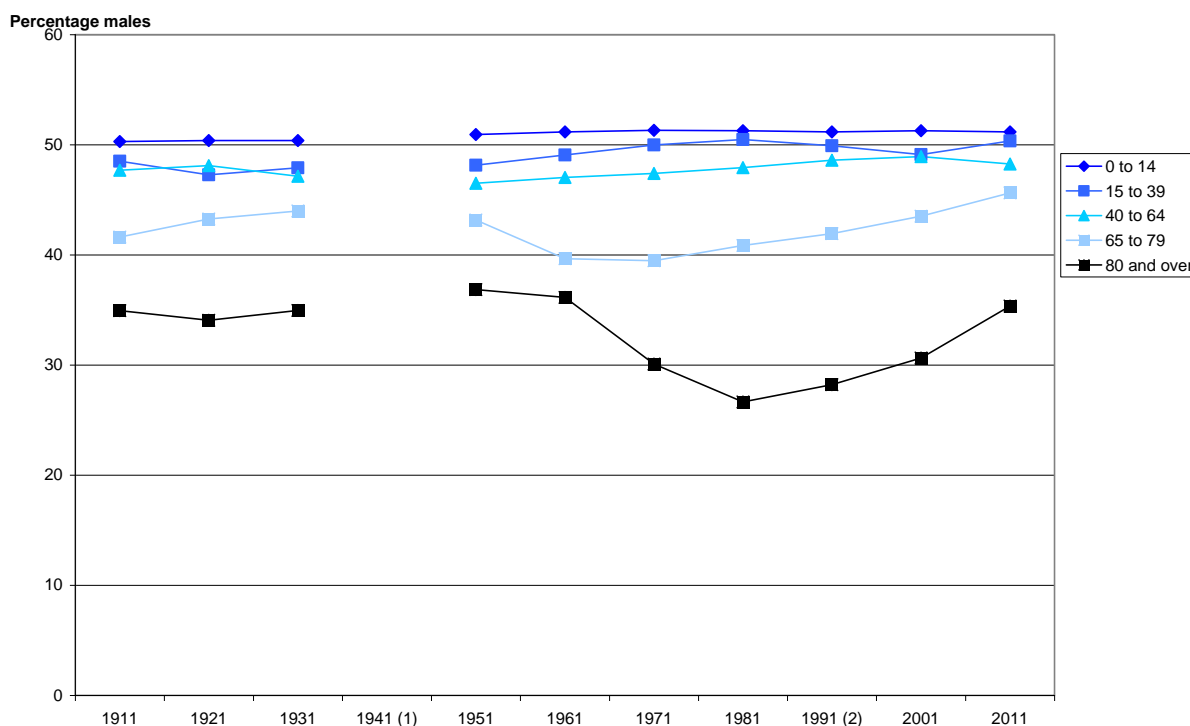
Figure 5 shows trends over the last 100 years in two population ‘dependency’ ratios. The first ratio is the number of children aged under 15 expressed as a percentage of the number of people aged 15 to 64 (i.e. mainly those of working age). The second ratio is the number of people aged 65 or more expressed as a percentage of the number of people aged 15 to 64.

These percentages can be re-stated as the number of children or older people per 100 people aged 15 to 64. In a simple way, given that most children and older people are economically inactive, these percentages could be interpreted as the number of children or older people who are ‘dependent’ on people aged 15 to 64. The reality is of course much more complex, since – to give just a few reasons - many people of working age are unemployed or economically inactive (e.g. at school or university), the age at which people retire varies greatly and many retired people are financially independent. However, these ‘dependency’ ratios are an informative way of examining the population figures.

Figure 5 shows that in the earlier part of the century most dependants were children whereas in the later part of the century the picture had changed to more older dependants than children. The children (aged under 15) ‘dependency’ ratio has fallen from 52 children per 100 people aged 15 to 64 (1911) to 24 children (2011), with the decline most marked in the last 40 years, since 1971. Conversely the number of people aged 65 and over for

every 100 people aged 15 to 64 has risen from 9 (1911) to 25 (2011) with continuous growth in this ratio over the period.

Figure 6 Census Day population estimates: percentage males by age, 1911-2011



1) No census was undertaken in 1941 due to the Second World War.

2) Mid-year population estimate for 1991; see background note 10.

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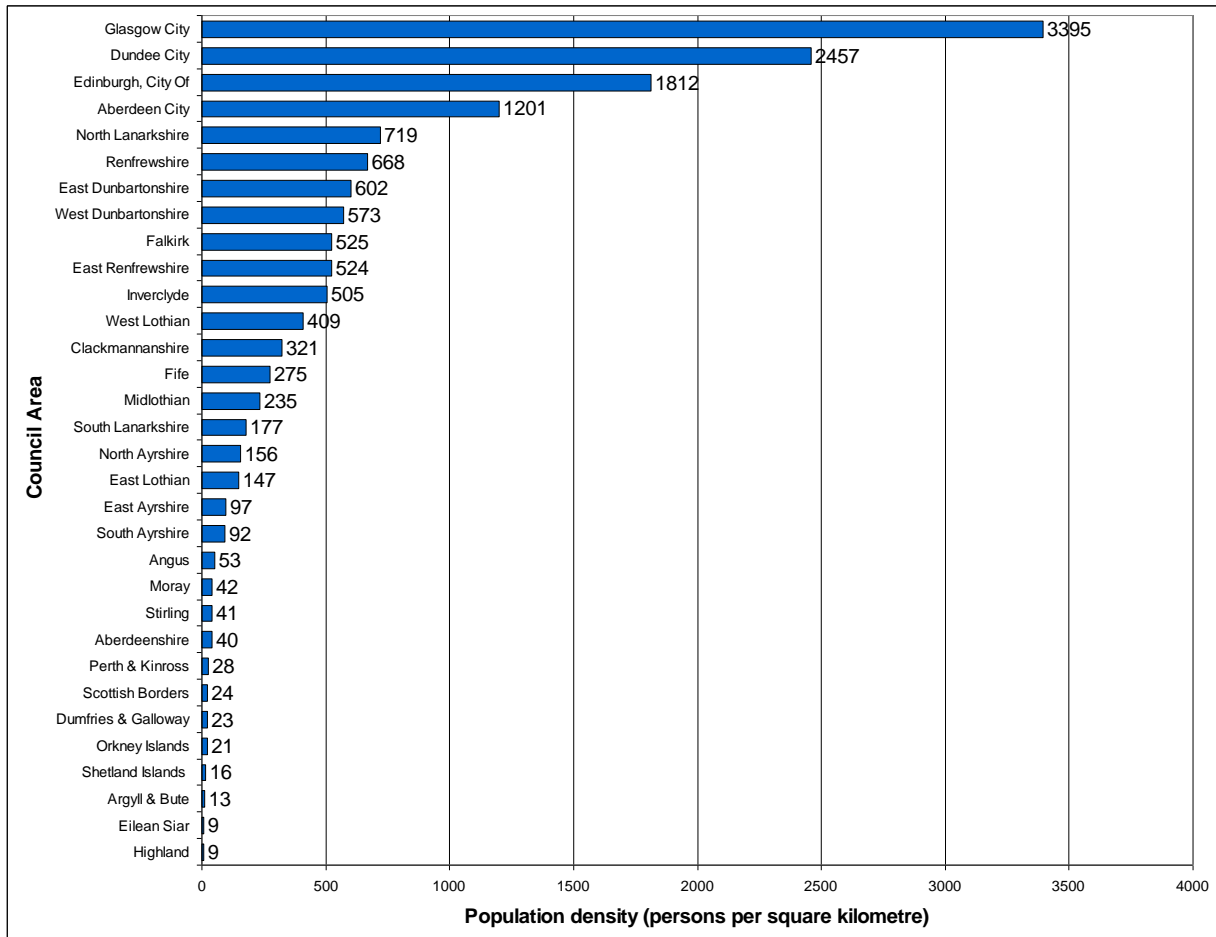
Generally speaking, slightly more boys are born than girls. This is reflected in the proportion of males in the under 15 age group being just over 50 per cent. The proportion of males then declines gradually with increasing age. However, for all age groups the proportion of males was higher in 2011 compared with 1911.

Amongst older people, particularly those aged 80 and over, the lower proportion of males reflects the fact that women tend to live longer than men, partly as a result of higher male mortality during the World Wars. In 2011, just over a third (35 per cent) of people aged 80 and over were male. The dip recorded in this proportion in the censuses of 1971 and 1981, and its subsequent recovery in later censuses, will in part reflect the passing of the generation who fought in the First World War. (A similar effect can also be seen with the dip for the 65 to 79 age group recorded in the censuses of 1961 and 1971).

7. Population density

Figures 7a and 7b provide information on land areas and population densities. The former shows that population density ranges from 9 persons per square kilometre in Eilean Siar and Highland to 3,395 persons per square kilometre in Glasgow City.

Figure 7a Population density by council area, 2011

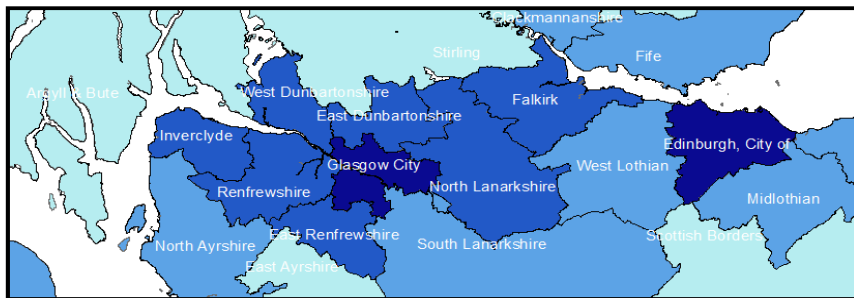
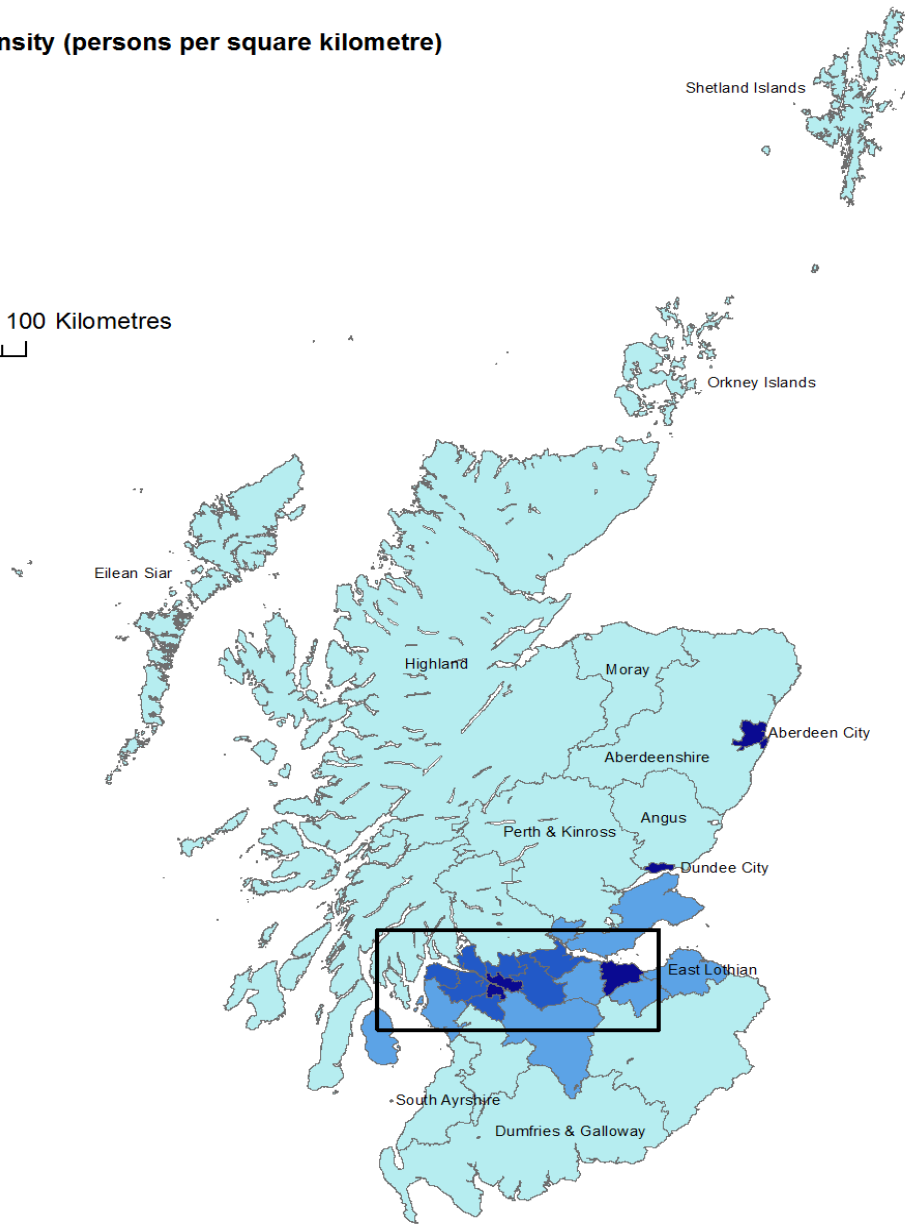
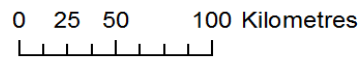
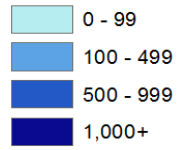


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Figure 7b Population density by council area, 2011

Scotland

Population density (persons per square kilometre)



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8. Scotland's population in an international context

This section places the structure of Scotland's population in an international context, using 2011 Census data for the UK and the latest available data for other European Union (EU) countries from Eurostat (the statistical office of the EU).

Considering the EU as a whole, Table 3 shows that the age profile of Scotland's population is broadly similar to most EU countries. Figure 8 shows that, at 68 persons per square kilometre, the population density of Scotland is among the lowest of the EU countries. It is similar to Ireland and Bulgaria, with only the Baltic and Scandinavian countries having lower population densities.

Table 3 Population age structure in Scotland compared with rest of UK and EU countries

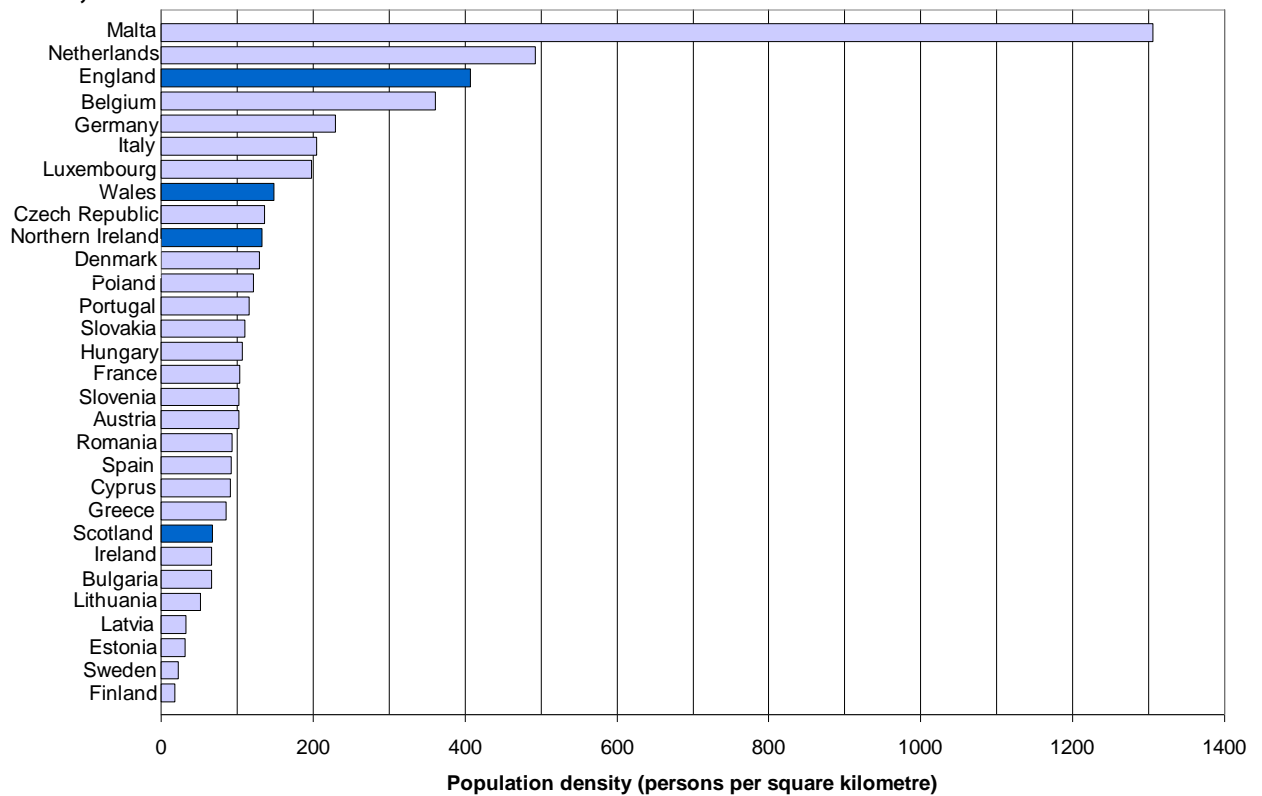
Country	Percentage population aged:		
	0 to 14	15 to 64	65 and over
Austria	15	68	18
Belgium	17	66	17
Bulgaria	13	68	19
Cyprus	17	71	13
Czech Republic ¹	15	70	16
Denmark	18	65	17
England ²	18	66	16
Estonia	15	68	17
Finland	17	66	18
France ¹	19	65	17
Germany	13	66	21
Greece	14	66	19
Hungary	15	69	17
Ireland ¹	21	67	12
Italy	14	66	20
Latvia	14	67	18
Lithuania	15	67	18
Luxembourg	18	69	14
Malta ¹	15	69	16
Netherlands	18	67	16
Northern Ireland ²	20	66	15
Poland	15	71	14
Portugal ¹	15	66	19
Romania ¹	15	70	15
Scotland ²	16	67	17
Slovakia	15	72	13
Slovenia	14	69	17
Spain	15	68	17
Sweden	17	65	19
Wales ²	17	65	18

Footnotes

1) Provisional.

2) 2011 Census data

Source: National Records of Scotland, Northern Ireland Statistics and Research Agency, Office for National Statistics, Eurostat (online data code *demo_pjanind*)Download this as [Excel](#), [csv](#), [PDF](#)

Figure 8 Population densities, EU27 countries, Scotland, England, Wales, Northern Ireland, 2011

Source: National Records of Scotland, Northern Ireland Statistics and Research Agency, Office for National Statistics, Eurostat

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Background Notes

1. The National Records of Scotland¹ (NRS) is responsible for carrying out the 2011 Census in Scotland. Simultaneous but separate censuses took place in England & Wales and Northern Ireland. These were run by the Office for National Statistics (ONS) and the Northern Ireland Statistics and Research Agency (NISRA) respectively.
2. The census provides estimates of the characteristics of all people and households in Scotland on Census Day, 27 March 2011.
3. In Scotland, the aim of the 2011 Census was to achieve a full census return for all people who were usually resident in Scotland for six months or more. A full census return was therefore required for people from outside the UK who had stayed or intended to stay in the UK for a total of six months or more. Anyone with a permanent UK address who was outside the UK on Census Day if they intended to be outside the UK for less than 12 months was also to be included in the census questionnaire for their UK address. This is defined as the **population base for enumeration**. The **main outputs population base** for the 2011 Census statistics is defined to be usual residents of the UK, that is anyone who, on Census Day, was in the UK and had stayed or intended to stay in the UK for a period of 12 months or more, or had a permanent UK address and was outside the UK and intended to be outside the UK for less than 12 months. (NRS made no specific adjustment for the presence of 6-12 months migrants among the persons counted in the census – [link for further details](#).)
4. The coverage of the population in an area is those who are usually resident there. A person's place of usual residence is in most cases the address at which they stay the majority of the time. For many people this will be their permanent or family home. Students are treated as being resident at their term-time address. If a member of the armed forces did not have a permanent or family address at which they are usually resident, they were recorded as usually resident at their base address.
5. As in 2001, adjustments for census under-enumeration were built into the census process and as such the 2011 Census statistics represent the full population. Similar adjustments were not made in the censuses prior to 2001. Figures for censuses up to and including 1971 are based on persons present on Census Day; figures for the 1981 and 1991 census are based on usual residents (but see background note 10 in relation to 1991).
6. The numbers presented in this bulletin may not sum to totals or sub-totals as all figures have been rounded independently to the nearest thousand. Similarly, percentages have generally been rounded to the nearest whole number to ease readability. The data from the 2011 Census have yet to be subjected to further processes to ensure respondent confidentiality in future releases. Any changes introduced by these processes are likely to be small and within the limits of the rounding that has been applied.

Age

7. Census population estimates by age relate to a person's age in years on their last birthday up to and including Census Day, 27 March 2011.

Land area

8. The land areas used to calculate the population density information presented in Figures 7a and 7b were Standard Area Measurements as supplied by Ordnance Survey. These area measurements (square kilometres) are taken to mean high water and exclude inland water.

Glossary

9. All key terms used in this publication, such as usual residents, are explained in the [2011 Census Glossary](#).

Mid-Year Population Estimates

10. The mid-year estimates are an annual series of population estimates. They are on a consistent basis and, accordingly, population change over time should be measured through the mid-year estimates. Up to 1971, the census statistics are the mid-year estimates for the relevant census years. In recent years, it has become acknowledged that the census may not include every person and hence subsequent mid-year estimates, while based on the census, have incorporated adjustments to the census. Thus, in particular, the mid-year estimates for 1991 differ from the census statistics to allow for estimated census under-enumeration. In 1991, this amounted to an estimated 85,000 people. Accordingly, the information presented in this bulletin for 1991 are the mid-year estimates rather than the census estimates.

11. NRS publishes annual mid-year population estimates for the population at 30 June each year. The unrounded 2011 Census population estimates to be published in Release 1C will be used to rebase the 2011 mid-year population estimates. These are scheduled for release in June/July 2013. Following this, the mid-year population estimates for 2002-2010 will also be re-based using the 2011 Census; the re-based mid-year population estimates will be published in October/ November 2013. Reports explaining the difference between the 2011 Census based population estimates and the rolled-forward mid-year population estimates based on the 2001 Census will be published along with these releases.

12. When the rebased mid-year estimates for 2011 become available, it will be recommended that population change between 2001 and 2011 is addressed through the mid-year estimates. In the interim, the adjustments made to the 2001 and 2011 Censuses for under-enumeration, mean that population changes in the range of population characteristics as recorded in the census can be examined through comparison of the 2001 and 2011 Censuses.

Designation as National Statistics

13. The United Kingdom Statistics Authority has designated these statistics as National Statistics. This means they are produced to the high professional standards set out in the Code of Practice for Official Statistics. They are produced free from any political interference.

Protecting personal census information

14. Personal census information is kept confidential by NRS, and is protected by law. Census records are not released for 100 years.

15. The census results are provided in aggregate format; no attributes of individuals can be identified from the information published.

16. Information on the measures taken to protect the confidentiality of personal census information is published on the [Scotland's Census website](#).

Further results

17. This bulletin represents the initial phase of the First Release of Scotland's 2011 Census statistics. More information from Scotland's Census will be released in stages over the next year. The [2011 outputs prospectus](#) describes this in more detail, including when results for lower levels of geography will be available. Release 1B is scheduled for March 2013, and will provide rounded population estimates (by five-year age band and sex) and household estimates for each council area. Release 1C, scheduled for May 2013, will provide unrounded figures of the population estimates by single year of age and sex, for Scotland and for each council area.

18. Statistics for the whole of the UK from the 2011 Census will be compiled and published on the relevant area in the [UK census website](#).

19. A range of supporting information to accompany the results presented in this bulletin is available online. This includes:

- 2011 Census definitions and glossary
- Population charts – 1911 to 2011 (visualisation)
- Mapping profile tool (visualisation)
- Frequently asked Questions (FAQs)

20. Please contact our Customer Services if you need any further information.

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If you have comments or suggestions that would help us improve our outputs or our standards of service, please contact:

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The bulletin is also available on our website at <http://www.scotlandscensus.gov.uk/en/censusresults.html>

1. The National Records of Scotland (NRS) was created by the amalgamation in April 2011 of the General Register Office for Scotland (GROS) and the National Archives of Scotland (NAS).

Appendix 1 How the 2011 Census population estimates were obtained

Introduction

The main purpose of the census is to provide an accurate population count. Although every effort is made to ensure everyone is included in the census, inevitably some individuals are missed. This under-counting does not usually occur uniformly across all geographical areas or across other sub-groups (for example, by age and sex) of the population.

To fill the gap, NRS implemented a coverage assessment and adjustment process to estimate the population that was missed. In addition, this process identified and adjusted for the people who were counted more than once or who were counted in the wrong place. Carrying out this work allowed a census estimate of the entire population to be obtained. Detailed below are the various elements that were used to calculate the final 2011 Census population estimates included in this bulletin.

The methods were largely based on those developed by the Office for National Statistics (ONS). ONS have produced a full suite of methodology papers detailing the statistical theory and practical application of the methodology. They can be found here:

<http://www.ons.gov.uk/ons/guide-method/census/2011/census-data/2011-census-data/2011-first-release/first-release--quality-assurance-and-methodology-papers/index.html>

Full details of the sizes of the adjustments which were made to the census results will be published as part of Release 1B.

Census Coverage Survey / Dual System Estimation

The primary source of 'missingness' was addressed using a Census Coverage Survey (CCS) in which about 40,000 households across Scotland were visited by trained survey interviewers. The CCS was a sample survey independent to the census, conducted six weeks after Census Day. Participation in it was voluntary.

Responses from both the Census and the CCS were matched and the known number of responses from each of these were used (in a statistical technique called Dual System Estimation) to determine the number of respondents missed for each of the sample areas in the CCS. The Dual System Estimators were then used to derive the population for a whole Processing Unit¹.

Communal Establishments

Small² communal establishments (CEs) were treated in the same way as individual respondents i.e. using a DSE to determine the missing people. This was carried out at Scotland level data (rather than PU by PU as the sample sizes would otherwise be too small) to produce accurate population figures to add in to the population estimate.

¹ A processing unit (PU) is made up of one or more neighbouring council areas (CAs) and consisted of approximately 500,000 respondents. CAs were grouped in to PUs for practicalities around data processing etc.

² Small communal establishments are those with less than 100 bed spaces. Large communal establishments are those with 100 or more bed spaces.

For larger communal establishments work was done to investigate the likely number of persons missed in the 2011 Census. This work included matching the number of actual questionnaires returned against the number issued by the CE manager, the number of available bed spaces and information gathered from administrative records. Where gaps were identified, the appropriate number of people were added in to the population estimate.

Between Household Bias Adjustment

The DSE method makes the assumption of independence between the CCS and Census so an individual's likelihood to respond to the CCS is not influenced by how they responded to the census. However, this assumption will not always hold due to the fact that i) households that are less willing and likely to respond to the census will also be less willing and likely to respond to the CCS; and ii) a household's likelihood of responding to one may be affected by whether or not it responded to the other.

To help overcome this bias, an alternative count of occupied households was calculated, based primarily on information gathered during the census field operation. This alternative count was fed in to the ratio estimation and was used (if necessary) as an inflation factor for the DSE that calculates people missed by both the census and the CCS.

Overcount

Particular groups of people may be included on one or more census questionnaires. An example would be students who completed a questionnaire at their term-time address but were also included in the one returned by their parents for the family home. Multiple responses for the same household were removed during the early stages of processing.

To produce an estimate of level of overcount, the census was matched to the CCS and to itself. This was used to produce conservative 'dampening' factors for broad population groups which modified the DSE and adjusted the census estimate.

Sample balance

The CCS sample would be expected to be an accurate representation of the overall population for the sampled areas. However, with every sampling process there is a risk that a sample may be an outlier amongst all possible samples. For example, the chosen CCS sample could have, by chance, drawn postcodes in an area where the census had managed to count everyone.

The CCS sample was assessed to determine if it was sufficiently representative when compared to all other possible samples that could have been drawn from the underlying population. This assessment showed that no adjustments were required to correct for sample balance.

Appendix 2 Quality Assurance Process

Introduction

The 2011 Census population results go through a rigorous quality assurance process prior to their publication. This Appendix describes the quality assurance (QA) which has been carried out in preparation for this first release of headline statistics for Scotland.

The census population figures are estimates determined mainly by the census count. However the final figures are higher than the census count because they include an estimate of the impact of under coverage of the population (such as people who were missed). In addition the process makes a relatively small adjustment for over coverage such as people counted more than once. The coverage estimation is based mainly on the results of the Census Coverage Survey (CCS) which National Records of Scotland (NRS) conducted. More details of the coverage adjustment process can be found in Appendix 1.

The aim of the QA is to identify where further adjustment might be required before the estimates can be finalised. For example, if there is evidence that something has gone wrong in processing or in the estimation process. The estimates published here have gone through a rigorous checking process which has been overseen by a series of working groups and panels. The membership and remits of these working groups and panels can be found in this [linked paper](#). These groups and panels have reviewed the evidence and made recommendations on further adjustment work. The Executive Level Panel recommended that the estimates will be published.

Quality Assurance process

The quality assurance of the summary tables published in this release, has followed the initial phase of the QA process and has included looking at the following aspects:

- age by sex profile by council area compared with published mid-year population estimates and a range of comparator sources including NHS Central Register, Child Benefit, Customer Information Service data on older people³ ;
- household numbers – compared to published household number estimates;
- fertility rates – using birth registration data from NRS;
- the inferred sex ratio distribution by age (i.e. the number of males per 100 females); and
- the pattern of response by age and gender.

³ For more information on these comparators, see <http://www.gro-scotland.gov.uk/files2/stats/about/census-overview-comparative-sources-uksa.pdf>

Prior to Release 1B, additional quality assurance will be carried out including the following aspects:

- household size - compared to published household size estimates;
- student numbers - compared to data on students from School Census, Higher Education Statistics Agency and Scottish Funding Council;
- mortality rates;
- Armed Forces numbers – compared to a range of other armed forces data;
- ethnicity; and
- international migration.

It is anticipated that these checks will only result in minor changes to the census estimates. The rounding applied to the census estimates published in Release 1A, is designed so that it covers the extent of any changes which occur between Release 1A and Release 1B.

External Data Quality Advisory Group

The External Data Quality Advisory Group examined preliminary census estimates for Scotland and council areas. As the quality assurance process progresses, specific queries from the summary tables for council areas will be directed to this group for further discussion. For Release 1A, the advisory group provided comments on the QA process, the initial figures and also commentary on the emerging trends.

Internal Quality Assurance

The census estimates were examined by the QA team in NRS using an agreed list of checks. The results of these checks, along with the comments from the External Data Quality Advisory Group, were discussed with the Internal Quality Assurance Panel. This group examined the issues highlighted in the quality assurance, and provided an assessment of the quality of the census estimates for each age-sex group. It suggested supplementary work to be carried out by the QA and coverage and adjustment teams in NRS, and identified where there were differences with comparator sources.

Executive Level Panel

The Executive Level Panel looked at summaries of the evidence which had been compiled from the whole quality assurance process. On the basis of these and further examination of the data, they agreed on the estimates that are now published.

Appendix 3 2011 Census Day Population Estimates

Table A1 2011 Census Day usual resident ¹ population estimates by five-year age group and sex, Scotland

Age ²	Persons	Males	Females
All ages	5,295,000	2,567,000	2,728,000
0 to 4	293,000	149,000	144,000
5 to 9	270,000	138,000	132,000
10 to 14	292,000	150,000	142,000
15 to 19	331,000	168,000	163,000
20 to 24	364,000	181,000	183,000
25 to 29	346,000	170,000	176,000
30 to 34	322,000	159,000	163,000
35 to 39	340,000	166,000	174,000
40 to 44	395,000	191,000	203,000
45 to 49	411,000	200,000	211,000
50 to 54	376,000	184,000	192,000
55 to 59	331,000	162,000	169,000
60 to 64	336,000	165,000	172,000
65 to 69	261,000	125,000	137,000
70 to 74	221,000	101,000	120,000
75 to 79	178,000	77,000	101,000
80 and over	230,000	82,000	149,000
Under 15	854,000	437,000	417,000
15 to 39	1,702,000	844,000	858,000
40 to 64	1,849,000	903,000	946,000
65 to 79	660,000	302,000	358,000
80 and over	230,000	82,000	149,000

Footnotes

1) For the 2011 Census, a usual resident of the UK is anyone who, on Census Day, was in the UK and had stayed or intended to stay in the UK for a period of 12 months or more, or had a permanent UK address and was outside the UK and intended to be outside the UK for less than 12 months.

2) The age of a person is derived from their date of birth. It is their age in years on their last birthday up to and including Census Day 2011.

3) Figures in this table may not add exactly because they have been rounded to the nearest thousand.

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Table A2 2011 Census Day usual resident ¹ population estimates by council area

Council area ²	Persons
SCOTLAND ³	5,295,000
Aberdeen City	223,000
Aberdeenshire	253,000
Angus	116,000
Argyll & Bute	88,000
Clackmannanshire	51,000
Dumfries & Galloway	151,000
Dundee City	147,000
East Ayrshire	123,000
East Dunbartonshire	105,000
East Lothian	100,000
East Renfrewshire	91,000
Edinburgh, City of	477,000
Eilean Siar	28,000
Falkirk	156,000
Fife	365,000
Glasgow City	593,000
Highland	232,000
Inverclyde	81,000
Midlothian	83,000
Moray	93,000
North Ayrshire	138,000
North Lanarkshire	338,000
Orkney Islands	21,000
Perth & Kinross	147,000
Renfrewshire	175,000
Scottish Borders	114,000
Shetland Islands	23,000
South Ayrshire	113,000
South Lanarkshire	314,000
Stirling	90,000
West Dunbartonshire	91,000
West Lothian	175,000

Footnotes

1) For the 2011 Census, a usual resident of the UK is anyone who, on Census Day, was in the UK and had stayed or intended to stay in the UK for a period of 12 months or more, or had a permanent UK address and was outside the UK and intended to be outside the UK for less than 12 months.

2) Council area boundaries as at 1 April 2011.

3) Figures in this table may not add exactly because they have been rounded to the nearest 1,000.

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Appendix 4 Relative Confidence Intervals of 2011 Census population estimates

Introduction

The 2011 Census used a sample survey (the Census Coverage Survey) to measure the coverage of the census and hence to provide overall estimates of the population, including people missed by the census. A basic requirement of any estimate is a measure of its precision or uncertainty.

A 95 per cent confidence interval, which provides a measure of accuracy, can be interpreted as the interval within which the true value being estimated will lie 95 per cent of the time if the sample was repeated a number of times. This appendix outlines the calculated confidence intervals for the 2011 Census population estimates and the method used to derive them.

The census estimate of the total Scotland population (5,295,000) had a 95 per cent confidence interval width of plus or minus 0.44 per cent (i.e. plus or minus 23,000 people). Table A3 provides the 95 per cent confidence interval widths for the census population estimates for specific age and sex groups at Scotland level, and Table A4 provides the corresponding figures for the census total population estimates for each council area.

**Table A3 2011 Census Day population estimate:
95% confidence interval widths by age group and sex, Scotland**

Age ¹ group	Relative confidence interval width ² (percentage)	
	Males	Females
0 ³	1.53	
1 to 4	1.15	1.27
5 to 9	1.06	1.07
10 to 14	0.94	0.93
15 to 19	1.01	0.94
20 to 24	2.47	1.62
25 to 29	1.84	1.52
30 to 34	1.42	1.26
35 to 39	1.38	1.20
40 to 44	0.96	0.98
45 to 49	0.92	0.81
50 to 54	0.83	0.66
55 to 59	0.77	0.64
60 to 64	0.71	0.49
65 to 69	0.71	0.47
70 to 74	0.64	0.55
75 to 79	0.60	0.45
80 and over	0.60	0.47

Footnotes

1) The age of a person is derived from their date of birth. It is their age in years on their last birthday up to and including Census Day 2011.

2) The relative confidence interval for an estimate is the width of the confidence interval expressed as a percentage of the estimate.

3) The confidence interval for babies under 1 year old was not calculated separately for males and females.

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**Table A4 2011 Census Day population estimates:
95% confidence interval widths, by council area**

Council area	Relative confidence interval width ¹ (percentage)
Scotland	0.44
Aberdeen City	2.61
Aberdeenshire	1.19
Angus	1.31
Argyll and Bute	1.36
Clackmannanshire	0.99
Dumfries and Galloway	0.79
Dundee City	2.15
East Ayrshire	0.93
East Dunbartonshire	1.44
East Lothian	1.09
East Renfrewshire	1.58
Edinburgh, City of	1.76
Eilean Siar	1.45
Falkirk	1.03
Fife	1.06
Glasgow City	1.83
Highland	1.49
Inverclyde	1.73
Midlothian	1.56
Moray	1.51
North Ayrshire	0.97
North Lanarkshire	1.36
Orkney Islands	2.34
Perth and Kinross	1.22
Renfrewshire	1.53
Scottish Borders	1.01
Shetland Islands	1.26
South Ayrshire	0.80
South Lanarkshire	1.16
Stirling	1.26
West Dunbartonshire	1.60
West Lothian	1.35

Footnotes

1) The relative confidence interval for an estimate is the width of the confidence interval expressed as a percentage of the estimate.

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Methods

A bootstrap methodology (Efron & Tibshirani, 1993) was used to estimate the variance of the census population estimates. This method was developed to estimate the variance and confidence intervals of complex estimators associated with multistage survey samples. An advantage of the bootstrap method is that it provides an easily understood methodology for the non-technical user.

The method draws a large number of bootstrap sample replicates, sampling with replacement from the observed sample, using exactly the same sample design. Each bootstrap replicate therefore has the same sample size as the original sample, but could (due to random chance) contain only data from one sample point (because of sampling with replacement). Each replicate is then used to construct an estimate using the usual estimation process. The result is a series of estimates of the population across the replicates. The empirical variance can then be taken from the distribution of those estimates.

For further information on the calculation of confidence intervals see:

<http://www.ons.gov.uk/ons/guide-method/census/2011/census-data/2011-census-data/2011-first-release/first-release--quality-assurance-and-methodology-papers/index.html>

Appendix 5 2011 Census - Person Response Rates

The person response rate provides a measure of the level of under-enumeration by the census of the usually resident population. It is calculated from the number of usual residents for whom individual details were provided on a returned and processed questionnaire, divided by the final estimated usually resident population. Table A5 provides the percentage person response rate from the 2011 Census for each council area in Scotland.

Table A5 2011 Census: percentage person response rate, by council area

Council area	Percentage person response rate ¹
Scotland	93.7
Aberdeen City	93.7
Aberdeenshire	95.5
Angus	94.7
Argyll & Bute	94.4
Clackmannanshire	95.5
Dumfries & Galloway	95.5
Dundee City	91.7
East Ayrshire	95.0
East Dunbartonshire	94.9
East Lothian	96.2
East Renfrewshire	94.3
Edinburgh, City of	91.1
Eilean Siar	94.2
Falkirk	95.1
Fife	95.2
Glasgow City	89.0
Highland	94.0
Inverclyde	93.0
Midlothian	96.1
Moray	94.1
North Ayrshire	94.5
North Lanarkshire	93.7
Orkney Islands	93.7
Perth & Kinross	94.4
Renfrewshire	93.6
Scottish Borders	96.4
Shetland Islands	95.5
South Ayrshire	95.4
South Lanarkshire	95.8
Stirling	94.1
West Dunbartonshire	93.8
West Lothian	94.1

Footnotes

1) Percentage of estimated population for whom individual details were provided on a returned and processed questionnaire.

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The numerator

- is based on completed questionnaires (paper or internet) received up to 26 April 2011
- includes people who are usually resident in communal establishments and households
- includes some duplication where an individual has been included on two questionnaires at different locations (for example, where a child in joint custody has been included on the census questionnaire at both parents' addresses)
- includes some people incorrectly included in the wrong location – such as a person being included at their second home rather than their usual residence
- includes valid responses only (A response is defined as valid if at least two of six key variables have been completed.)
- excludes returned questionnaires identified as duplicates in processing. For example, if a person completed a census questionnaire both on paper and the internet.

The denominator

- is the estimate of the number of usual residents, after taking account of both estimated under enumeration and over enumeration
- includes all persons estimated to have been missed from the census via the coverage assessment and adjustment methodology
- excludes duplication where an individual has been included in two forms, and people wrongly enumerated at the wrong location. These have been removed during processing or via an overcount adjustment.