



Northern
Territory
Government

Northern Territory Population Projections

Main Update (2014 Release)

Northern Territory 2011-41

Northern Territory Regions 2011, 2016, 2021, 2026

Date of publication: May 2014.

Suggested citation: Northern Territory Department of Treasury and Finance, Northern Territory Population Projections, Main Update (2014 Release). 2014: Darwin.

Website address www.treasury.nt.gov.au/

Acknowledgements:

Northern Territory Department of Treasury and Finance (DTF) acknowledges the expertise of The Northern Institute, Charles Darwin University (CDU) in preparing these projections, especially Dr Andrew Taylor.

Contents

1. Introduction	4
2. Outputs on the Website.....	5
3. How to Use These Projections	7
4. Overview of Territory Population Growth.....	8
5. NTPOP Population Projections Model.....	10
6. Overview of Results	12
7. Sensitivity Analysis – the Effect of Change in the Assumptions for Migration, Fertility and Mortality	22
Appendix 1: Technical Details of the NTPOP Population Projections Model	28
Appendix 2: Notes on Data Sources and Assumptions in the Main Update.....	33
Appendix 3: NTPOP Regions.....	38

1. Introduction

This report provides an overview of the Northern Territory Population Projections, Main Update (2014 Release), covering the years 2011 to 2041. The projections incorporate final estimated resident population (ERP) figures and other demographic data based on the 2011 Census. The report informs on the process of development and interprets key results for the Territory and its regions.

A summary of the projection results is included in this report, but for the complete set of projected population numbers, users should refer to the electronic Excel spreadsheets available through the Department of Treasury and Finance (DTF) website at <https://treasury.nt.gov.au/df/economic-group/population-projections>.

The population projections outlined in this report were developed using the NTPOP model, which calculates future estimates of Northern Territory residents based on historical trends in fertility, mortality and migration (technical details on the NTPOP model are at Appendix 1). As is the practice for ERP produced by the Australian Bureau of Statistics (ABS), the projected number of residents excludes people in the Territory whose usual residence is another state or country, for example, fly-in fly-out workers, business visitors and tourists. Accordingly, the projected population does not accurately represent the service population for Northern Territory Government agencies.

The population projections reflect the consequences of applying certain assumptions about the future direction and levels of the components of population growth (fertility, mortality and migration). The nature of these assumptions means that the population projections have a smooth trajectory (further details on the assumptions can be found in Appendix 2). In reality, the pattern of population growth varies from year to year, but no attempt has been made to model these annual fluctuations, which is consistent with standard projection practices. Therefore, the projections should not be interpreted as accurate forecasts or predictions, but rather an indication of population change over time should a given set of assumptions apply in the future.

The projections in this report update the previous projections presented in Northern Territory Population Projections, Interim – Update (2013 Release), and are the outcome of a comprehensive revision of parameters and assumptions used to generate projections.

The report includes information on two sets of population projections:

- residents of the whole of the Northern Territory from 2011 to 2041, disaggregated by individual year of age, sex and Indigenous status; and
- residents of six Territory regions: Greater Darwin, Rest of Darwin, Katherine, East Arnhem, Barkly and Alice Springs (refer map at Appendix 3). These sub-NT level projections are made available for 2011, 2016, 2021 and 2026 and are disaggregated by five-year age groups up to age 85, sex and Indigenous status.

The boundaries of the six Territory regions have been changed slightly in this release to align with then new Australian Statistical Geography Standard (ASGS) introduced by the ABS in July 2011. The Greater Darwin region aligns with the ASGS Statistical Area 4 region of Darwin, which comprises of the Statistical Area 3 (SA3) regions of Darwin City, Darwin Suburbs, Palmerston and Litchfield. The Rest of Darwin region aligns with the SA3 region of Daly-Tiwi-West Arnhem while the Katherine, East Arnhem, Barkly and Alice Springs regions align with ASGS SA3 regions of the same name.

Population projections should be used with caution, particularly the regional projections where the data used to develop assumptions for the model is less accurate and migration flows are more complex requiring intra-region, interstate and international migration to be taken into account. Consideration should also be given to the sensitivity of the projections to change in the assumptions used in the model (refer section 7 of this report).

2. Outputs on the Website

The detailed projection results are available through the DTF website, <https://treasury.nt.gov.au/df/economic-group/population-projections>. A mathematical description of the projection model NTPOP is also provided on the website (Wilson, T, Mathematical details of the NTPOP projection model, School for Social and Policy Research, Charles Darwin University, Darwin).

There are three standard output Excel files for the Northern Territory population projections including:

- NTPOP summary, 2011-2041
- NTPOP single-year age, 2011-2041
- NTPOP 5-year age, 2011-2041

Content of the Output Files

The summary spreadsheet contains:

- projection totals (no age or sex breakdowns) for each population sub-group (Table 1) for each year of the projection period to 2041;
- projection totals (no age or sex breakdown) for each population sub-group, every five years (2011, 2016, 2021, 2026) for the six regions;
- average annual growth rates;
- summary population accounts (start population, growth components, end population);
- growth indices;
- sex ratios; and
- median ages for the Territory-wide projections.

The single-year of age projections spreadsheet contains projected numbers for each population sub-group for each year of the projection period by sex and individual year of age, from 0 to 100 years and over. The single-year of age sheet is not available for the regions.

The five-year age groups spreadsheet contains projected numbers for each population sub-group for each year of the projection period by sex and five-year age groups 0-4 years up to 100 years and over for the Territory as a whole and to 85 years and over for the regions.

A single population projection has been produced (the NT Population Projection) together with sensitivity analyses showing the effect of differing overseas and interstate migration, fertility and life expectancy assumptions. The results of these sensitivity analyses are discussed in section 7 (Sensitivity Analysis – the Effect of Change in the Assumptions for Migration, Fertility and Mortality) of this report.

It should be noted that sensitivity analyses do not represent alternative expectations of what might occur in the future. Rather, they aim to demonstrate the degree to which the projections would change in response to use of a different assumption. The sensitivity analyses indicate that the model is most sensitive to changes in the assumptions for interstate and overseas migration.

The NTPOP model also produces population projections for the geographic regions of Australia and 'rest of Australia' to enable dynamic modelling of interstate migration flows to

and from the Territory. Depending on the objectives of their work, users may need to use ABS projections for an Australia level total, rather than these projections.

Table 1: Population Sub-Groups, NTPOP Projection Model ^{1, 2}

	Indigenous			Non-Indigenous			All persons		
	sex	sya	5ya	sex	sya	5ya	sex	sya	5ya
NT	✓	✓	✓	✓	✓	✓	✓	✓	✓
Regions (six)	✓	x	✓	✓	x	✓	✓	x	✓

1: sya = single year of age; 5ya = five year age

2: Five year age groups up to 100 years and over for NT and to 85 years and over for the regions

3. How to Use These Projections

Guidelines for Northern Territory Government Agencies

Population projections should not be interpreted as accurate forecasts or predictions. Projections are the result of applying certain assumptions about the future direction and levels of fertility, mortality and migration to a base population, in this case 2011 population estimates (refer to Taylor (2011) for a discussion of these issues in the context of places like the Northern Territory¹).

Users of these projections should exercise caution when using them in decision-making. The following guidelines are not intended to be fully prescriptive, and agency staff are encouraged to contact DTF with any questions regarding the appropriate use of projections. In general, Northern Territory Government (NTG) agencies should use the projections for:

- work relating to internal Territory issues; and
- work that will be used in official documents circulated to other agencies.

Uncertainty in Projections

Population projections are not predictions of the future size and composition of the Territory's population. Rather, they are calculations of what the population will be at future times given specific assumptions about the components of population growth between the base year for the projections and any future year. The degree to which projections coincide with actual future growth will ultimately depend on the extent to which the assumptions about future growth turn out to be correct.

The accuracy of the projections also depends on the accuracy of the initial population estimates used as the foundation for the projections. These population projections are based on final ERPs for the Territory and Australia and estimates of the Aboriginal and Torres Strait Islander population as at 30 June 2011. Both are provided by the ABS in 3101.0 Australian Demographic Statistics, March 2013. These estimates are based on final 2011 Census data and are used to derive the jump-off (or starting populations) for the projections by age, sex and Indigenous status.

Uncertainty will be greater at a regional level and for specific age/sex groups than total estimates. Users should be mindful of this uncertainty when considering the likely accuracy of more detailed levels of projections.

¹ Taylor, A. (2011). The Forecasting of Remote Area Populations: Numbers Aren't Everything, In D. Carson, R. Rasmussen, P. C. Ensign, A. Taylor and L. Huskey (Eds). *Demography at the Edge: Remote human populations in developed nations*. Farnham, England: Ashgate Publishing, 39-52.

4. Overview of Territory Population Growth

Population growth in the Territory is significantly more volatile than Australian population growth, largely reflecting the impact of major projects on the Territory's interstate and overseas migration. Nationally, population growth is influenced by changing fertility and mortality patterns over time and Commonwealth policy on the intake of international migrants. Population growth is also influenced by living conditions and employment opportunities in Australia compared with those abroad.

Over the long term, the Territory's population growth has been predominately driven by natural increase (Chart 1). The contribution of natural increase (births less deaths) to the Territory's annual population growth is about double that of the national percentage contribution.

The Territory population's crude birth rate is influenced by the age distribution of non-Indigenous women, which favours the child-bearing ages by comparison with other jurisdictions. As at June 2011, 56.0 per cent of non-Indigenous women in the Territory were aged 15 to 49 years compared with 48.5 per cent nationally. Higher fertility rates among Territory Indigenous women also influence the Territory population's crude birth rate.

Territorians have a lower life expectancy than people in other jurisdictions, reflecting high mortality rates in the Territory's Indigenous population, largely the result of a high prevalence and early onset of chronic disease. Non-Indigenous life expectancy is also lower than in other jurisdictions. Despite a lower life expectancy, the Territory's population experiences a relatively low crude death rate (deaths per 1000 persons) because of its young age profile.

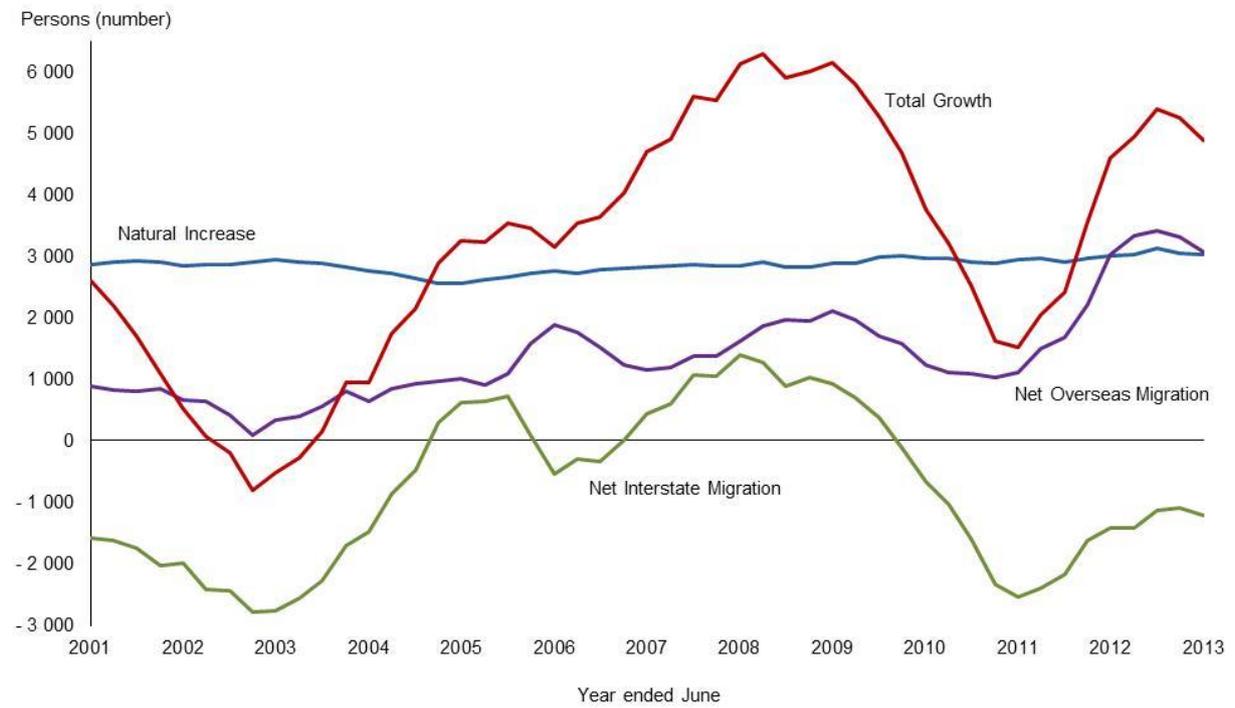
Net overseas migration has consistently made a positive contribution to annual population growth in the Territory, but its contribution is more variable than that from natural increase. In recent years, net overseas migration in the Territory has increased markedly and in 2012-13 the contribution to growth exceeded that from natural increase. This reflects increased labour demand as a result of major projects and skills shortages, particularly for trades and technical workers and specialists in the mining and construction sectors. Net overseas migration is also heavily influenced by changes to Commonwealth migration intake policies particularly in relation to temporary migrants.

Significant fluctuations in the Territory's annual population growth rate are largely due to variations in interstate migration. The Territory experiences very large interstate flows of people both into and out of the Territory, with about 7 per cent of the Territory's population going interstate each year and a similar number arriving from interstate. The net annual figure is volatile and has fluctuated from as low as negative 3129 to as high as positive 1754 in the last 30 years. Interstate migration in the Territory has, however, typically been a detractor from growth, with positive interstate migration occurring only for short periods of time, in response to major projects and other activities that increase the demand for labour, particularly in the construction sector.

Although high rates of natural increase drive growth in both the Territory's Indigenous and non-Indigenous populations, variations in the Territory's annual population growth rates are largely a consequence of the non-Indigenous population, through interstate and, to a lesser extent, overseas migration. The Territory's Indigenous population, while highly mobile, typically moves intrastate and experiences significantly lower rates of net interstate and overseas migration. As a consequence, population growth of the Indigenous population is significantly more stable and almost exclusively a consequence of natural increase.

Chart 1: Components of Population Growth, Northern Territory, 2001 to 2013 (moving annual total)

Source: ABS. Cat. No. 3101.0



5. NTPOP Population Projections Model

Development

The Northern Territory population projections were developed in response to a long-standing need within the NTG to better understand the drivers of, and likely future trends for, the Indigenous and non-Indigenous populations in the Territory. Population-specific denominators are also required in order to properly plan for the very different and separate needs of the Indigenous and non-Indigenous populations.

Although the ABS produces a range of projections series after each Census (for Australia, the States and Territories, and the capital city/balance of State level), these projections do not take into account the different growth patterns in the Indigenous and non-Indigenous populations. This is a significant issue for the Territory, with the Indigenous population accounting for about 30 per cent of the population. Additionally, NTG agencies have a need for sub-Territory level projections, which the ABS projections do not provide.

The process of developing population projections was approved by the NTG in December 2007. Agencies are required to use the NTG projections unless another approach is warranted and can be justified. Annual reviews of the projections are conducted with updates where necessary, with a major review and re-release of population projections conducted every five years following the release of the Census. DTF develops the projections in collaboration with the Northern Institute at Charles Darwin University. The principles supporting the development of the assumptions for the population projections are outlined below.

Principles for Developing Northern Territory Population Projection Assumptions

- The underlying assumptions for the parameter values of the projections model are to be based on historical statistical evidence.
- Evidence will consist of information on and analyses of past trends and likely future trends in relation to fertility, mortality and migration.
- All NTG agencies may put forward their views on the assumptions, but evidence must be supplied in order to receive support for them.
- Information about future possibilities may also be put forward; however, policy-based assumptions which conflict with statistical evidence will not be considered for incorporation into the model.
- Key assumptions and parameters are based on recent historical evidence. Trends may be built into the parameters if sound rationale is available. The yearly fluctuation that occurs in interstate migration and other parameters is not modelled.
- There will be a process of review, annually at the most frequent and at least five yearly, allowing for change to the assumptions as new information comes to light.

Method

The NTPOP projection model is a cohort-component growth model. The cohort-component method is the most common method used for demographic projections. The method adjusts a base population for births, deaths and migration, to arrive at a population one year into the future. The process continues for the extent of the projection horizon.

A short technical summary of the model is provided in Appendix 1 of this report. The mathematical details of the model are available from the DTF website.

Outputs

Previous releases have included alternative projections, which demonstrate the sensitivity of the model to change in the assumptions for the baseline projection. For this release, a single projection (the NT Population Projection) has been produced. However, to demonstrate the influence of migration on the projections, various interstate and overseas migration scenarios have been developed by assuming different levels of constant annual net migration and holding all other parameters fixed. The impact of differing assumptions for fertility and life expectancy is also discussed.

The NTPOP model also has the capacity to run other user-defined scenarios if users need to explore other population futures that incorporate different parameter values for the growth components. Users wishing to explore different scenarios should discuss their needs with DTF.

Assumptions

The NT Population Projection uses input parameters based on averages and trends over the past 10 years, where possible, and assumes that these trends will continue into the future. A shorter period of time has been used for some assumptions where data is only available for a shorter period (e.g., overseas migration) or other matters mean that a shorter period has been used (e.g., fertility). Appendix 2 provides further detail on data sources and the development of the input parameters for the model.

No adjustments are made to reflect policy choice or the impact of specific projects. These issues will only influence population projections through their impact on historical averages and trends on the components of population change (births, deaths and migration).

Table 2 provides a summary of the assumptions for key components of growth in the NT Population Projection.

Table 2: Summary of Assumptions and Parameters for the NT Population Projection, Main Update (2014 Release)

Growth Component	Parameter¹
Fertility	Total Fertility Rate (TFR)
NT Indigenous mothers	<i>TFR 2.401 held constant all years (7 year average)</i>
NT non-Indigenous mothers	<i>TFR 1.927 held constant all years (7 year average)</i>
Mortality	Life Expectancy
NT Indigenous males	<i>63.40 years in 2011-12 increasing to 72.10 years in 2040-41</i>
NT Indigenous females	<i>68.70 years in 2011-12 increasing to 75.95 years in 2040-41</i>
NT non-Indigenous males	<i>77.80 years in 2011-12 increasing to 81.75 years in 2040-41</i>
NT non-Indigenous females	<i>83.10 years in 2011-12 increasing to 86.06 years in 2040-41</i>
Interstate migration	Net interstate migration
NT Indigenous	<i>-110 in 2011-12; -94 in 2012-13 then held constant at -35 (10 year average)</i>
NT non-Indigenous	<i>-1313 in 2011-12; -1126 in 2012-13 then held constant at -417 (10 year average)</i>
Overseas migration	Net overseas migration
NT Indigenous	<i>Zero net migration assumed</i>
NT non-Indigenous	<i>3018 in 2011-12; 3065 in 2012-13 then held constant at 1660 (9 year average)</i>

1: Fertility and mortality assumptions for regional projections are the same as the Territory total; migration varies between the regions and is based on movements recorded between Censuses.

6. Overview of Results

Refer to <https://treasury.nt.gov.au/dtf/economic-group/population-projections> for the complete set of projection numbers, available in Excel spreadsheets.

Projected Population growth

Projections are presented for each year of the period 2011-2041 for the Northern Territory and at five year intervals from 2011 to 2026 for six Territory regions.

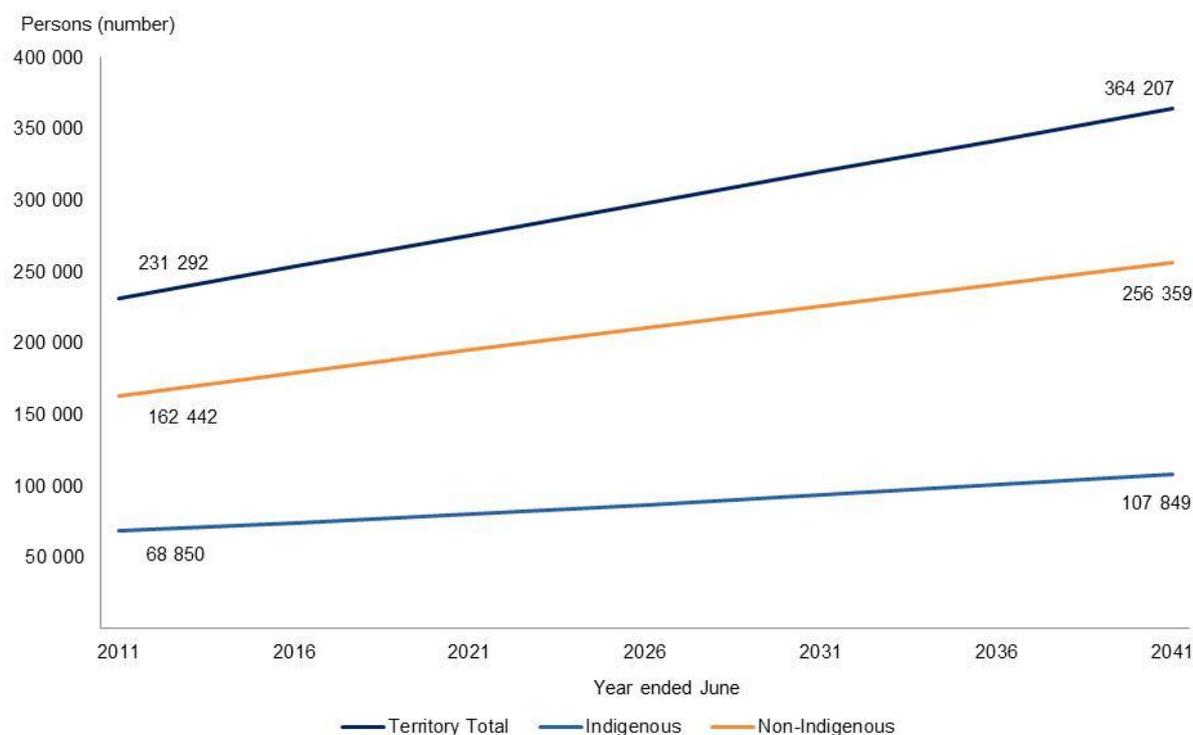
Table 3 shows the Territory's population (as at 30 June) is projected to grow from 231 292 in 2011 to 319 533 by 2031 and to 364 207 by 2041 (illustrated in Chart 2). The Territory's Indigenous population is projected to rise from 68 850 in 2011 to 93 471 by 2031 and to 107 849 by 2041.

Table 3: Population Estimates and Projections, Northern Territory, 2011 to 2041

	2011	2016	2021	2026	2031	2036	2041
	no.						
Territory Total	231 292	253 330	275 128	297 369	319 533	341 655	364 207
<i>Indigenous</i>	68 850	74 264	80 285	86 773	93 471	100 415	107 849
<i>Non-Indigenous</i>	162 442	179 067	194 843	210 596	226 062	241 241	256 359

Source: Northern Territory Population Projections, Main Update (2014 Release)

Chart 2: Population Estimates and Projections, Northern Territory, 2011 to 2041



Source: Northern Territory Population Projections, Main Update (2014 Release)

The Territory's population is projected to grow at an average annual growth rate of 1.5 per cent per annum over the life of the projections (Table 4). Growth is projected to moderate from an average annual growth rate of 1.8 per cent in 2011-16 to an annual average growth rate of 1.3 per cent in 2036-41.

Table 4: Average Annual Population Growth Rates, Northern Territory, Five-Year Periods

	2011-16	2016-21	2021-26	2026-31	2031-36	2036-41	Average annual growth rate 2011-41
	%	%	%	%	%	%	%
Territory Total	1.8	1.7	1.6	1.4	1.3	1.3	1.5
<i>Territory Indigenous</i>	1.5	1.6	1.6	1.5	1.4	1.4	1.5
<i>Territory non-Indigenous</i>	2.0	1.7	1.6	1.4	1.3	1.2	1.5

Source: Northern Territory Population Projections, Main Update (2014 Release)

Projected growth rates for the non-Indigenous population are similar to those for the total population, but moderate over the projection period by a greater amount (from 2.0 per cent in 2011-16 to 1.2 per cent in 2036-41). The reduction in growth in the non-Indigenous population largely reflects the influence of projected net overseas migration. In the first two years, net overseas migration figures are based on actual numbers (a net gain of over 3000 people in each year) then from 2013 onward net overseas migration is held constant at net gain of 1660 people per annum. Holding net overseas migration constant means that its contribution to total growth declines over time (from 39.3 per cent in 2013-14 down to 36.4 per cent in 2040-41).

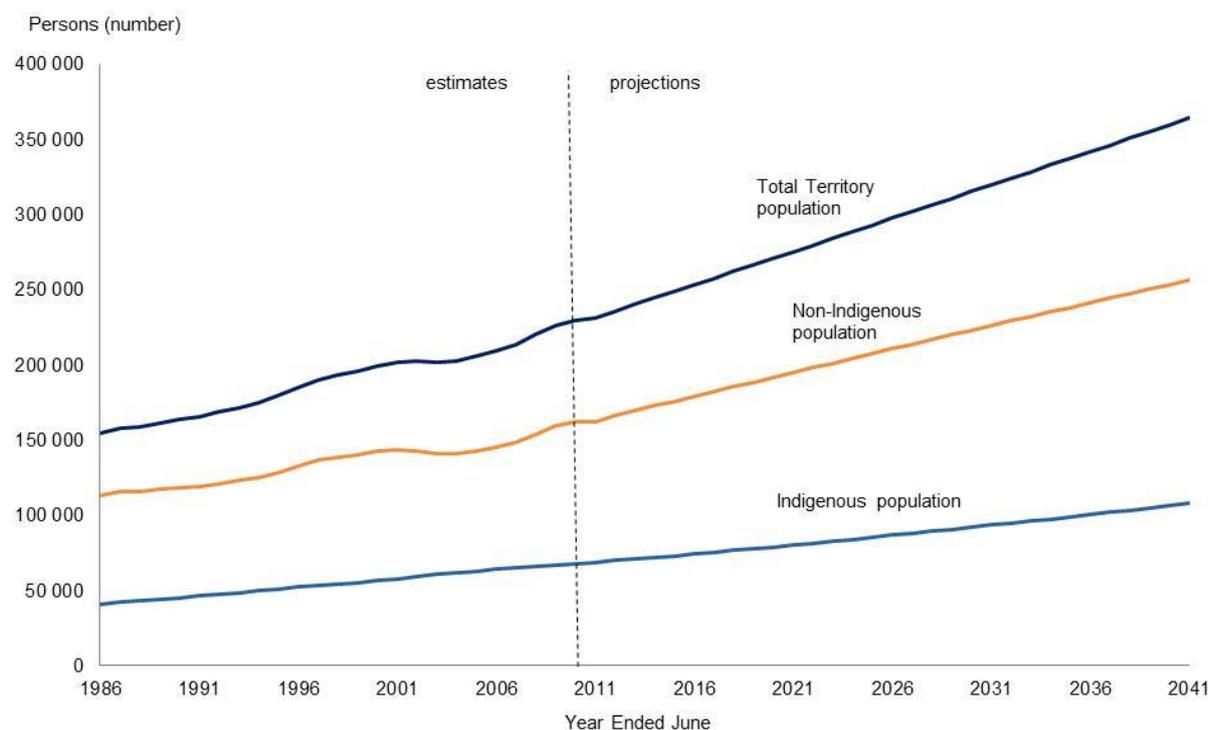
Natural increase also contributes fewer people to population growth over time until 2031-32 when it reaches a low point. This reflects a combination of population ageing and diminishing improvements in life expectancy and a decline in the proportion of women of child bearing age in the total population. After this time, natural increase slowly increases with births rising as younger cohorts of females reach child-bearing age and the proportion of women of child-bearing age stabilises at about 25 per cent of the total population.

Growth in the Indigenous population is largely driven by natural increase. Growth moderates by a lesser extent than for the total Territory population and is supported by growth in births. This in turn depends on the proportion of women of child-bearing age which moderates over the projection period.

Chart 3 shows population estimates for the Territory by ABS from 1986 to 2011 and the NT Population Projections from 2011 to 2041 for the Indigenous, non-Indigenous and total populations. Volatility in the historical estimates is particularly evident in the non-Indigenous population and reflects the impact of migration, particularly net interstate migration where annual values can be positive or negative (albeit primarily the latter) and can vary substantially between years. The volatility of the Territory's population estimates are further illustrated in Chart 4, which shows the annual variation in the components of population growth.

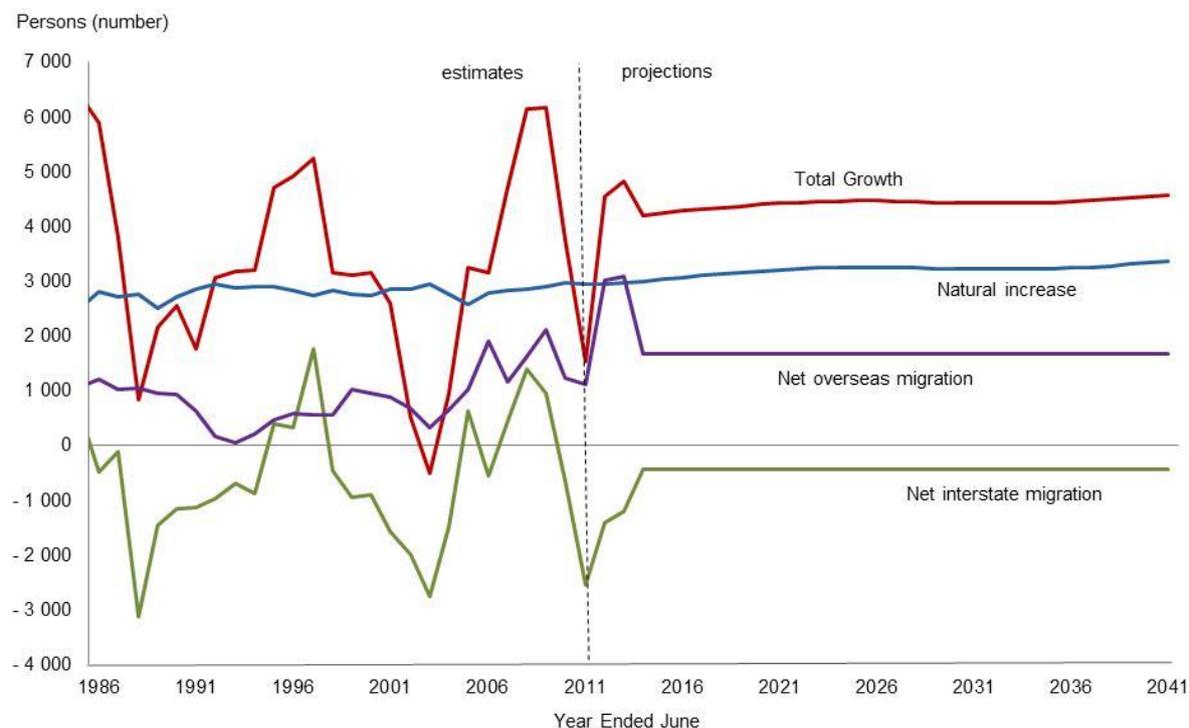
The smooth trajectory of projected population growth from 2014 onward does not imply that volatility will not be present in actual population growth as it occurs in the future. Rather, it is not sensible to attempt to project the yearly variations that are likely to occur as these will be driven by the largely unpredictable and unknown short-term major projects and the direct and indirect demand for labour associated with those projects and other events. Trying to incorporate annual variation in the projections would add further uncertainty and may lead to much greater variability between projected and actual estimates of the population.

Chart 3: Population Estimates and Projections, Northern Territory, 1986 to 2041



Source: ABS Cat. Nos. 3101.0 and 3238.0; Northern Territory Population Projections, Main Update (2014 Release)

Chart 4: Components of Growth, Estimates and Projections, Northern Territory, 1986 to 2041



Source: ABS Cat. No. 3101.0; Northern Territory Population Projections, Main Update (2014 Release)

Age Structure

The population under 15 years is projected to increase from 52 634 persons in 2011 to 77 613 persons by 2041 (Table 5). Despite this, the proportion of the population aged under 15 years is projected to decline slightly from 22.8 per cent in 2011 to 21.3 per cent in 2041 (Table 6). The proportion of the population aged under 15 years for the Territory's Indigenous population is projected to decline 3.8 percentage points from 32.7 per cent in 2011 to 28.9 per cent by 2041, reflecting stronger growth in the older age groups and some decrease in the proportion of women of child-bearing age. The Territory's non-Indigenous population is also projected to experience a slight decrease in the proportion of the population under 15 years, down from 18.5 per cent to 18.1 per cent in 2041.

The Territory's "working-age" population (i.e., people aged 15-64 years) is projected to increase to 240 628 by 2041, growing by 1.2 per cent per annum on average over the life of the projections. The proportion of the working-age population is, however, projected to decline from 71.7 per cent to 66.1 per cent by 2041. This decline is primarily driven by an increase in the proportion of the older age population (65 years and over), which is projected to more than double by 2041. The proportion of the Indigenous population in the older age groups is projected to nearly triple, increasing from 3.1 per cent to 8.7 per cent by 2041. There is also a substantial increase in people aged 65 years and over in the non-Indigenous population, with their share of the population projected to more than double over the 30 year period (6.6 per cent to 14.3 per cent).

Table 5: Population Estimates and Projections by Age Cohort, Northern Territory, 2011 to 2041

	2011	2016	2021	2026	2031	2036	2041	Average annual growth rate 2011-41
Aged under 15 (no.)								%
<i>Indigenous</i>	22 519	23 196	24 057	25 985	27 877	29 518	31 165	1.1
<i>non-Indigenous</i>	30 115	33 586	37 063	39 893	42 181	44 252	46 448	1.5
<i>Total population</i>	52 634	56 782	61 120	65 879	70 057	73 771	77 613	1.3
Aged 15-64 (no.)								
<i>Indigenous</i>	44 185	48 268	52 528	55 849	59 340	62 958	67 250	1.4
<i>non-Indigenous</i>	121 632	129 486	136 740	144 850	153 907	163 409	173 377	1.2
<i>Total population</i>	165 817	177 754	189 268	200 699	213 247	226 367	240 628	1.2
Aged 65 and over (no.)								
<i>Indigenous</i>	2 146	2 800	3 700	4 939	6 255	7 939	9 433	5.1
<i>non-Indigenous</i>	10 695	15 994	21 040	25 853	29 974	33 580	36 533	4.2
<i>Total population</i>	12 841	18 794	24 741	30 791	36 229	41 518	45 967	4.3
Median age (years)								
<i>Indigenous</i>	23.7	25.0	25.9	26.7	27.5	28.2	28.4	
<i>non-Indigenous</i>	34.7	35.0	35.6	36.1	36.6	36.9	37.0	
<i>Total population</i>	31.4	32.2	32.9	33.5	34.0	34.4	34.7	

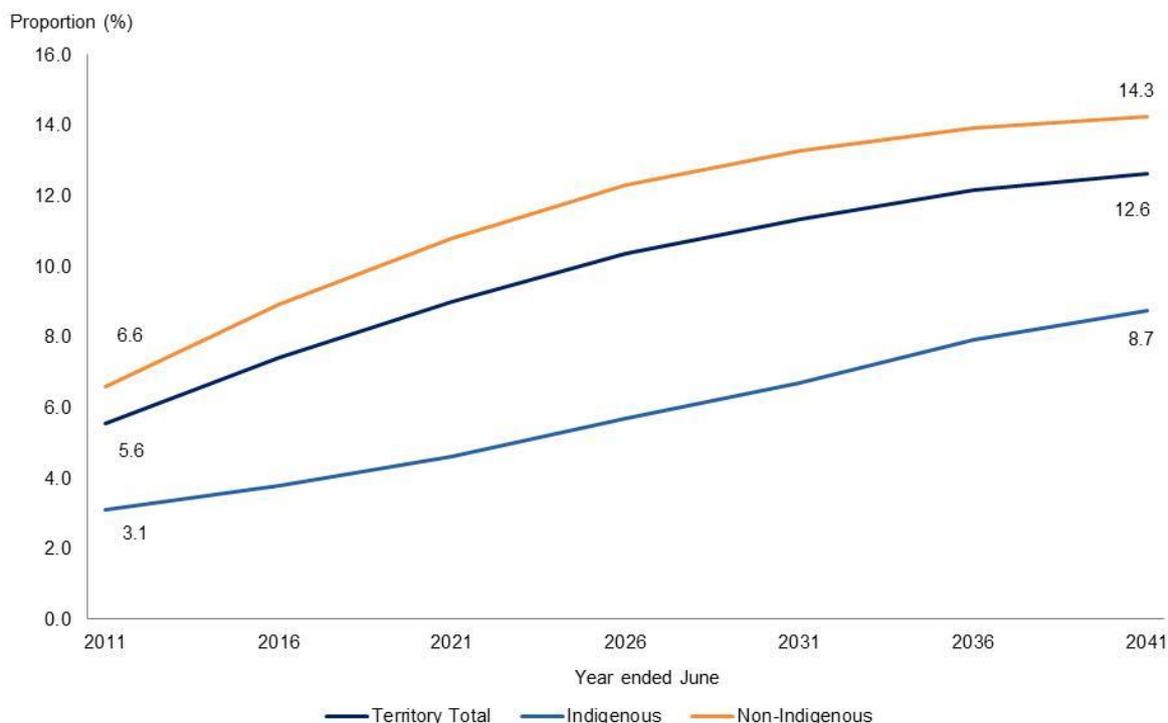
Source: Northern Territory Population Projections, Main Update (2014 Release)

Table 6: Percentage of Population by Age Cohort, Northern Territory, 2011 to 2041

	2011	2016	2021	2026	2031	2036	2041
	%	%	%	%	%	%	%
Aged under 15 (proportion)							
<i>Indigenous</i>	32.7	31.2	30.0	29.9	29.8	29.4	28.9
<i>Non-Indigenous</i>	18.5	18.8	19.0	18.9	18.7	18.3	18.1
<i>Total population</i>	22.8	22.4	22.2	22.2	21.9	21.6	21.3
Aged 15-64 (proportion)							
<i>Indigenous</i>	64.2	65.0	65.4	64.4	63.5	62.7	62.4
<i>Non-Indigenous</i>	74.9	72.3	70.2	68.8	68.1	67.7	67.6
<i>Total population</i>	71.7	70.2	68.8	67.5	66.7	66.3	66.1
Aged 65 and over (proportion)							
<i>Indigenous</i>	3.1	3.8	4.6	5.7	6.7	7.9	8.7
<i>Non-Indigenous</i>	6.6	8.9	10.8	12.3	13.3	13.9	14.3
<i>Total population</i>	5.6	7.4	9.0	10.4	11.3	12.2	12.6

Source: ABS Cat. No. 3238.0; Northern Territory Population Projections, Main Update (2014 Release)

In absolute terms, the non-Indigenous population is projected to age by a greater degree than the Indigenous population (Chart 5). This is primarily driven by the much larger proportion of 40-60 year olds in the non-Indigenous population (refer Chart 8) caused by previous substantial in-migration of younger working age non-Indigenous people.

Chart 5: Proportion of the Population Aged 65 years and Over, Northern Territory, 2011 to 2041

Source: Northern Territory Population Projections, Main Update (2014 Release)

Despite some projected net out-migration when people get older, the large cohorts of working age Territorians are projected to form a growing group of 'senior' non-Indigenous Territorians. Projected improvements in life expectancy also contribute the ageing of both the non-Indigenous and Indigenous populations although the improvements are greatest in the Indigenous population, albeit from a lower base (Table 7).

Table 7: Assumed Life Expectancy at Birth (years) by Indigenous Status, Northern Territory

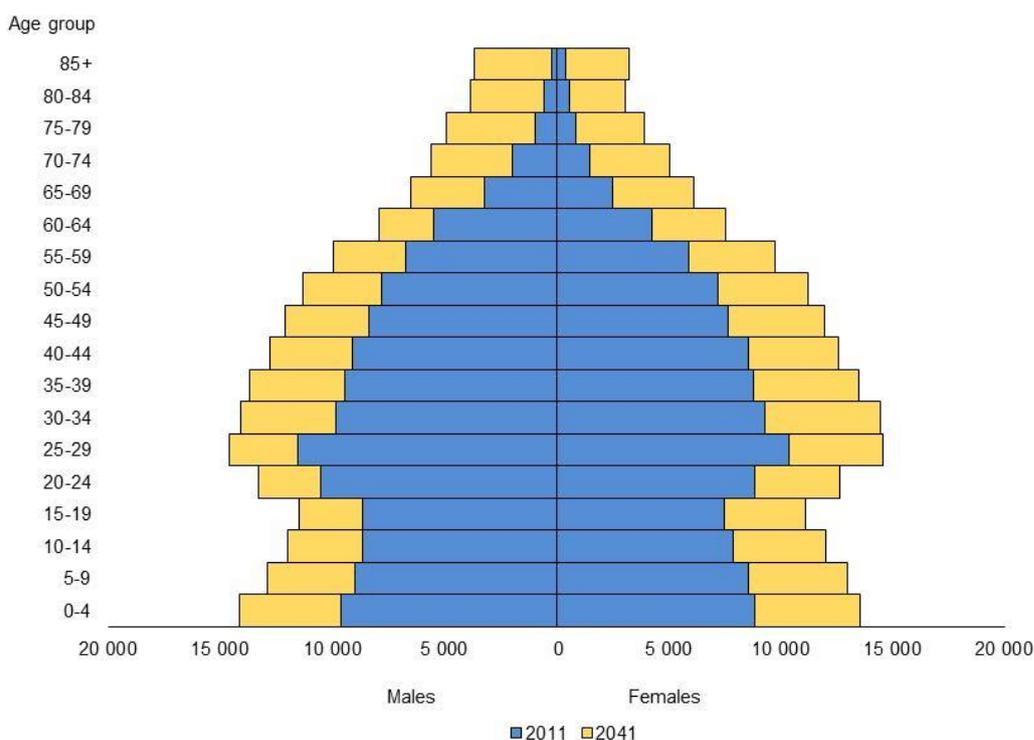
	2011	2021	2031	2041	Change 2011-41
Indigenous males	63.4	66.1	69.4	72.1	8.7
Indigenous females	68.7	71.0	73.7	76.0	7.3
non-Indigenous males	77.8	79.8	81.1	81.8	4.0
non-Indigenous females	83.1	84.6	85.6	86.1	3.0

Source: ABS Cat. Nos.3222.0, 3238.0 and 3301.055.003.

Charts 6 to 8 show the current (2011) and projected age distributions of the total Territory population, and the Indigenous and non-Indigenous populations. The shape of the age pyramids is not projected to change markedly. Although the extent of tapering in the older years lessens in the Indigenous age pyramid for 2041 due to improving life expectancy, the base (0-4 age group) widens, accentuating the pyramid shape compared with that in 2011. The shape reflects the influence of high fertility and high mortality.

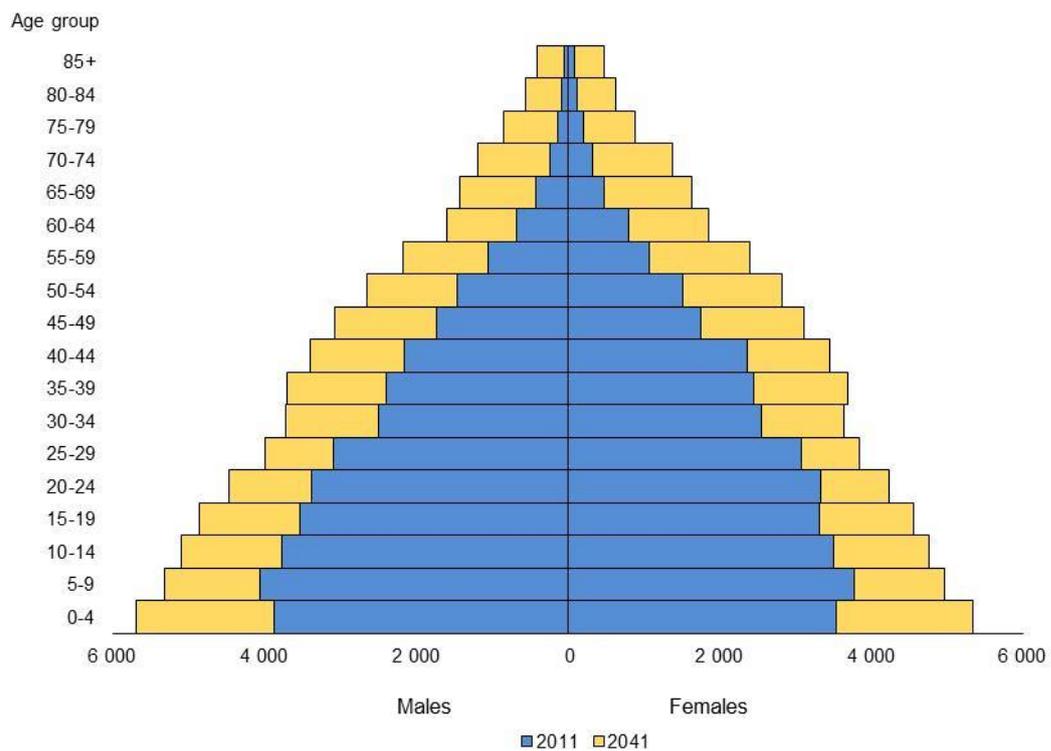
The non-Indigenous population in 2041 has a similar structure to that in 2011 as a consequence of migration churn in the middle years. The ageing of both populations can be seen in the increasing numbers of older people at the top of the pyramids.

Chart 6: Age Pyramid, Northern Territory Population, 2011 and 2041



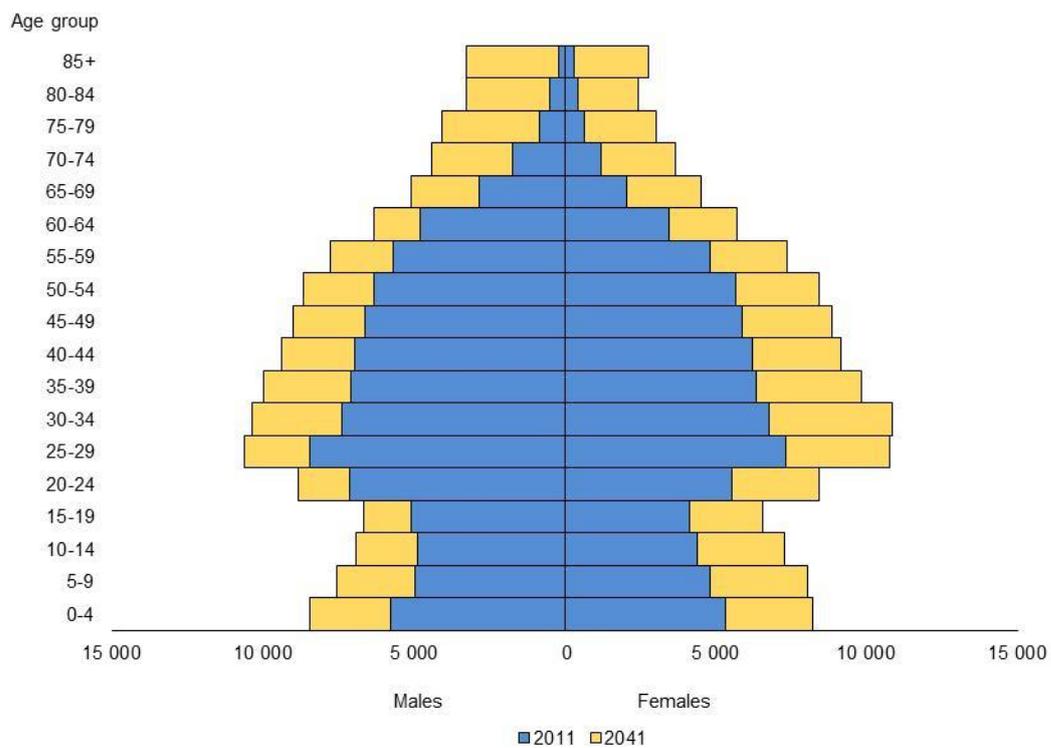
Source: Northern Territory Population Projections, Main Update (2014 Release)

Chart 7: Age Pyramid, Northern Territory Indigenous Population, 2011 and 2041



Source: Northern Territory Population Projections, Main Update (2014 Release)

Chart 8: Age Pyramid, Northern Territory Non-Indigenous Population 2011 and 2041



Source: Northern Territory Population Projections, Main Update (2014 Release)

Regional Projections

Projections are produced for six regions, which align with the boundaries of the Australian Statistical Geography Standard (ASGS) geography, which is the new geographical framework introduced by the ABS in July 2011. The ASGS has been utilised for release of data from the 2011 Census and estimates of regional populations are now released by the ABS based on the ASGS geographies. The six regions in this report and their alignment with ASGS geographies are as follows:

- Greater Darwin – aligns with the ASGS Statistical Area 4 region of Darwin, which comprises of the Statistical Area 3 (SA3) regions of Darwin City, Darwin Suburbs, Palmerston and Litchfield.
- Rest of Darwin – aligns with the SA3 region of Daly-Tiwi-West Arnhem.
- East Arnhem – aligns with the SA3 region of the same name.
- Katherine – aligns with the SA3 region of the same name.
- Barkly – aligns with the SA3 region of the same name
- Alice Springs – aligns with the SA3 region of the same name.

A map of the regions is at Appendix 3. The change to the ASGS geography means that population projections from the NTPOP model can be compared with ABS estimates and population projections. Regional projections in this release should not, however, be compared with regional projections from previous releases due to minor changes in the populations of some regions (Rest of Darwin, Katherine and Alice Springs) due to change in the regional boundaries.

Projections for the six regions are only produced for five-year periods and five-year age groups, from 2011 to 2026, reflecting the uncertainty and difficulty associated in projecting regional populations compared with the total Territory population. One of the major difficulties is the projections of intra-Territory migration by age, sex and Indigenous status due to small numbers for some age and cohort groups and the need to constrain the sum of migration for all regions to be the same as total migration at the Territory level.

The assumptions for fertility and mortality used for the Territory total projections are applied to all regions. Currently, the available births and deaths data does not support the accurate estimation of regional fertility and mortality patterns.

The results from the regional projections model (Table 8) show that the population of the Greater Darwin region is projected to increase to 172 271 persons by 2026. Growth in the region is projected to increase by an average of 2.1 per cent per annum in the five years to 2016, before decreasing to 1.8 per cent per annum on average between 2021 and 2026. The share of the Territory's population living in the Greater Darwin region is projected to increase from 55.8 per cent to 57.9 per cent in 2026.

Of the other regions, Alice Springs is projected to have the strongest growth with a projected annual average increase of 1.8 per cent in 2011-16 before decreasing to 1.5 per cent in 2021-26. Growth in the region reflects natural increase and a net gain of about 250 people per year through net migration. Net migration has a considerable influence on the level of growth and contributes to projected population growth for the Alice Springs region being much higher than the average annual growth rate over the past 10 years (0.4 per cent). The sensitivity of the population projection for Alice Springs to differences in the net migration is explored in section 7 of this report.

The higher rate of growth the Alice Springs region (compared with historical rates) may also reflect the application of fertility and mortality rates for the Territory as a whole to the regions rather than the use of region-specific rates. While publications from the Health Gains Planning Branch of the Northern Territory Department of Health indicate there could be differences in fertility and mortality rates between regions, data at lower geographic levels is not sufficiently reliable to support region-specific assumptions for these components of population growth.

Growth is projected to be lowest in the Katherine region with an annual average increase of 0.9 per cent in each of the five year periods. In this region, growth due to natural increase is partially off-set by losses due to net out-migration.

The Indigenous population is projected to grow more strongly than the non-Indigenous population in all regions except Alice Springs. In Alice Springs, stronger growth in the non-Indigenous population is projected due to relatively substantial additions from net overseas migration.

Table 8: Regional Projections and Average Annual Growth Rates (5-Year Periods)

Region	2011	2016	2021	2026	2011-16	2016-21	2021-26
	no.	no.	no.	no.	%	%	%
Greater Darwin							
Indigenous	13 960	15 744	17 889	20 299	2.4	2.6	2.5
Non-Indigenous	115 157	127 803	139 818	151 972	2.1	1.8	1.7
Total population	129 117	143 547	157 708	172 271	2.1	1.9	1.8
Share of total Territory population (%)	55.8	56.7	57.3	57.9			
Rest of Darwin							
Indigenous	12 852	13 782	14 756	15 750	1.4	1.4	1.3
Non-Indigenous	5 246	5 599	5 904	6 184	1.3	1.1	0.9
Total population	18 098	19 381	20 660	21 934	1.4	1.3	1.2
Share of total Territory population (%)	7.8	7.7	7.5	7.4			
East Arnhem							
Indigenous	10 154	10 874	11 621	12 396	1.4	1.3	1.3
Non-Indigenous	5 939	6 329	6 686	7 040	1.3	1.1	1.0
Total population	16 093	17 203	18 307	19 436	1.3	1.2	1.2
Share of total Territory population (%)	7.0	6.8	6.7	6.5			
Katherine							
Indigenous	11 283	11 896	12 587	13 353	1.1	1.1	1.2
non-Indigenous	9 117	9 435	9 752	10 005	0.7	0.7	0.5
Total population	20 400	21 331	22 339	23 358	0.9	0.9	0.9
Share of total Territory population (%)	8.8	8.4	8.1	7.9			
Barkly							
Indigenous	4 474	4 702	4 937	5 179	1.0	1.0	1.0
Non-Indigenous	2 087	2 192	2 303	2 393	1.0	1.0	0.8
Total population	6 561	6 893	7 240	7 572	1.0	1.0	0.9
Share of total Territory population (%)	2.8	2.7	2.6	2.5			
Alice Springs							
Indigenous	16 127	17 266	18 496	19 795	1.4	1.4	1.4
Non-Indigenous	24 896	27 706	30 371	32 989	2.1	1.8	1.7
Total population	41 023	44 972	48 867	52 785	1.8	1.7	1.5
Share of total Territory population (%)	17.7	17.8	17.8	17.8			

Source: Northern Territory Population Projections, Main Update (2014 Release)

Note: There may be small differences between the sum of the regional projections and the projection of the total Territory population due to the method of calculating net migration in the regional model and issues of rounding.

Comparison of Projection Releases

This section compares the output from this release (based on the 2011 Census) with the Interim Update – 2013 Release (2013 Interim Release), and the prior release of population projections in 2011, which was based on the 2006 Census (2011 Release). The releases have different start ('jump-off' years) and end points so comparison is made based on years common to all three releases – 2020 and 2030 (Table 9).

At both time periods, this release projects a higher total population than both the 2011 Release and the 2013 Interim Release. The difference is greatest between this release and the 2013 Interim Release. The differences in total population projections are mainly due to large differences in the projections for non-Indigenous Territorians between the three releases. For the non-Indigenous population, the 2014 Release consistently gives the highest projections, with the 2013 Interim Release being the lowest.

For the Indigenous population, however, the 2011 Release gave the highest projection. This is largely due to higher Indigenous 'jump-off' population assumptions in the 2011 Release, which were based on ABS projections of the Indigenous population generated following the 2006 Census. The assumption of a higher Indigenous jump-off population then flows through to subsequent years increasing the projection of the Indigenous population. Indigenous jump-off populations for the 2013 and 2014 Releases are estimated resident population figures (preliminary and final) based on the 2011 Census.

Changes in the projections between each of the releases are also a reflection of changes in other input assumptions, primarily net interstate and overseas migration assumptions.

Table 9: Comparison of 2014 Main Release Projections with Previous Projections at Years 2020 and 2030

2020	2011 Release (2006 Census based)	2014 Main Release (2011 Census based)	Difference	2013 Interim Release (2011 Census based)	2014 Main Release (2011 Census based)	Difference
NT Total						
<i>Indigenous</i>	80 778	79 040	1 738	77 790	79 040	- 1 250
<i>Non-Indigenous</i>	186 229	191 676	- 5 447	185 165	191 676	- 6 511
<i>Total</i>	267 077	270 716	- 3 639	262 954	270 716	- 7 762
Age Structure						
<i>15 years and under</i>	64 261	60 314	3 947	60 485	60 314	171
<i>15-64 years</i>	183 242	186 870	- 3 628	183 115	186 870	- 3 755
<i>65 years and over</i>	19 574	23 531	- 3 957	19 354	23 531	- 4 177
2030						
NT Total						
<i>Indigenous</i>	94 018	92 120	1 898	88 358	92 120	- 3 762
<i>Non-Indigenous</i>	215 459	222 994	- 7 535	212 045	222 994	- 10 949
<i>Total</i>	309 477	315 114	- 5 637	300 403	315 114	- 14 711
Age Structure						
<i>15 years and under</i>	73 390	69 272	4 118	67 311	69 272	- 1 961
<i>15-64 years</i>	209 639	210 613	- 974	207 104	210 613	- 3 509
<i>65 years and over</i>	26 448	35 229	- 8 781	25 988	35 229	- 9 241

Source: Northern Territory Population Projections, Interim – Update (2013 Release) and Main Update (2014 Release)

7. Sensitivity Analysis – the Effect of Change in the Assumptions for Migration, Fertility and Mortality

As emphasised previously, the population projections provided in this report are not forecasts or predictions, but are the consequence of the compounding effects of assumptions made about the future components of growth. Many different approaches could be taken to developing the assumptions for the projections; however, for the projections presented in this report, it was decided that the underpinning assumptions would be based on recent historical data, and where possible for a period of ten years. Accordingly, when considering and interpreting these projections it is helpful to be aware of the consequences of making different assumptions for each of the key parameters.

This section presents results from analyses where key input assumptions are varied. In addition, there are two examples which explore what changes in parameter values would be required to modify the projected populations in a specified way.

Scenarios to Explore the Sensitivity of Projections to Varying Key Assumptions about the Components of Growth

The NTPOP model partitions the elements of population change into four components - interstate migration, overseas migration, births and deaths. NTPOP calculates the contribution to population growth of each of these components from a number of variables and parameters, but each component has only one primary parameter summarising the manner in which that component is assumed to change on an annual basis. These key parameters are respectively: net interstate migration (NIM), net overseas migration (NOM), female total fertility rate (TFR) and life expectancy from birth (LE). The analyses presented below describe the results of various projection scenarios in which these four parameters are varied from those used to produce the projections presented in this report.

Interstate Migration Scenarios

The principle driver of volatility in the Territory's annual population growth rate is NIM (refer Chart 4). The following scenarios explore the effects of some alternative NIM assumptions on the Territory's projected population over the medium and long term.

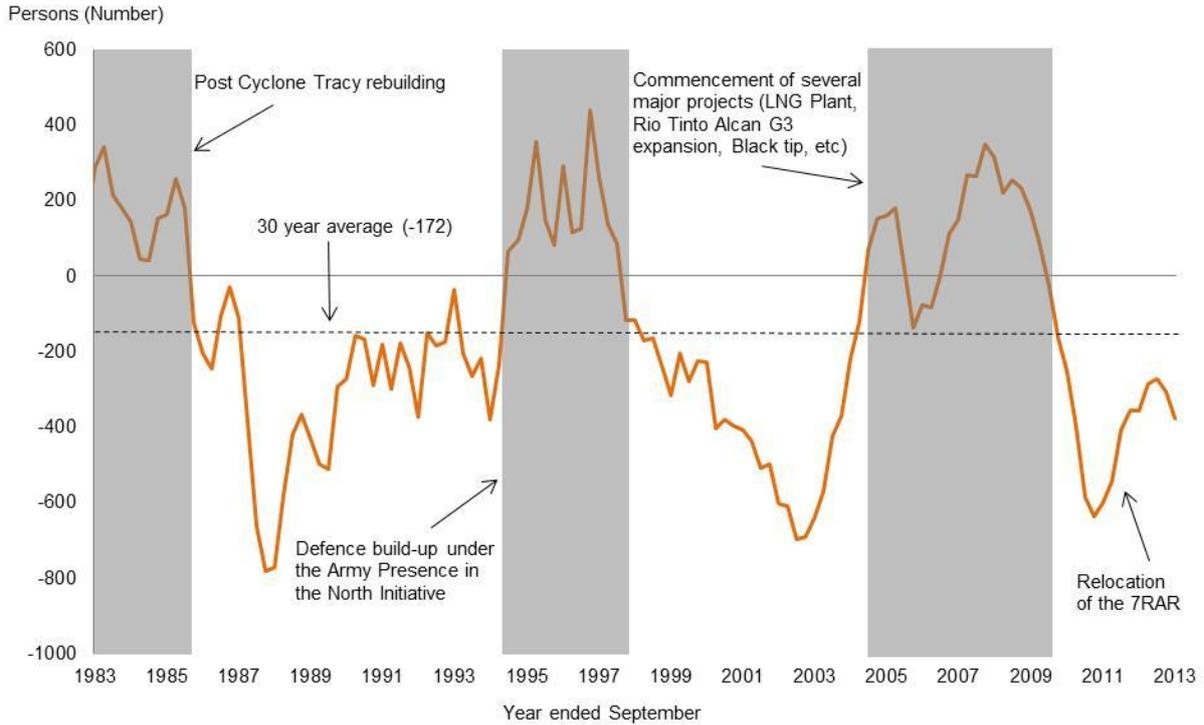
The annual net interstate flow for the Territory has ranged from a low of -3129 to a high of +1754 over the last three decades. In the short term, positive NIM related to the construction of major projects can drive above average growth while negative NIM can follow the completion of major construction projects or in periods of economic downturn. Consequently, fluctuations in net interstate migration tend not to be randomly distributed in time, but broadly follow the cycles of economic activity (refer Chart 9).

It is not possible to make realistic long-term assumptions about the timing or size of future economic cycles or about cycles of NIM. Accordingly, the NIM assumptions used to develop the NT Population Projections are based on the immediate past historical average, calculated over a reasonable period of time (in this instance 10 years).

However, to demonstrate the influence of interstate migration on the projections, various scenarios have been developed by assuming different levels of annual NIM and holding all other parameters fixed. The following annual NIM assumptions were modelled: -1000, -500, 0, 500 and 1000. Chart 10 shows the resulting projected Territory population as well as the projected population from this report (refer Table 2 and Appendix 2 for the NIM assumptions for the NT Population Projections).

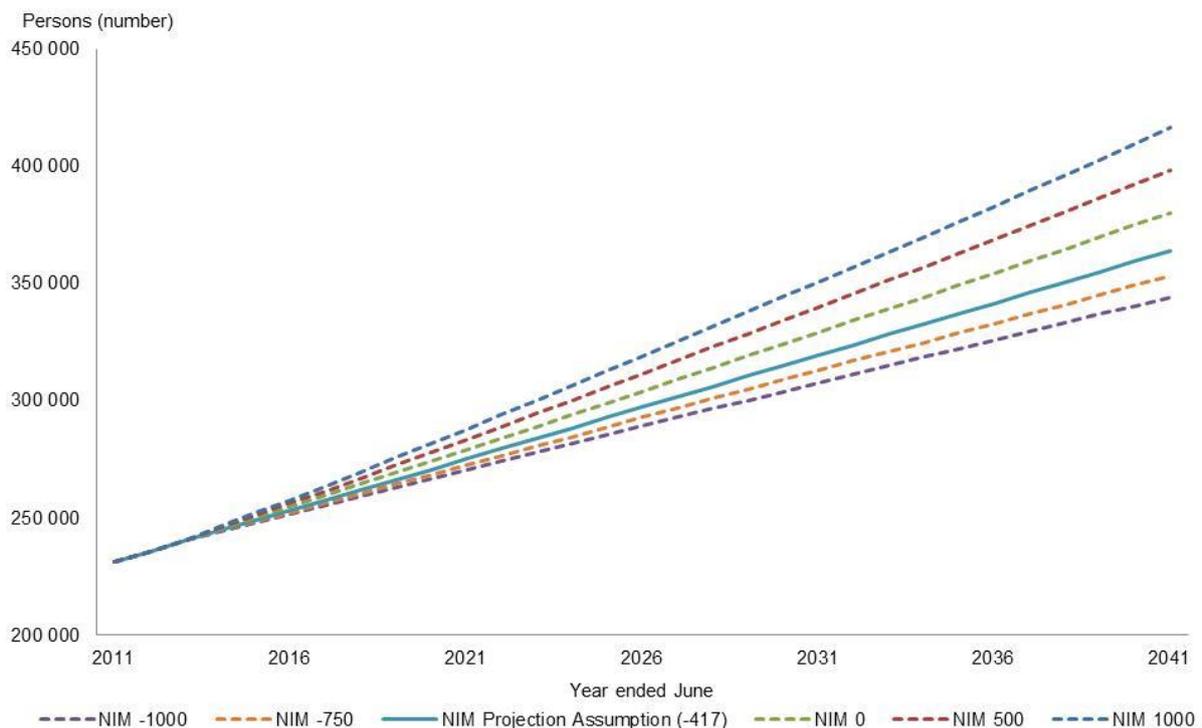
It is noted that all of the 10 year annual averages for NIM that can be calculated for the period between 1983 and 2013 are within the range of -1000 to 0. Thus, if future Territory growth turns out to be comparable to the last few decades, in the medium to longer term interstate migration could be expected to have an impact on the Territory population of somewhere between -1000 and 0 scenarios shown in Chart 10. The difference in between the -1000 and 0 scenarios reached about 36 000 people in 2041 (that is, after 30 years of growth).

Chart 9: Net Interstate Migration, Quarterly Moving Annual Average, and the Occurrence of Major Events, Northern Territory, 1983 to 2013



Source: ABS. Cat. No. 3101.0

Chart 10: Territory Population Projection Scenarios using Different NIM Assumptions



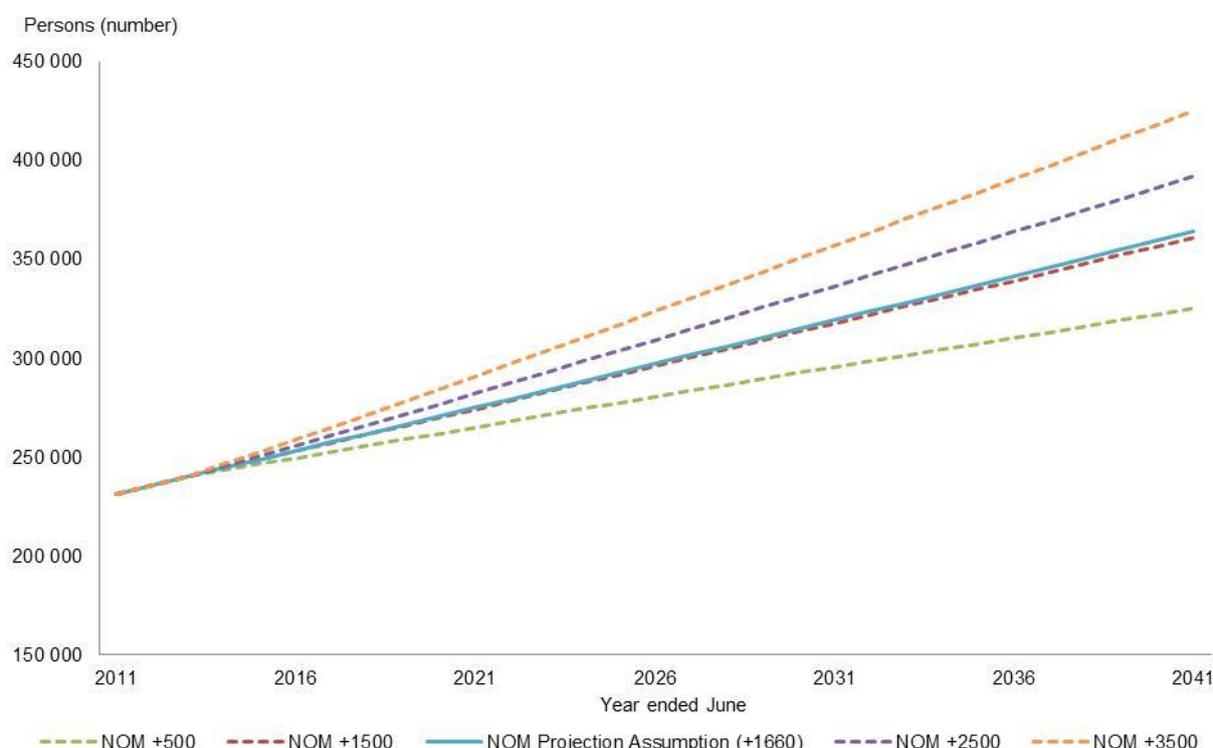
Overseas Migration Scenarios

Until recent years NOM to the Territory has tended to be much more predictable than interstate migration (refer Chart 1). Unlike NIM, annual NOM is always been positive over the last three decades and usually within the range of +400 to +600 per year. In recent years, however, the Territory’s annual NOM has increased substantially, so much so that in the past two years it has overtaken natural increase (births minus deaths) as the primary contributor to population growth.

It is not possible to say with any certainty whether this increased annual NOM is likely to be maintained into the future. Consequently, there is greater uncertainty for the current Northern Territory Population Projections arising from the assumed value for NOM than for previously produced Northern Territory projections.

In Chart 11 the consequences for the projected Territory population of alternative future values of the average annual NOM are displayed. The plausible range of NOM modelled in Chart 11 spans the relatively low values of annual NOM recorded in the early 2000s to the recent record highs of 2012 and 2013. In comparison with Chart 10 and considering the commentary of the previous section, it is evident that the range of NOM modelled here has a similar influence on possible future population projections as the corresponding NIM scenario simulations. Indeed, the difference in between the +500 and +2500 NOM scenarios (that is, a projected extra 2000 migrants per annum) accumulated to about 67 000 people by 2041, which is about double the impact of an additional 1000 NIM (the difference between the -1000 and 0 NIM scenarios).

Chart 11: Territory Population Projection Scenarios using Different NOM Assumptions

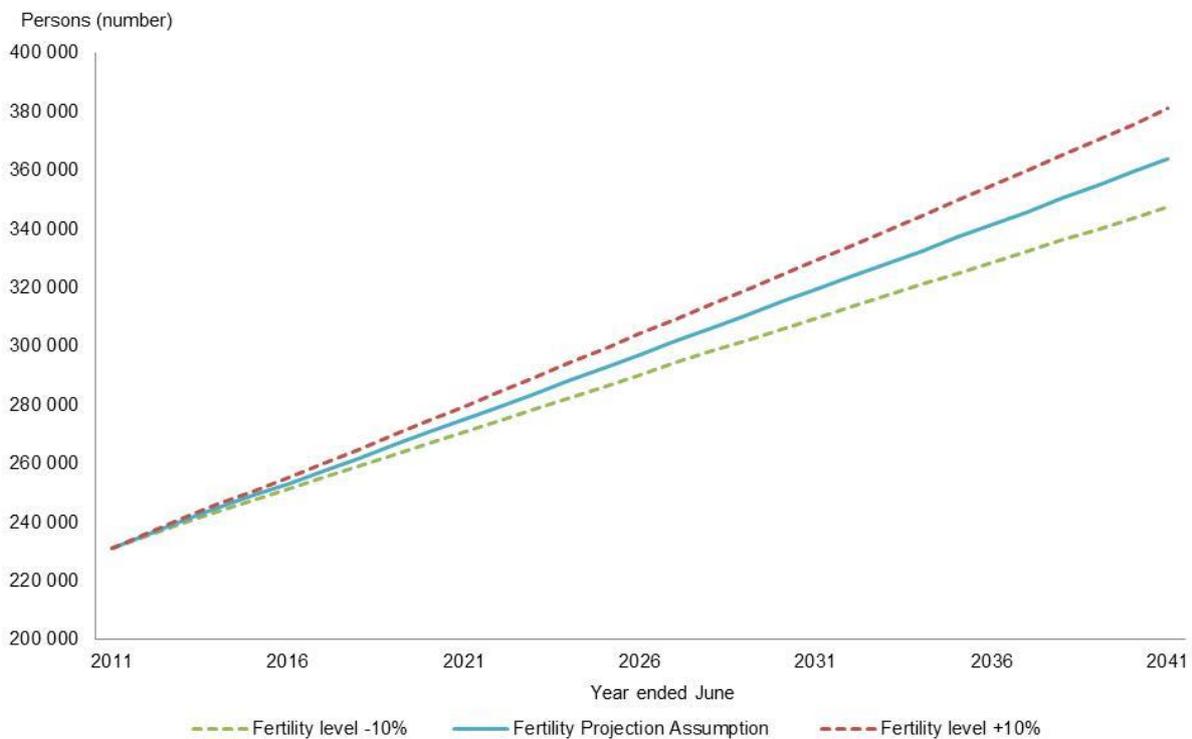


Fertility

While fertility within a population can exhibit long term trends, it tends not to fluctuate sharply over short periods. Over a 25 year period, however, it is possible that the average total fertility rate for women (TFR) could be 10 per cent higher or lower than the figure of slightly more than 2.0 assumed for the projections in this report. The TFR used in the NT Population Projections is derived from evidence over the recent years with further detail provided in Appendix 2.

Chart 12 demonstrates the effect of assuming fertility to be consistently 10 per cent higher and 10 per cent lower than the assumptions for the NT Population Projections. The effect is not insubstantial, but much less that the impacts of possible variation in migration (interstate or overseas).

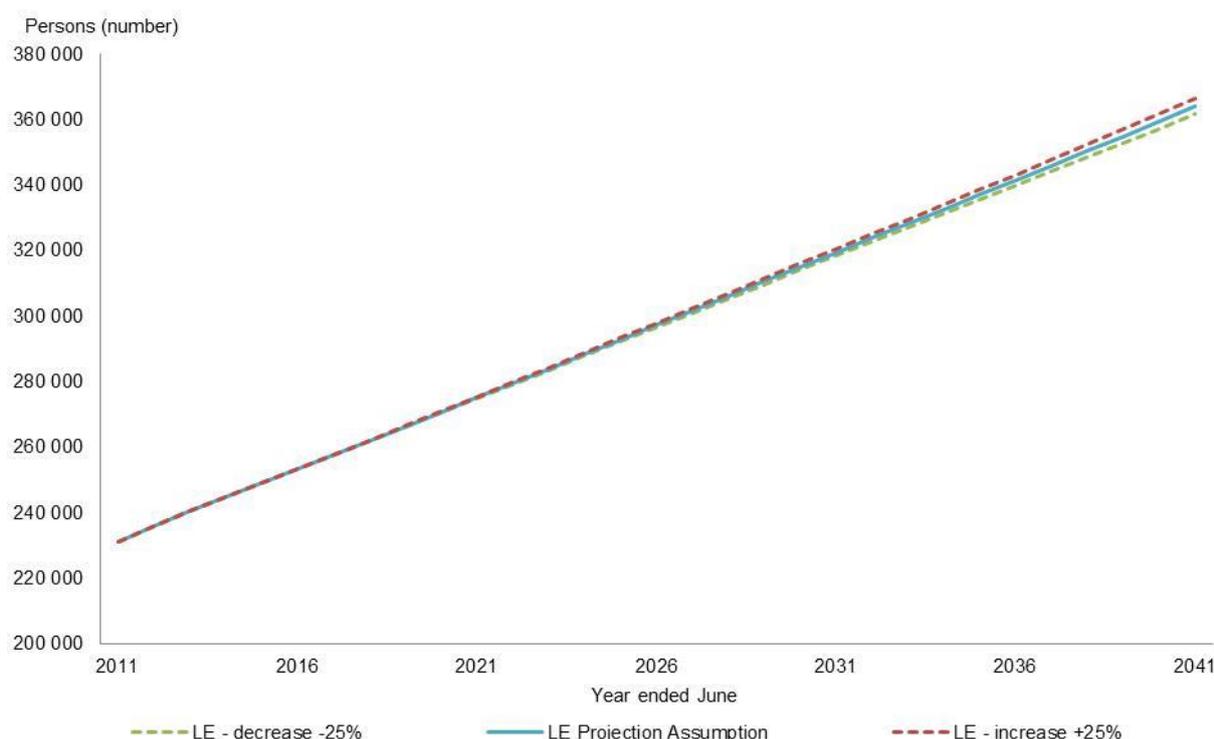
Chart 12: Territory Population Projection Scenarios using Different TFR Assumptions



Life Expectancy

Life expectancy from birth is perhaps the most predictable of the key population growth parameters. Life expectancy is on an upward trajectory for all segments of the Australian population even though there may be some uncertainty about the rate of increase of life expectancy improvements in future years. Information on the life expectancy (LE) assumptions for the NT Population Projections can be found in Table 2 and Appendix 2.

The scenarios illustrated in Chart 13 show the consequences of LE increasing at the assumed rates in the NT Population Projections plus and minus 25 per cent of that rate. It is noted that such a range is unlikely to be reached in the near future; rather, the range is chosen for illustrative purposes. Chart 13 demonstrates that the modelled changes to LE have little effect on projected total population size or growth rate. The age-composition of the projected future population (not shown) would, however, be much more susceptible to variations in LE.

Chart 13: Territory Population Projection Scenarios using Different LE Assumptions

Scenario Modelling to Understand Particular Counter-intuitive Projection Results

Close inspection of the detailed features of any set of population projections inevitably reveals some aspects of the projected populations that are in some sense counter intuitive or different to pre-conceived ideas of the likely future. By selecting different values for key parameters, the NTPOP model can be used to explore the possible factors behind specific features of interest in the projection results. In particular, it is possible to identify what value of a key parameter would be necessary to eliminate or reduce substantially an unexpected or counter-intuitive result.

While it could be argued that the NT Population Projections should be determined after a process of repeated re-runs of scenarios in which all 'unexpected' results are eliminated, such a process has not been followed because, in part, there is a fine and subjective line between what are 'unexpected' and what are 'unwanted' projection results. Hence, in eliminating 'unexpected' results there would be a danger of introducing undesirable subjectivity into the projection process. Further, if absence of the unexpected, or agreement with preconceived ideas, were to be the sole or major criterion for determining which set of population projections to adopt for reporting then there would be no need for modelling. On the contrary, all that would be needed is to document those preconceived ideas.

The following two case studies demonstrate issues of counter-intuitive results and use of the NTPOP model to investigate these issues. The examples are provided for information and illustration purposes to assist users in understanding and interpreting the projections. The reported projections have not been adjusted based on these case studies as any changes that could be made would be subjective.

Case Study 1: Projected Unequal Growth in Numbers of Non-Indigenous Males and Females in the Northern Territory

In this example, it was observed that the projected growth by 2041 in numbers of non-Indigenous males in the Territory in the age range 14-24 years is much less than the

corresponding figure for non-Indigenous females (refer Chart 8). While there are many factors in the dynamics of a growing population which could give rise to this phenomenon, it was observed that the age-sex specific migration profiles for non-Indigenous migrants to the Territory that were used as inputs into the NTPOP model tended to contribute more to growth in the number of females in this age range than was the case for males (i.e., in-migration probabilities were greater for females than for males and the reverse was true for out-migration probabilities). To determine whether this feature of the Territory's migration was sufficient to give rise to the observed gender differences in this age group a projection scenario was run in which in and out migration probabilities for males were forced to be the same as those for females. The projections from this scenario (not shown) demonstrated that this change alone in the NTPOP model's assumptions largely removed the observed gender growth discrepancy among non-Indigenous youths.

While this scenario provides insight into a counter-intuitive projection result, it should be noted that the values assumed for the in- and out- migration probability parameters in the reported projections were derived from the best available historical evidence, namely, the average over the past three Censuses of records of movements of males and females to and from the Territory. Therefore, there are no objective grounds for changing the parameter values for the reported projections.

It is possible that the passage of time will prove intuition to be correct and gender balance in the growth of these age groups will be closer to one than indicated by the projections. Should this be the case, it may reflect limitations in the data from which the parameter values were constructed, or that the NTPOP model could be overly simplistic in its construction. Only time will tell whether this will be the case or whether future growth in the numbers of young non-Indigenous female Territorians outstrip the growth in the number of males, as occurs in the reported projections.

Case Study 2: Projected Relatively Strong Future Growth in Alice Springs

This example relates to the population projection for the Alice Springs region which, as noted in Section 6, has a growth rate somewhat larger than might be expected based on recent historically reported growth rates. Inspection of the input assumptions to produce these projections shows that net migration to Alice Springs region, largely calculated from the evidence provided in movement statistics from the 2011 Census, may be higher than expected by comparison with assumed net migration for other Territory regions.

A projection scenario was run in which net in-migration to the region was reduced by 100 people per year (down from about 250 to about 150). This lowered annual average growth for the Alice Springs region by 2.4 percentage points (from 1.7 per cent to 1.5 per cent), which was closer to expectation, but still high based on historical comparisons.

This scenario indicates that the unexpectedly elevated projected growth rates (compared with recent historical trends) are only partly accounted for by lowering annual regional net in-migration assumptions by 100 people per year. This suggests that a larger reduction in net regional migration would be needed to produce projected populations for the region that are more consistent with what might be expected given historical trends.

Conversely, a number of other alternative or partial explanations are possible. For instance, Alice Springs women may have lower fertility than women from other parts of the Territory (as noted in section 6, fertility has been assumed to be the same across regions). Mortality could also be higher. A further possibility is that expectations regarding Alice Springs regional growth rates could be inaccurate, for example, this could occur if previous growth estimates were too low because of low and possibly inaccurate previous local population estimates (regional populations are difficult to estimate and may incorporate errors of some hundreds of people).

Appendix 1: Technical Details of the NTPOP Population Projections Model

In addition to the summary presented below, interested readers are referred to the DTF website <https://treasury.nt.gov.au/dtf/economic-group/population-projections> for the mathematical details of NTPOP (Wilson, T, Mathematical details of the NTPOP projection model, School for Social and Policy Research, CDU, Darwin).

The projections in this report were produced using the NTPOP projection model, a cohort-component model designed specifically for the Territory to project both Indigenous and non-Indigenous populations.

The model produces projections of the population disaggregated by:

- sex (male and female);
- Indigenous status (Indigenous and non-Indigenous);
- region (Northern Territory, six Territory regions, and rest of Australia); and
- single-year and five-year age cohorts.

Projected population numbers are calculated at 30 June for each year of the projection horizon, and demographic components of change reflect the year to 30 June.

For the population of the Territory and the rest of Australia, each cohort (age, sex, Indigenous status and region) is individually considered in the projection model. Projection calculations proceed in one-year intervals, from 30 June one year to 30 June in the next. During every projection interval various population increments are added to each initial population component and others are subtracted, deriving the updated projected population for the end of the year. These increments are known as the demographic components of change (hence the description 'cohort-component' model).

The population accounting equation in the NTPOP model is:

Population at time t = population at time $t - 1$ + (births - deaths) + (interstate in migration - interstate out migration) + (overseas arrivals – overseas departures).

For the Territory regions, interstate, intra-region and overseas migration are combined into one net migration input figure which represents the expected net flow of migrants to the region over a five-year period. The conceptual basis is, however, essentially the same as that presented above with the components of growth being added to or subtracted from the initial population.

Projection assumptions and parameters are required for each component of the population equation for Indigenous and non-Indigenous populations for the Territory, the rest of Australia and each Territory region for each year of the projection period.

Demographic components of change in the accounting equation are calculated by multiplying rates by populations, for example: deaths = death rate \times population; or in the case of net migration, set as numbers directly.

More information on these calculations is provided in the following section.

Components of NTPOP Population Projections Model

Jump-Off Year

The current version of the model commences from 30 June 2011. The population at 30 June 2011 (referred to as the “jump-off” population) is the final ERPs for the Indigenous and non-Indigenous populations of the Territory and Australia, based on the 2011 Census. The “jump-off” populations were derived in the following way:

- ERPs by five year age group were sourced from ABS Publication, 3238.0.55.001 Estimates of Aboriginal and Torres Strait Islander Australians, Jun 2011.
- Single age profiles found in the Census data were used to proportionately generate single age estimates.
- A basic smoothing technique was applied to address the issue of five-year age heaping found in the Census data, a major issue for the Territory’s Indigenous population.
- Jump-off populations for the six regions by five year age groups and Indigenous status were based on SA3 ERPs sourced by consultancy from the ABS.

NTPOP Projection of Cohort Births

The projection of the cohort born in each projection interval is performed in a three step process.

1. The number of babies born by Indigenous status of mother is projected by multiplying age-specific fertility rates by the female population in each single-year age group from 15 to 49 years. This gives projected births to Indigenous mothers and non-Indigenous mothers.
2. All births to these two groups of mothers are assigned an Indigenous status according to predetermined proportions. All births and mothers are then cross-classified by their Indigenous status giving rise to a four-fold classification of infants:
 - a) Indigenous births to Indigenous mothers;
 - b) non-Indigenous births to Indigenous mothers;
 - c) Indigenous births to non-Indigenous mothers; and
 - d) non-Indigenous births to non-Indigenous mothers.

Babies in groups (a) and (c) are then grouped as the total number of Indigenous births; (b) and (d) as the non-Indigenous births.
3. The resulting Indigenous and non-Indigenous infant cohorts then have various components of change added or subtracted in the same manner as for other cohorts. The previous accounting equation is modified slightly, with births replacing the start-of-year population.

Geography

The projection model considers Australia to be divided into two geographic regions: Northern Territory and the ‘rest of Australia’. Migration between the two geographic regions is allowed, as is migration into and out of Australia through either of the regions. Within the Territory, migration is allowed between the regions, as well as to and from the rest of Australia and overseas.

Parameter Setting

All demographic rates are split into two parts: a summary indicator and an age profile.

Fertility

For the fertility component, the user needs to set the total fertility rate (TFR) and a fertility age profile for the females of each population group. The fertility age profile consists of age-specific fertility rates. Once the fertility age profile has been set, it does not need to be changed again; however, at the five yearly review, consideration should be given as to whether new information warrants a change to the profile. In contrast, the TFR can be easily changed allowing different scenarios to be explored.

The NTPOP model applies TFRs to four population sub-groups (Territory Indigenous mothers; Territory non-Indigenous mothers; rest of Australia Indigenous mothers; rest of Australia non-Indigenous mothers), adjusts for the percentage of Indigenous births to these mothers, and uses the age-profiles of fertility at each reproductive age to calculate age-specific fertility rates. The projected numbers of births are then calculated by multiplying the age-specific fertility rates by the relevant populations.

The input parameters are TFRs, sex ratios at birth, the percentage of Indigenous births, and age profiles of fertility for each of the population subgroups of mothers and for each year of the projections. Different fertility scenarios can be explored by changing the TFRs.

Mortality

The NTPOP model uses life expectancies at birth for eight population sub-groups (Territory Indigenous males; Territory Indigenous females; Territory non-Indigenous males; Territory non-Indigenous females, rest of Australia Indigenous males; rest of Australia Indigenous females; rest of Australia non-Indigenous males; rest of Australia non-Indigenous females) and age-specific death rates (ASDRs) to calculate numbers of deaths for each of the groups for each year of the projections.

Inputs are the life expectancies at birth for each year of the projections and a mortality rate surface based on ASDRs for each of the eight population sub-groups. Different mortality scenarios can be explored by changing the life expectancy at birth estimates.

Interstate Migration

The NTPOP model calculates in-and out-migration differently. The user defines a net interstate migration figure and an out-migration figure is added to this to obtain a total in-migration figure. The out-migration figure is calculated by multiplying the Territory population by age-specific out-migration rates. These out-migration rates are known as gross migration rates (GMRs) and are inputs to the model. They are similar in concept to TFRs in that they are the sum of all the age-specific migration rates. The GMR represents the total number of out-moves a person might make in his or her lifetime.

Numbers of in-migrants by age and sex are calculated by applying the age and sex-specific rates of in-migration to the Territory from the rest of Australia to the population of rest of Australia. These numbers are then scaled so they sum to the total in-migration figure calculated as above. This ensures that sensible in-migration numbers are maintained.

Inputs are:

- Net interstate migration (NIM) numbers for the Territory for each year of the projections for: (i) Indigenous males; (ii) Indigenous females; (iii) non-Indigenous males; and (iv) non-Indigenous females.

- GMRs for out-migration from the Territory (to the rest of Australia) for each year of the projections for: (i) Indigenous males; (ii) Indigenous females; (iii) non-Indigenous males; and (iv) non-Indigenous females.
- Age profiles of interstate in-and out-migration for each year of the projections for the same four categories as above. Age-specific migration rates are stable over time, and as a consequence, these age profiles remain fixed over the life of the projections.

Different interstate migration scenarios can be explored by changing the NIM numbers.

Overseas Migration

Immigration (migration into Australia from overseas) is projected as numbers rather than rates. It is common practice to use numbers rather than rates in the projection of immigration for several reasons including: (i) the origin population for immigration is the rest of the world, so taking a 'rates times origin population' approach would require projections for the rest of the world; and (ii) unlike many other demographic variables, immigration has little to do with the global population size and more to do with things like migration policy and major refugee generating events.

Emigration (migration from Australia to overseas) is calculated by multiplying emigration rates by the origin (Territory or rest of Australia) population and then scaling to the user-defined total. By having a user-defined total for emigration, it is possible to also indirectly set net overseas migration totals because, as described above, immigration assumptions are also set in terms of numbers.

Inputs are:

- Immigration totals for each year of the projections for: (i) Territory Indigenous males; (ii) Territory Indigenous females; (iii) Territory non-Indigenous males; (iv) Territory non-Indigenous females; (v) rest of Australia Indigenous males; (vi) rest of Australia Indigenous females; (vii) rest of Australia non-Indigenous males; and (viii) rest of Australia non-Indigenous females.
- Emigration totals for each year of the projections for each of the eight categories above.
- Age profiles of immigration and emigration for each of the eight categories above. These age profiles remain fixed over time in the model.

Different overseas migration scenarios can be explored by changing the immigration and emigration numbers.

Regional Migration

A net migration figure for each of five year period in the 15 year regional projection horizon is required for the Indigenous population and the non-Indigenous population for each of the six regions. The net migration figure is the sum of intra-region, interstate and overseas migration.

Different overseas, interstate and/or intra-region migration scenarios for the regions can be explored by changing the net migration figures; however, the interstate and overseas components of the net migration figure must sum across the regions to the same total figure for net interstate and overseas migration for the whole of the Territory. Net intra-region migration sums to zero across the regions.

Changes in Indigenous Identification

Direct migration between the Indigenous and non-Indigenous populations is possible in the NTPOP model, simulating changes in the propensity for people to change their Indigenous

status. This is a unique feature of the model, but currently the lack of available information about people's propensity to identify as Indigenous means that it has not been feasible to set meaningful values for these parameters. Hence, at present changes in identification, which are projected as rates multiplied by populations, are set at zero.

Appendix 2: Notes on Data Sources and Assumptions in the Main Update

Key publications

Key ABS publications used in setting assumptions and parameters in the Main Update are:

- 3101.0 - Australian Demographic Statistics, June 2013 (released 17/12/2013);
- 3222.0 - Population Projections, Australia, 2012 to 2101 (26/11/2013);
- 3238.0 - Experimental Estimates and Projections, Aboriginal and Torres Strait Islander Australians, 1991 to 2021 (08/09/2009);
- 3238.0.55.001 – Estimates of Aboriginal and Torres Strait Islander Australians, June 2011 (30/08/2013);
- 3301.0 - Births, Australia, 2012 (24/10/2013); and
- 3412.0 - Migration, Australia 2011-12 and 2012-13 (18/12/2013).

ERP by five year age group, sex and Indigenous status at SA3 level in the Territory were sourced by the ABS by consultancy. Census data was sourced using TableBuilder Pro, under the NTG licence.

Fertility

There are two potential sources for fertility data in the Territory – ABS Cat. No. 3301.0 and the NT Midwives Collection maintained by the Department of Health. ABS data was chosen as the more complete collection as it records interstate births to Territory mothers (omitted from the NT Midwives Collection) and adjusts for interstate births in the Territory. The NT Midwives Collection provides a greater level of detail on mothers and babies than ABS data, which can usefully inform population projections, particularly future trends.

TFR

Territory TFRs were based on a seven year average over the period 2006 to 2012 from ABS Cat. No. 3301.0. Fertility rates were calculated for each five year age group (15 to 49 years) in each year of the seven-year period for Indigenous and non-Indigenous women. The TFR for each year was derived from the fertility rates for five year age groups. The average TFR over the seven year period was used in the Main Update (2.401 births per Indigenous woman and 1.927 births per non-Indigenous woman).

The number of births required for the numerator in the calculation fertility rates was available from ABS Cat. No. 3301.0. There were, however, several options for the selection of an age-specific population estimate for the denominator including backcast projections of the Indigenous population based on the 2011 Census. It was decided to use estimates of the Indigenous population from ABS Cat no. 3238.0, based on the 2006 Census, for the population estimates as this population was likely to be consistent with the population identifying as Indigenous over the period 2006-2012. Age-specific population estimates for non-Indigenous women are the total age-specific female population in the Territory (from ABS 3101.0) less the number of Indigenous women (as per ABS 3238.0).

A clear trend was not evident in the Indigenous and non-Indigenous TFRs over the seven year period. Following consultation with the Department of Health, the TFRs were set at the seven year average and held constant across the projection period.

Sex ratios at birth

Territory sex ratios at birth for Indigenous mothers were calculated as the eight year average (2005 to 2012) number of male births divided by the eight year average number of female births, based on data from ABS Cat. No. 3301.0 (106.12 males per 100 females). The sex ratios at birth for non-Indigenous mothers were derived using the same method and data source (105.27 males per 100 females).

Percentage Indigenous births

The Territory's percentage of Indigenous births to non-Indigenous mothers was derived using numbers of total births, total Indigenous births and births to Indigenous mothers from ABS Cat. No. 3301.0. The percentage of births to non-Indigenous women, which are Indigenous, was calculated for eight years (2005 to 2012) and the average of the eight years was used in the Main Update (4.91 per cent of births to non-Indigenous women).

There was no clear trend in the eight year period so the percentage of births to non-Indigenous women was held constant across the projection period. The percentage of Indigenous births to Indigenous mothers was set to 100 per cent in all years of the projection period.

Age Profiles of Fertility

The age profiles of fertility for Indigenous and non-Indigenous women in the Territory were updated using the average age specific fertility rates over the eight years from 2006 to 2012 (from ABS 3301.0). This was the first update of the age profile since modelling commenced in 2009. The age profiles from the original model used data from the 1990s and early 2000s.

The average fertility rates by five year age group were interpolated to single year of age rates by allocating the fertility rate to the middle year in each age group (e.g., age 17 in the 15 to 19 age group) and fitting the single year of age rates between these points in a linear manner until all values summed to the TFR. The single year profiles were converted to a proportional format to fit the requirements of the NTPOP model.

Mortality

Life expectancies

Indigenous and non-Indigenous life expectancies in the Territory were based on data from ABS Cat. No. 3302.0.55.003. The ABS life expectancy at birth in 2010-2012 for Indigenous males (63.4 years) was used for the jump-off year (2011-12) then increased at a constant rate of 0.3 years per annum in subsequent years. The ABS life expectancy at birth in 2010-2012 for Indigenous females (68.7 years) was used for the jump-off year and increased at a constant rate of 0.25 years per annum in subsequent years. Life expectancy at birth for non-Indigenous males (77.8 years) and non-Indigenous females (83.1 years) were increased in accordance with estimates of declining improvement in life expectancy (ABS medium assumption).

Mortality rate surface

The mortality rate surfaces are based on national ASDRs by Indigenous status and sex. Thus, the mortality rate surface is the same for Indigenous male Territorians and that for the Rest of Australia Indigenous males, but differs from the surfaces for Indigenous females and non-Indigenous males and females. The mortality rate surfaces are based on data, which is now over a decade old; however, update of the surfaces including derivation of Territory-specific surfaces would constitute a major research project beyond what was possible for the current review of the NTPOP model.

Regional Fertility and Mortality

The same Indigenous and non-Indigenous TFRs as for the Territory total population (see previous sections) are used for all six regions. There is uncertainty over the data on place of usual residence for mothers giving birth in the Territory, hence the TFRs published by the ABS for regions are not considered accurate.

Mortality is assumed to be the same for all regions as for the Territory as a whole. This is thought not to be the case; however, there is insufficient accurate data to justify an alternative approach.

Interstate Migration

Gross Migration Rate

The gross migration rate (GMR) was updated using data from the 2011 Census on the place of usual residence one year ago. The GMR was calculated as the sum of the age specific probabilities of out-migration. Out-migration probabilities for each single year of age were calculated by dividing out-migrants (the number of people whose usual residence at the Census was another state/territory, but one year before Census their usual residence had been in the Territory) by the 'at risk' population (out-migrants plus people whose usual residence at Census and one year before Census was the Territory).

The GMR from the 2011 Census was used in the jump-off year of the projections. Trends in the GMRs were determined by evaluating the linear trend over seven Censuses (five yearly from 1981 to 2011) to give sufficient data points for the analysis. The resulting GMRs were:

- Indigenous males: GMR of 1.50 in 2011-12, decreasing to 0.93 in 2040-41;
- Indigenous females: GMR of 1.48 in 2011-12, decreasing to 0.76 in 2040-41;
- Non-Indigenous males: GMR of 8.03 in 2011-12, increasing to 8.72 in 2040-41; and
- Non-Indigenous females: GMR of 8.05 in 2011-12, decreasing to 7.47 in 2040-41.

Net Interstate Migration

Territory annual net interstate migration was set to -1423 persons in 2011-12 and -1220 persons in 2012-13, being estimates of actual net migration for these years as published in ABS Cat. No. 3101.0. From 2013-14 onward, the average level of net interstate migration over the 10 year period from 2003-04 to 2012-13 (-452) was used. Indigenous net migration in each year was calculated according to the average proportion (8 per cent) of Indigenous Census net migration (based on place of usual residence one year ago) from the 2001, 2006 and 2011 Censuses.

The actual (2011-12 and 2012-13) and average (2013-14 onwards) proportion of male and female net migration, based on ABS data, was apportioned between Indigenous and non-Indigenous males and females according to their relative contribution derived from Census data. From 2013-14 onward, annual net migration for the Territory was distributed as follows:

- Indigenous males: -18 persons;
- Indigenous females: -17 persons;
- Non-Indigenous males: -195 persons; and
- Non-Indigenous females: -222 persons.

Age Profiles of Interstate Migration

The age profiles of out-migration and in-migration for the Territory were updated based on the average age profile of Census migrants from the 2001, 2006 and 2011 Censuses. The Census variable used to determine migration status was the place of residence one year ago.

The Indigenous age profiles were smoothed using a polynomial trend to reduce volatility across the age profile. No smoothing was performed on the non-Indigenous age profiles.

Each profile (out-migration by sex; in-migration by sex) was converted to a proportional format to fit the requirements of the NTPOP model.

Overseas Migration

Immigration, Emigration and Net Overseas Migration

Net overseas migration for Indigenous people for the Territory is set at zero.

For non-Indigenous people, immigration, emigration and net overseas migration data for 2011-12 and 2012-13 was sourced from ABS Cat. No. 3101.0. Overseas migration for 2011-12 (a net of 3018 persons) and 2012-13 (a net of 3065 persons) are actuals. Immigration and emigration for males and females from 2013-14 onward were set at the nine year average to June 2013. Net overseas migration was calculated as immigration less emigration. The resulting net overseas migration from 2013-14 onward was 803 males and 857 females, a total of 1660 persons.

Age Profiles of Overseas Migration

The age profiles for non-Indigenous overseas arrivals and departures were updated based on the average age profile of international migrants to and from the Territory from 2006-07 to 2011-12 (ABS 3412.0). The average profiles by five year age group were transformed to single year of age profiles using Beer's interpolation coefficients.

The each profile (immigration by sex; emigration by sex) was converted to a proportional format to fit the requirements of the NTPOP model.

Regional Migration

As noted previously in this report, the regional population projections have greater limitations than the Territory total projections because the base input data is less accurate for smaller geographic areas. Furthermore, the migration flows become more complex at lower geographic levels as intra-region as well as interstate and international migration to the Territory needs to be taken into account. Partly for these reasons, regional projections are made at five yearly intervals rather than annually as occurs for the Territory total projections. The projection period is also shorter at 15 rather than 30 years.

Regional Net Migration

Regional net migration is the sum of intra-region migration, net interstate migration and net overseas migration. Intra-region migration sums across the six regions to zero. Regional net migration for all three types of migration for all regions sums to net interstate and net overseas migration for the Territory as a whole.

2011 Census data on migration patterns (place of usual residence five years ago) was used to allocate intra-region migration to the regions. While 2006 Census data was available there were differences in the patterns of migration in some regions between the 2006 and 2011 Censuses, particularly in the Indigenous population. In addition, 2006 Census data was not available for the new ASGS and differences in the geography could contribute to differences in regional migration between the two Censuses.

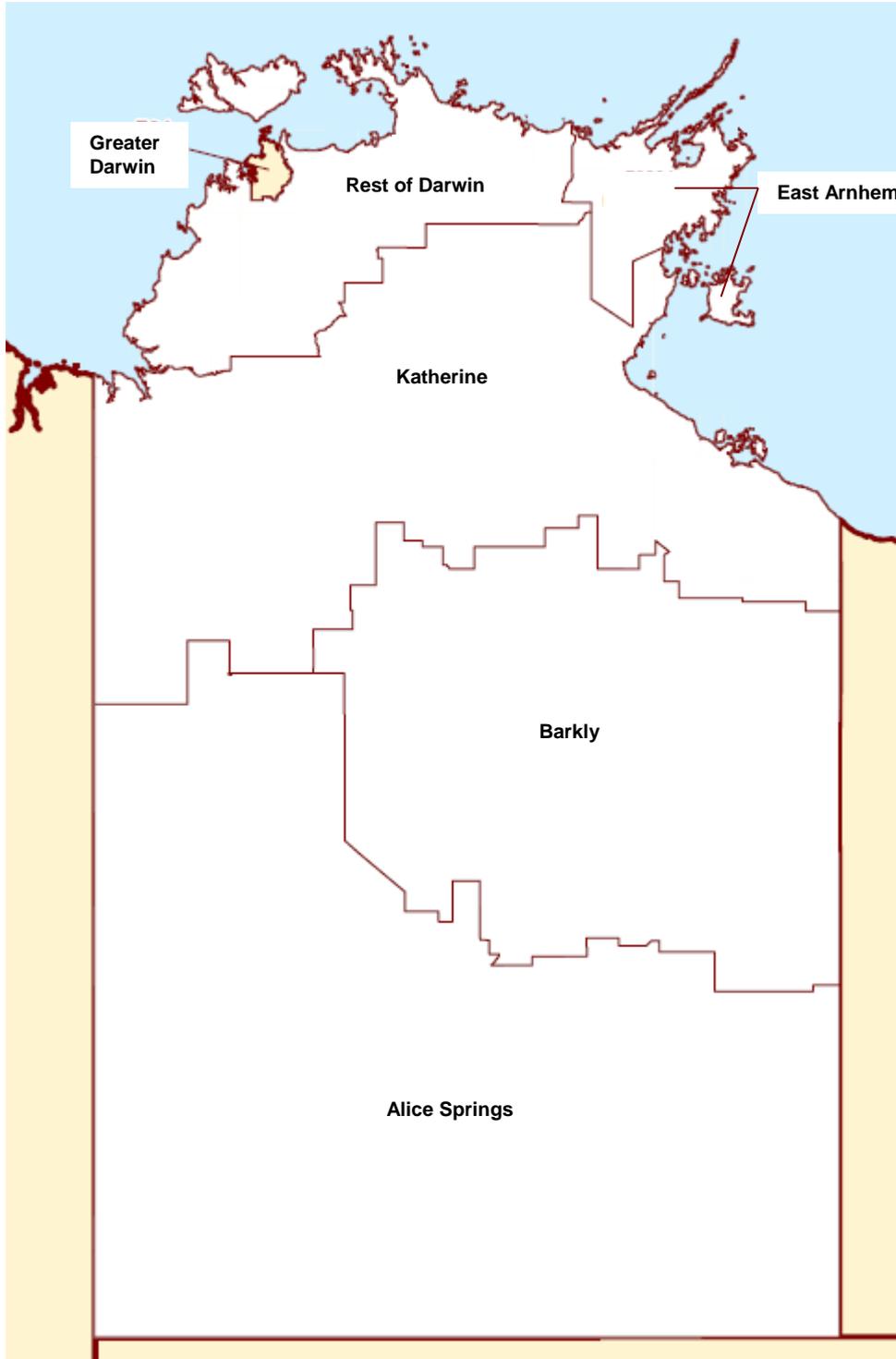
Regional Migration Age Profiles

Typically, the age profiles of regional migration are updated using the most Census data (intra-region and interstate migration) and ABS 3412.0 (overseas migration); however, operational issues were encountered running the updated profiles in the NTPOP model, uncovering a flaw in the mathematical process for distributing migrants among regions. To

overcome this issue, it has been assumed that the age profile for migrants at a regional level is similar to each region's existing population profile (i.e., the jump-off population). While this solution enabled the NTPOP model to generate an acceptable projection of regional populations, the need to use a standard age profile limits the reliability of the age distribution of the projected populations for regions.

The projections for the Territory as a whole are not affected by this limitation.

Appendix 3: NTPOP Regions



Source: Adapted from ABS Australian Statistical Geography Standard (ASGS) Volume 1 - Northern Territory Maps, July 2011, Statistical Area Level 4 & 3.