THE AUSTRALIAN NATIONAL UNIVERSITY

CAEPR Centre for Aboriginal Economic Policy Research

Growth of the Aboriginal and Torres Strait Islander population, 1991–2001 and beyond

A. Gray

No. 150/1997

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DISCUSSION PAPER

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Professor Jon Altman
Director, CAEPR
The Australian National University
December 1997

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Foreword

Dr Alan Gray was a Visiting Fellow at CAEPR in September and October 1997. During that time he authored 'The explosion of aboriginality: components of indigenous population growth 1991–96' (*CAEPR Discussion paper No. 142*). Later in October and November, CAEPR collaborated with the Council for Aboriginal Reconciliation in organising a Benchmarking Workshop convened at Parliament House of 18 and 19 November 1997. In the lead-up to this workshop, it was decided that it was important to commission some early projections of the indigenous population to 2001 and beyond.

I approached Dr Gray, a Centre Associate currently employed at the Centre for Population and Social Research, Mahidol University, Bangkok, Thailand, to undertake this work during his Australian visit, using data purchased from the Australian Bureau of Statistics. Subsequently, his preliminary projections were used by Dr John Taylor and myself in two papers ('Indigenous population change: implications for benchmarking' and 'Policy and program approaches to unemployment: implications for benchmarking') prepared for, and presented to, the workshop.

Dr Gray's detailed early projections are extremely important and are now presented as CAEPR's sesquicentennial discussion paper. Also presented are three detailed appendices which include important information on population estimates and life expectancy for each State and Territory. This paper is published as CAEPR's last discussion paper for calendar year 1997; it foreshadows far more analysis of 1996 Census material that will be published in a series of discussion papers in 1998.

I would like to thank Dr Gray for undertaking this work at very short notice with his usual commitment to professionalism and excellence; and I would like to thank the Council for Aboriginal Reconciliation and its Secretariat for collaborating in this work and providing some financial assistance.

Professor Jon Altman
Director, CAEPR
December 1997

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Summary

The immediate aim of this paper is to describe the growth path of the indigenous population during the period 1991–2001 and beyond. While it is possible to do this, it must be emphasised at the outset that the sizes of the Aboriginal and Torres Strait Islander populations remain unknown. Estimates in this paper are relative to the population size estimated by the 1996 Census.

Components of indigenous population growth

The process of indigenous population change during the period 1991–96 was reconstructed, then projected for the period 1996–2001.

- There were an estimated 41,300 births to indigenous mothers between 1991 and 1996, and a further 16,100 births to non-indigenous mothers and indigenous fathers.
- After allowing for deaths of 13,600 indigenous people, natural increase during the five years was 43,800, from 313,500 to 357,200, at an annual rate of 2.6 per cent.
- During the period 1996–2001, it is expected that natural increase of the indigenous population will have amounted to a further 43,600 people, at an annual rate of 2.3 per cent, producing an indigenous population in 2001 of 400,900.
- The projected increase assumes a fall in fertility of Aboriginal mothers to 2.5 children per woman, increasing births to non-Aboriginal mothers in continuation of the established trend, but no change in mortality levels. The projections are not highly sensitive to these assumptions.

Implications of population change

Population change occurs in a simple and predictable manner, and over a short interval such as the period from 1996–2001, the changes are mostly caused by survival of existing members of the population to age groups five years senior.

- The indigenous population continues to have the pyramidal shape typical of a population with a much higher level, because of the contribution from births to non-Aboriginal mothers.
- Previous projections of Aboriginal and Torres Strait Islander population size have envisaged much greater changes to population structure, but such projections did not recognise the impact of intermarriage on maintaining a strong level of growth and a wide base to the population pyramid.
- During the period 1991–2001 there will have been only slight changes to the broad structure of the indigenous population; for example, the masculinity ratio (number of males per hundred females) will have remained at 97.3, while the median age of the population is estimated to increase from 19.7 to 19.8.

- The main change will be increasing concentration of the indigenous population in the southeastern States and Queensland, and projected loss of population share in South Australia (from 5.9 per cent in 1991 to 5.7 per cent in 2001), Western Australia (from 14.8 per cent to 14.2 per cent) and the Northern Territory (from 13.3 per cent to 12.6 per cent).
- The main implication of these results is that change to the existing emphasis of self-help, social support and intervention programs would not be warranted purely on the basis of demographic change, but the scale of programs needs to be set at a constantly higher level to meet the challenge of rapid expansion of population numbers.

Beyond 2001

Experience with projections of the indigenous population should produce caution about assessing even medium-term prospects. With strong warnings about the consequences that could accompany rapid social and cultural change, it is feasible and it may be helpful to extend the projection to 2011.

- The preferred assumptions for the projection are that fertility of Aboriginal mothers will continue to fall, to a total fertility rate of 2.25 in 2001–6 and 2.00 in 2006–11, increasing intermarriage will continue to boost growth, and age-specific mortality levels will be reduced substantially, by 25 per cent in each five-year period beyond 2001.
- Under these assumptions, the indigenous population would grow by 46,700 to 447,500 between 2001 and 2006 then by a further 49,700 to 497,200 by 2011.
- The underlying growth rates would be 2.2 per cent for 2001–6, and 2.1 per cent for 2006–11.

In conclusion, this population projection envisages little change in Aboriginal and Torres Strait Islander population structure and continuing strong growth of the indigenous population in the immediate future and beyond. While the projection is predictive for the 1996–2001 period, longer-term projection really requires more complete information about the processes and characteristics of intermarriage with non-indigenous Australians.

Acknowledgments

I am grateful to the Centre for Aboriginal Economic and Policy Research for the opportunity to carry out this research as a follow-up to work done while visiting CAEPR this year. I especially thank Dr John Taylor and Professor Jon Altman for their advice as the work progressed. I am also grateful for input and advice from Yanbali Pty. Ltd. Editorial assistance was provided by Hilary Bek and Linda Roach, and layout by Jennifer Braid.

Introduction

The indigenous population of Australia is officially defined by the Australian Government as consisting of people who are of indigenous (Aboriginal or Torres Strait Islander) descent, who identify themselves as indigenous, and are identified as indigenous by the communities with which they are associated. The evident difficulties of this definition have not deterred the Australian Bureau of Statistics (ABS) from attempting to enumerate the Aboriginal and Torres Strait Islander populations using, since 1971, a definition which excludes the criterion of community identification. Nor have they been deterred by the evident difficulties associated with infants and young children identifying themselves.

Commendable persistence by the ABS in applying this definition, indeed persistence at an increasing level, has not produced results which are always immediately identifiable as worthwhile. Successive censuses often yield population sizes which are evidently incompatible, usually at the national level, usually too at State or Territory level, and usually at local level, no matter whether city, town, rural or remote communities are being considered. Yet it has always been the case that the indigenous population revealed by successive censuses bears demographic, social and economic characteristics which are totally unlike those of the rest of the Australian population, and these characteristics show consistent trends from census to census (see Altman and Daly 1995: 71–91; Altman 1997). The inescapable conclusion is that census enumerations capture an incomplete portion of the indigenous population each time. Because the characteristics, other than size, of the indigenous population are described consistently, population censuses have been an extremely useful source of data on change in social and economic welfare and indigenous population structure.

The immediate aim of this paper is to cut away the difficulties associated with incomplete enumerations to examine the current growth path of the indigenous population during the period 1991 to 2001, and to highlight significant changes in population structure which are occurring during the period. It is possible to do this because of extensive analysis of census results over a long period of time which have revealed the essential components of Aboriginal population growth (Taylor 1997a, 1997b). Most of the new work for this exercise has already been undertaken using results from the 1996 Census (Gray 1997). It must, however, be emphasised at the outset that the sizes of the Aboriginal and Torres Strait Islander populations remain unknown; all estimates in this paper are relative to the size estimated by the 1996 Census, adjusted minimally for consistency.

Components of indigenous population growth: explanation and summary

Populations grow by natural increase, that is, the difference between births and deaths, plus any additions or subtractions due to net migration. Usually, in assessing the component due to births, it is sufficient to restrict attention to births to women who belong to the population. In the case of the Aboriginal and Torres Strait Islander population of Australia, this restricted attention is insufficient, because an increasingly significant proportion of births of children who will later be identified as indigenous occur within marital relationships between indigenous men and non-indigenous women.

Ignoring any contributions from net international migration, and indeed from internal migration between the States and Territories, the three components of growth considered in this paper are:

- births to indigenous mothers;
- births to non-indigenous mothers and indigenous fathers; and
- deaths of indigenous people.

These components are estimated relative to adjusted estimates of Aboriginal population size and age-sex structure, based on the level of enumeration in the 1996 Census. The adjusted estimates calculated for this discussion paper, as a result of corrections to the age structure, are lower than the 1996 Census estimates which derive a total estimated resident population of 372,000 (ABS 1997: 17). They are also substantially different from the 1991 Census estimates, which were too low to be compatible with the level of enumeration in 1996.[1] The components of growth in the period 1991–2001 are shown in Table 1, together with the assumptions behind the projection given.

Table 1. Components of Aboriginal and Torres Strait Islander population increase, 1991–2001

	1991–96	1996–2001
Population as enumerated by census (start of period)	265,465	353,022
Estimated population (start of period)	313,500	357,200
B1: Births to indigenous mothers	41,300	41,200
B2: Births to non-indigenous mothers	16,100	17,900
D: Deaths of indigenous people	13,600	15,500
Natural increase (B1+B2–D)	43,800	43,600
Estimated population (end of period)	357,200	400,900

Note: basis of projection 1996–2001: no change in mortality level; decreasing fertility of indigenous mothers; and increasing intermarriage.

These broad estimates suggest a population increasing by almost exactly the same in the second half of the ten-year period (43,600) as in the first five years

(43,800). Nevertheless, this implies a decreasing rate of growth: the annual rate of natural increase is projected to decrease from 2.6 per cent in the 1991–96 period to 2.3 per cent in the 1996–2001 period. This apparent slowdown in growth is the net result of the assumption of further decline in fertility levels, which might or might not eventuate, and the certain impact of higher numbers of deaths in a rapidly growing population. Notice, however, that a small projected decline in numbers of births to indigenous mothers is more than offset by a projected increase in the number of indigenous births to non-indigenous mothers, resulting from increasing intermarriage.

This general overview is changed to some degree when any of the assumptions behind the projections is altered. The immediate purpose of presenting these results, which represent the favoured assumptions (indeed predictions), is to set out the general pattern of contemporary Aboriginal population change, which is shaped to a considerable degree by the trend towards increasing intermarriage between Aboriginal and non-Aboriginal Australians and the fact that most children of such marriages come to be identified as Aboriginal or Torres Strait Islander as the case may be.

Implications of population change

Population change occurs in a simple and predictable manner and, over a five-year period such as the short interval between 1996 and 2001, the changes are mostly caused by survival of existing members of the population to age groups five years senior. If there have been recent rapid changes in fertility levels, the shape of the 'population pyramid' can change quite rapidly, as occurred to the Aboriginal population in the 1970s and 1980s. During the 1990s, the impact of fertility decline at a gentle level is undoubtedly being offset by the effects of increasing levels of intermarriage, which are ensuring that the indigenous population continues to have the pyramidal shape typical of a population with a much higher level of fertility. The rather small changes to this pattern which will have occurred during the 1990s are illustrated in Figure 1, using the same assumptions as for Table 1.

Previous projections of Aboriginal and Torres Strait Islander population size have generally implied much greater changes to population structure, but in general such projections did not recognise the impact of intermarriage on maintaining a strong level of growth and a wide base to the population pyramid. The structural changes which are apparently occurring in the 1990s are so slight that broad indicators seem to remain identical. For example, the masculinity ratio (number of males per hundred females) is estimated to remain about 97.3 throughout the ten-year period, while the median age of the indigenous population is estimated to only increase from 19.7 years to 19.8. The slight changes in age structure which do occur are summarised in Table 2, showing broad age groups of the population in 1991, 1996 and 2001. It can be seen that the main change which will apparently have occurred during the 1990s is

expansion of the age groups 30–44 and 45–49, mainly at the expense of the 15–29 age group. It should be evident that this structural immobility is a result of the assumptions of the projection to some extent, but could only be mistaken if fertility fell sharply further.

Previous population projections have explored the implications of changing population structure for policy and programs in Aboriginal affairs (Gray and Tesfaghiorghis 1991), which examined the social, economic and policy implications of projected changes in Aboriginal population structure over the 20-year period from 1981 to 2001. We concluded that changes in population structure would have major implications for the nature of government programs, but there can now be no doubt that the projections on which these conclusions were based did not take adequate account, indeed any account, of the phenomenon of population growth through intermarriage. The same critique applies to a more particular analysis referring to employment prospects (Tesfaghiorghis and Gray 1991; Altman and Gaminiratne 1994; Taylor and Altman 1997). The main implication of the results presented is that change to the emphasis of existing self-help, social support and intervention programs would not be warranted purely on the basis of demographic change, but that the scale of programs needs to be set at a constantly higher level to meet the challenge of rapid expansion of population numbers.

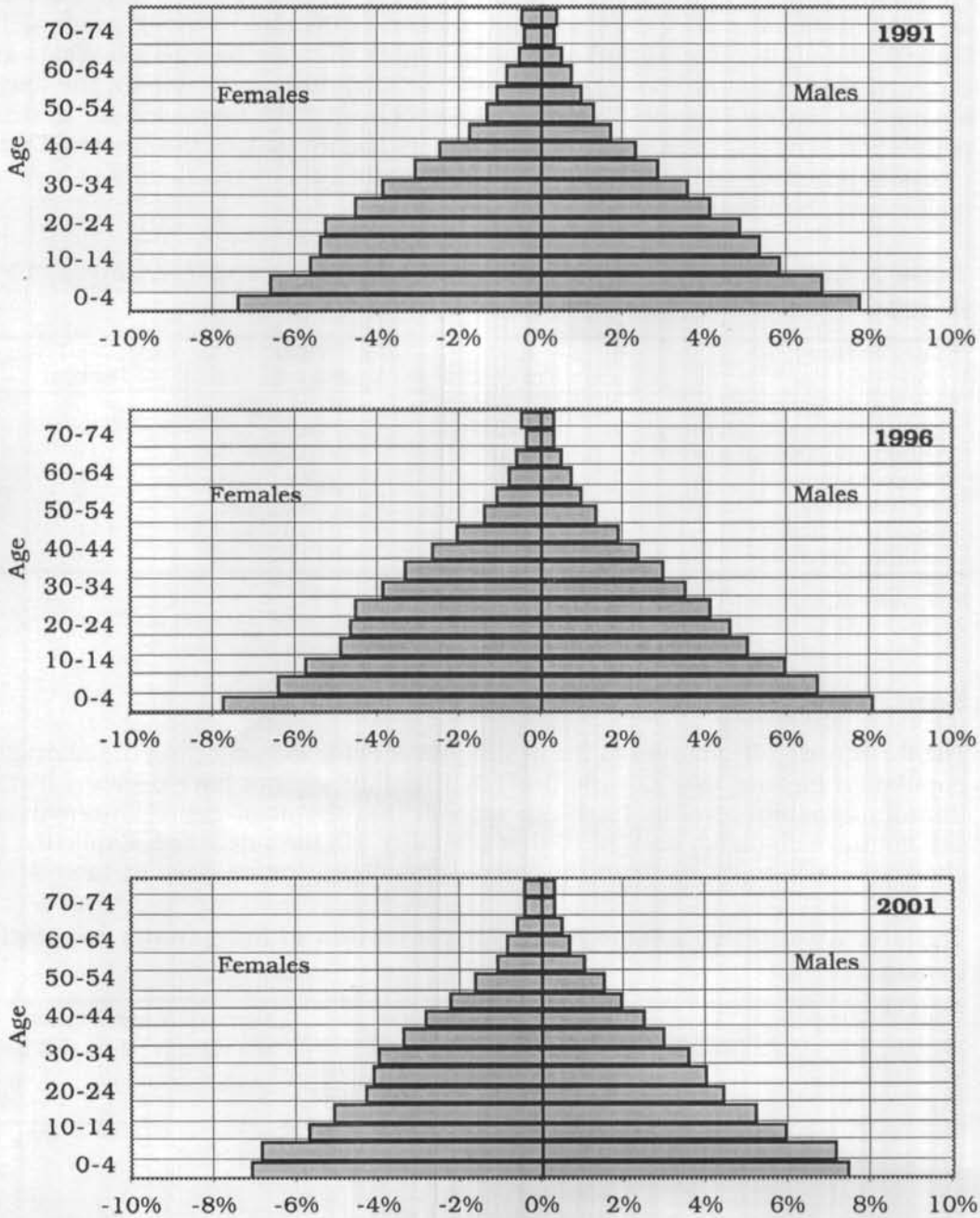
Table 2. Indigenous population structure, broad age groups, 1991, 1996 and 2001

Age group	1991 %	1996 %	2001 %
0–4	15.1	15.7	14.4
5–14	24.8	24.9	25.6
15–29	29.5	28.0	27.3
30–44	18.2	18.7	19.3
45–59	8.1	8.7	9.5
60+	4.2	4.1	4.0

Note: basis of projection 1996–2001: no change in mortality level; decreasing fertility of indigenous mothers; and increasing intermarriage.

It is self-evident that increasing inter-marriage has its main effects in the metropolitan and other urban areas of Australia, and so would have more effect in south-eastern Australia than in the north and west. Table 3 shows the redistribution of indigenous population that will likely have occurred during the 1990s as a result of different rates of natural increase between the States and Territories of Australia. This analysis does not envisage any significant level of net interstate migration. The net result shows considerable redistribution towards the south-eastern States, and to Queensland, while South Australia, Western Australia and the Northern Territory will have lower proportions of the indigenous population by 2001 than they had in 1991, if there is no alteration of the trend set in the first half of the 1990s.

Figure 1. Aboriginal and Torres Strait Islander population structure, 1991–2001



The largest decrease is projected to occur in the Northern Territory, which paradoxically is projected to have a relatively high total fertility rate (TFR) for indigenous women in the 1996–2001 period (2.57 children per woman). This rate is only fractionally less than for Queensland (2.66 children per woman, the highest among the States) and quite a lot higher than for New South Wales and the Australian Capital Territory combined (2.32 children per woman, the lowest among the States) New South Wales, however, will have increased its share of population. The explanation of the paradox is simply that in the eastern States births to non-indigenous mothers and indigenous fathers are already at a much higher level than in the Northern Territory.

Table 3. Indigenous population distribution, States and Territories, 1991 to 2001

State/Territory	1991 Per cent	1996 Per cent	2001 Per cent
New South Wales and Australian Capital Territory	29.2	29.5	29.8
Victoria and Tasmania	10.0	10.2	10.4
Queensland	26.9	27.1	27.3
South Australia	5.9	5.8	5.7
Western Australia	14.8	14.4	14.2
Northern Territory	13.3	12.9	12.6

Note: basis of projection 1996–2001: no change in mortality level; decreasing fertility of indigenous mothers; and increasing intermarriage.

Sensitivity of the estimates to the assumptions

The three main alternatives to the assumptions made for projecting the Aboriginal population forward to 2001 are, first, that fertility will not have declined further from its apparent level in 1991–96; second, that the incidence of intermarriage will not have changed; and third, that mortality will have declined. Explicitly, the alternative assumptions about the components of growth are given in Table 4.

Table 4. Alternative assumptions for projection of indigenous population to 2001

Growth component	Preferred assumption	Alternative assumption
Fertility of indigenous women	TFR declines from 2.71 in 1991–96 to 2.5 in 1996–2001, and by corresponding amounts in each State/Territory group	TFR remains constant at 2.71
Indigenous births to non-indigenous women	Increase towards a logistic limit of 50 per cent of indigenous births according to a pattern suggested by 1991 Census data on proportions with non-Aboriginal mothers for different ages of children	No further increase in the proportion
Mortality	No change from 1991–96 levels	Reduction by 25 per cent in age-specific death rates

The effect of altering each of these assumptions, singly and in combination, is given in Table 5 using the same format as Table 1. These are not suggested for use as alternative projections, because over such a short period it is unnecessary to consider more than a single projection. Rather, the purpose is to illustrate that the preferred projection is relatively insensitive to changes in the assumptions.

Table 5. Alternative assumptions about Aboriginal and Torres Strait Islander population increase, 1996–2001

	A.	B.
Population as enumerated by census (start of period)	353,022	353,022
Estimated population (start of period)	357,200	357,200
B1: Births to indigenous mothers	44,700	41,200
B2: Births to non-indigenous mothers	19,400	16,100
D: Deaths of indigenous people	15,600	15,400
Natural increase (B1+B2–D)	48,500	41,900
Estimated population (end of period)	405,700	399,100
	C.	D.
Population as enumerated by census (start of period)	353,022	353,022
Estimated population (start of period)	357,200	357,200
B1: Births to indigenous mothers	41,100	44,500
B2: Births to non-indigenous mothers	17,800	17,400
D: Deaths of indigenous people	12,400	12,500
Natural increase (B1+B2–D)	46,500	49,500
Estimated population (end of period)	403,700	406,700

Note:
basis of projection A. no change in mortality level;
no change in fertility level; and
increasing intermarriage.

basis of projection B. no change in mortality level;
decreasing fertility of indigenous mothers; and
no change in proportion of births to non-indigenous mothers.

basis of projection C. age-specific mortality reduced by 25 per cent;
decreasing fertility of indigenous mothers; and
increasing intermarriage.

basis of projection D. age-specific mortality reduced by 25 per cent;
no change in fertility level; and
no change in proportion of births to non-indigenous mothers.

These explorations confirm both that projection of total growth of the Aboriginal and Torres Strait Islander population to just past the turn of the century is not very sensitive to the assumptions made, to within a few thousand individuals; and that the general size of the components of growth is also represented quite reasonably in Table 1. The projections in Table 1 are at the lower end of the range represented in Table 5, but this is because two of the alternative assumptions (no change in fertility, and substantial reduction in mortality) tend to produce higher growth.

Beyond 2001

Past experience with projections of Aboriginal population trends should produce caution about assessing even medium-term prospects. Although Aboriginal identity is seemingly maintained strongly by the children of intermarriages in the contemporary cultural and social conditions of Australia, increasing blurring of the distinction between Aboriginal and non-Aboriginal in Australia must lead eventually to similar population characteristics governed by the same forces of fertility and mortality as in the rest of the Australian population. At the same time there will emerge an ever-larger component of the Australian population who may choose to be identified as Aboriginal on the basis of descent and affinity with Aboriginal communities, or choose not to be. It would be hazardous even to try to assess prospects only as far as one generation, approximately 25 years past the last census in 1996, because of the possibility of rapid change in society. With strong warnings about the consequences of rapid cultural and social change, it is feasible and it may be helpful to extend the preferred population projection given here a further ten years, to 2011, in two five-year steps.

The preferred assumptions for this projection are that fertility will continue to fall, to a TFR of 2.25 in 2001–6 and then 2.0 in 2006–11; increasing intermarriage will continue to boost growth, and age-specific mortality levels will be reduced substantially, by 25 per cent in each five-year period past 2001. There is no particular reason to believe that any society will successfully organise itself to have replacement-level fertility. Since fertility levels for Australians generally have now been below replacement level for a long period, it seems reasonable to avoid such an artificial limit for Aboriginal fertility decline. The mortality assumption is based wholly on the observation that Australian society should eventually recognise that extremely high Aboriginal mortality levels cannot be allowed to persist. Table 6 shows population prospects based on these assumptions.

Table 6. Prospects for Aboriginal and Torres Strait Islander population increase, 2001–11

	2001–2006	2006–11
Estimated population (start of period)	400,900	447,516
B1: Births to indigenous mothers	40,700	40,500
B2: Births to non-indigenous mothers	19,500	21,200
D: Deaths of indigenous people	13,500	12,100
Natural increase (B1+B2–D)	46,700	49,700
Estimated population (end of period)	447,500	497,200

Note: basis of projections: age-specific mortality decreases by 25 per cent from each previous five-year period;
fertility decreases to TFR 2.25 in 2001–6 and to TFR 2.0 in 2006–11; and
increasing intermarriage.

In each of the prospective periods, Aboriginal and Torres Strait Islander population growth is projected to be a little under 50,000, with underlying growth rates of 2.2 per cent in the 2001–6 period and 2.1 per cent in the 2006–11 period. Note that while births to indigenous mothers are projected to decrease absolutely, as a result of assumptions about declining fertility levels, indigenous births to non-indigenous mothers will nevertheless continue to increase under the assumption of increasing intermarriage. Growth will also be boosted to a minor extent by absolute decline in numbers of deaths, but this will only happen if there are very substantial improvements in Aboriginal survival, as envisaged for this set of population prospects.[2]

Conclusion

This population projection envisages little change in Aboriginal and Torres Strait Islander population structure and continuing strong growth of the indigenous population in the immediate future and beyond. While predictive for the 1996–2001 period, the projection will nevertheless be difficult to verify immediately from the 2001 Census enumeration unless by fortunate coincidence the level of enumeration of the indigenous population is consistent with the 1996 Census. Longer-term projection really requires more complete information about the processes and characteristics of intermarriage with non-indigenous Australians, as has been emphasised in the detailed discussion in the appendices.

It is necessary to emphasise again that the size of the Aboriginal population should be regarded as unknown, and that the estimates in this paper are relative to Aboriginal population size as enumerated at the 1996 Census. 'Experimental population estimates' produced by the ABS (1997) are nonetheless a valuable contribution towards policy and program formulation and the analysis in this paper shows that for 1996 they are not very different in distribution from the estimates obtained here, except for the 0–4 age group. It is hoped that this paper will be a useful contribution to the ABS in continuing to develop this useful set of official statistics.[3]

Appendix A. Projection method and detail

Projection 1996–2001

The projections given in this paper were based in the first instance on establishing a baseline of population change during the 1991–96 period. The main details of this estimation process are given in Appendix B. The output of the process was a consistent set of indigenous population estimates for 1991 and 1996, at the level of five-year age groups and sex, for the whole of Australia, for New South Wales and the Australian Capital Territory combined, for Victoria and Tasmania combined, for Queensland, for South Australia, for Western Australia, for the Northern Territory and for Torres Strait Islanders in Queensland. The estimates are consistent in the sense that application of the fertility estimates in Table B.3 (Appendix B) and the mortality estimates in Appendix C to the estimates for 1991 exactly reproduces the 1996 population estimates. The final estimates are shown in Table B.4 of Appendix B.

Projection from this basis involves making assumptions about fertility and mortality levels in each projection period. For the period 1996–2001, mortality levels are assumed to remain unchanged from the levels given in Appendix C for the 1991–96 period, but fertility is assumed to decrease from a total fertility rate of 2.71 in 1991–96 to 2.50 in 1996–2001. The assumed fertility levels are shown in Table A.1.

Table A.1. Fertility estimates for population projection, 1996–2001

	New South Wales & ACT	Victoria & Tasmania	Queens-land	South Australia	Western Australia	Northern Territory	Australia
			Age-specific fertility rates				
15–19	96	76	95	96	137	130	104
20–24	153	130	170	138	188	153	160
25–29	117	123	137	132	101	104	120
30–34	70	88	77	90	36	72	70
35–39	21	44	24	29	18	26	25
40–44	4	28	15	11	5	15	11
45–49	3	26	13	10	4	13	10
TFR	2.32	2.57	2.66	2.53	2.45	2.57	2.50
Adjustment for non-Aboriginal mothers (per cent)	+61	+63	+43	+37	+29	+16	+43

The major part of this table is simple adjustment from the levels of 1991–96. However, comparison with the adjustments for non-Aboriginal mothers in Table B.3 reveals that this adjustment is projected to increase rapidly.

The mathematical model of this process is the equation

$$\text{logodds}(2p_t) = 0.051454 + 0.0358 * (t-1991)$$

where p_t is the proportion of indigenous births to non-indigenous mothers in year t. This model is based on data from the 1991 Census suggesting growth in the proportion of non-indigenous women in couple families at that level in the 14 years before 1991. (See Gray 1997 for further discussion of the model.) Relative levels for the States were established from a table published by the ABS and the Australian Institute of Health and Welfare (1997), showing the proportion of non-indigenous mothers among indigenous births in most States and Territories in 1993.[4] These relative levels needed to be adjusted upward by small amounts to agree with the model, for the year 1993.

An arbitrary upper limit of 50 per cent is set by the model, for the proportion of indigenous births to non-indigenous mothers. This is because it would be expected that approximately half of all indigenous births would still occur to Aboriginal and Torres Strait Islander mothers even if all indigenous people intermarried. The limit could be somewhat more or somewhat less, depending on relative fertility levels and distribution by age, and sociological considerations.

There should be no doubt that this model is no more than a preliminary version of the process it represents. In particular, the possibility that non-indigenous partners of indigenous men, or women, have fertility levels more like those of other non-indigenous Australians should be recognised and investigated. This should be an integral part of a program aimed at understanding the phenomenon of intermarriage better, as suggested in Gray (1997).

The net result of the assumptions is shown in Table A.2, showing the projected indigenous population by age, sex and State/Territory in 2001. Several alternative assumptions are mentioned in the text of the report. Except in the case of reduced mortality, these have effect in the 0–4 age group and no effect on the rest of the age distribution shown in the table. An assumption of no change in level of fertility from the level in 1991–96 would have a very large effect on this age group, which would number 62,439 (almost 5,000 more than projected) if the TFR remained at 2.71 as in 1991–96 instead of the projected level of 2.50. On the other hand, if the level of intermarriage remained at its estimated level in 1991–96, the size of the 0–4 age group would be slightly lower than projected, at 55,860.

As shown in Table A.2 the reduction of age-specific mortality rates by 25 per cent across the board would affect population numbers in all age groups, in the form of slight increases. The net effect, for Australia as a whole, is shown in Table A.3.

Table A.2. Projected Aboriginal and Torres Strait Islander population, 2001: preferred assumptions

	NSW & ACT	Vic & Tas	Qld	SA	WA	NT	Aust	TSI (Qld)
Males								
0–4	8,959	3,299	8,410	1,610	3,865	3,284	29,409	1,836
5–9	8,705	3,141	8,022	1,559	3,737	3,195	28,339	1,673
10–14	7,140	2,415	6,334	1,386	3,695	3,028	23,997	1,400
15–19	6,234	2,119	5,643	1,239	3,059	2,758	21,052	1,328
20–24	5,088	1,784	4,890	978	2,554	2,415	17,709	1,106
25–29	4,650	1,587	4,372	909	2,342	2,239	16,100	926
30–34	4,090	1,421	3,832	846	2,128	1,980	14,298	799
35–39	3,485	1,179	3,177	755	1,788	1,544	11,929	657
40–44	2,937	1,129	2,532	601	1,490	1,256	9,944	498
45–49	2,325	860	1,984	501	1,066	1,019	7,755	418
50–54	1,882	690	1,596	337	798	712	6,015	369
55–59	1,313	474	1,017	239	542	533	4,118	209
60–64	887	290	639	168	390	360	2,733	155
65–69	597	182	502	102	264	251	1,896	130
70–74	339	116	302	78	193	150	1,176	67
75+	302	148	332	74	176	160	1,191	87
Total	58,931	20,833	53,582	11,380	28,086	24,886	197,661	11,658
Females								
0–4	8,580	3,151	8,054	1,546	3,718	3,155	28,192	1,756
5–9	8,352	3,004	7,698	1,501	3,607	3,078	27,226	1,603
10–14	6,842	2,244	6,254	1,328	3,461	2,808	22,937	1,348
15–19	5,926	2,032	5,542	1,208	3,062	2,762	20,533	1,259
20–24	4,947	1,768	4,790	972	2,559	2,313	17,349	1,135
25–29	4,792	1,628	4,570	930	2,296	2,285	16,501	1,009
30–34	4,613	1,542	4,362	950	2,387	2,245	16,099	836
35–39	4,063	1,323	3,621	822	2,042	1,802	13,673	717
40–44	3,441	1,230	2,977	704	1,654	1,492	11,497	610
45–49	2,679	900	2,416	504	1,269	1,151	8,917	519
50–54	2,064	738	1,781	375	890	839	6,687	389
55–59	1,378	438	1,194	261	597	608	4,477	251
60–64	1,014	334	881	202	456	438	3,326	211
65–69	721	231	626	143	332	342	2,395	168
70–74	500	182	440	99	239	204	1,665	124
75+	456	202	477	99	267	245	1,745	126
Total	60,369	20,948	55,683	11,643	28,837	25,766	203,219	12,063
Persons	119,300	41,781	109,266	23,023	56,923	50,653	400,880	23,720

Table A.3. Projected Aboriginal and Torres Strait Islander population, 2001: reduced mortality assumption

	Males	Females	Persons
0–4	29,677	28,163	57,840
5–9	28,447	27,234	55,681
10–14	24,097	22,879	46,977
15–19	21,193	20,471	41,664
20–24	17,854	17,318	35,173
25–29	16,383	16,374	32,757
30–34	14,650	15,914	30,564
35–39	12,324	13,459	25,783
40–44	10,402	11,203	21,605
45–49	8,046	8,834	16,879
50–54	6,236	6,724	12,960
55–59	4,438	4,394	8,831
60–64	3,041	3,256	6,297
65–69	2,179	2,330	4,509
70–74	1,353	1,654	3,007
75+	1,473	1,732	3,205
Total	201,793	201,940	403,733

Projections 2001–11

For the period beyond 2001, a single projection was carried out at the level of the whole of Australia, using the assumptions that fertility would fall to 2.25 in 2001–6 then 2.00 in 2006–11, while age-specific mortality rates would fall by 25 per cent in each of these five-year periods.[5] The projection results are shown in Table A.4.

Table A.4. Projected Aboriginal and Torres Strait Islander population, 2006 and 2011

	2006			2011		
	Males	Females	Persons	Males	Females	Persons
0–4	30,129	28,836	58,965	31,126	29,753	60,879
5–9	29,221	28,058	57,279	29,985	28,734	58,719
10–14	28,226	27,194	55,420	29,134	28,034	57,167
15–19	23,812	22,853	46,665	28,062	27,119	55,181
20–24	20,803	20,375	41,179	23,600	22,721	46,322
25–29	17,356	17,188	34,544	20,492	20,233	40,724
30–34	15,680	16,323	32,003	17,016	17,048	34,064
35–39	13,782	15,837	29,619	15,254	16,123	31,377
40–44	11,338	13,364	24,702	13,265	15,568	28,833
45–49	9,359	10,999	20,358	10,833	12,927	23,759
50–54	7,181	8,347	15,528	8,833	10,467	19,300
55–59	5,364	6,194	11,558	6,590	7,883	14,473
60–64	3,496	4,017	7,513	4,747	5,708	10,456
65–69	2,206	2,881	5,087	2,979	3,608	6,587
70–74	1,439	1,912	3,351	1,795	2,431	4,226
75+	1,470	2,274	3,744	2,028	3,086	5,113
Total	220,864	226,652	447,516	245,738	251,443	497,181

Appendix B. Correction of age structure and intercensal deaths, 1991 and 1996

Because of different levels of enumeration of the Aboriginal and Torres Strait Islander population in the 1991 and 1996 Censuses, and deaths data at best incomplete for the period 1991–96, the relationships that must hold in a virtually closed population[6] are difficult to detect in raw data from these sources. The basic relationship which should hold is that the population for any five-year age group in 1996 should be equal to the population for the age group five years younger in 1991 less any deaths which occurred at corresponding ages between 1991 and 1996. In symbols,

$$N2_c = N1_c - D_c \quad (1)$$

where the subscript 'c' refers to a five-year birth cohort (the people born in a particular five-year period, counting in five-year segments back from the first census date), N1 refers to population numbers for a birth cohort at the first census in 1991, N2 refers to population numbers for the same birth cohort at the second census in 1996, and D refers to deaths from the birth cohort which occurred between the two census dates.

In practice, because of different levels of enumeration, correction factors need to be applied to make this relationship hold more exactly. Specifically, the relationship needs to be modified to the form

$$K2.N2_c = K1.N1_c - C.D_c \quad (2)$$

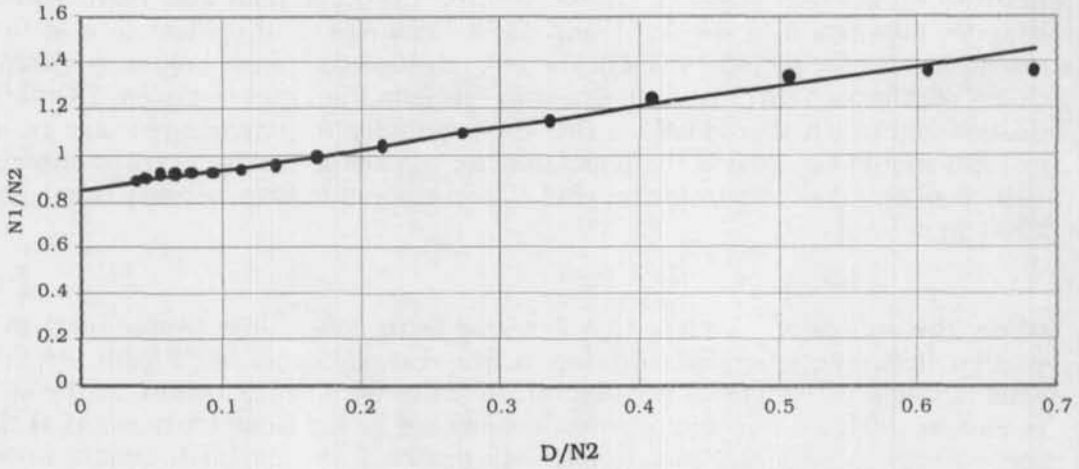
where K1, K2 and C are the required correction factors, assumed constant for different birth cohorts (Preston and Hill 1980). Equation (2) implies a linear relationship between $N1_c/N2_c$ and $D_c/N2_c$, considered as functions of birth cohort c. Actual linearity from observed data would signal that the assumption of constant values for the three correction factors is consistent with the observations. Observed non-linearity can be due to many factors.

In applying this theory to data for the Aboriginal population, intercensal deaths were estimated using life tables estimated for the period 1986–91 (Gray and Tesfaghiorghis 1993) under the initial assumption that the level of enumeration in each census was complete. Given that the two censuses were clearly incompatible in level, the estimated numbers of deaths calculated in this way would have a level of enumeration somewhere in between, unless there had been a marked change in the level of mortality between 1986–91 and 1991–96. The case of three different levels of enumeration (first census, second census and intercensal deaths) is fine for application of the theory, as is clear from relationship (2).

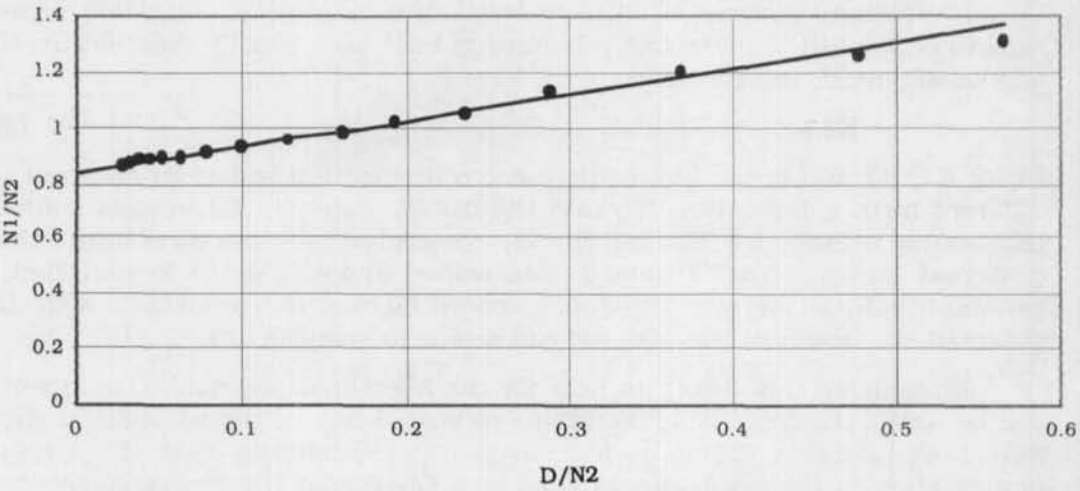
Figure B.1 illustrates the 'linear' relationships observed from the data for each sex for Australia as a whole and fitted lines drawn through the data points.

Figure B.1. Preston-Hill intercensal analysis, Aboriginal females and males, Australia, 1991–96

Males



Females



The same calculations were carried out for six State/Territory groupings and for Torres Strait Islanders in Queensland.[7] The slopes and intercepts of the linear relationships are directly related to relative levels of enumeration of the population and death estimates, as summarised in Table B.1.

Table B.1. Correction factors implied by Preston-Hill Analysis

	Males		Females	
	1991 population relative to 1996 population	Deaths relative to 1996 population	1991 population relative to 1996 population	Deaths relative to 1996 population
New South Wales and Australian Capital Territory	1.2685	0.9638	1.2794	1.0906
Victoria and Tasmania	1.2344	0.9230	1.2128	0.8458
Queensland	1.1775	0.9978	1.2183	1.3030
South Australia	1.1553	1.3146	1.0989	1.0964
Western Australia	1.1085	1.3035	1.1167	1.2776
Northern Territory	1.0309	0.8538	1.0235	0.5895
Australia	**1.1758**	**1.0433**	**1.1830**	**1.0952**
Torres Strait Islanders (Queensland)	1.2501	1.2363	1.2748	1.5022

Experience with use of this method of analysis has shown that it can provide good estimates of the relative level of population enumeration but is only useful for correcting levels of deaths relative to population enumeration if the fitted line is extremely close to the data points. This is the case in Figure B.1, but it is not so for all of the State/Territory groupings, indicating either particular patterns of enumeration error affecting different sections of the population, or (less likely) erroneous features of the assumed distribution of deaths. The correction factors for deaths obtained in this way are too unreliable for further use in some cases, especially in the case of the Northern Territory, and for reasons of employing a consistent approach none of these correction factors for deaths are used further in this analysis.

The correction factors for the 1991 population are taken as first estimates for the next stage of the analysis, in which initial correction factors for population size in each census, and for births and deaths in the intercensal period, are adjusted using methods of functional analysis to locate the closest set of population, birth and death estimates which satisfy equation (1), minimising a weighted distance from the input data.[8] The original version of this method was described by Luther and Retherford (1988) and other versions have been applied to analysis of the Aboriginal population by Gray (1990), Gray and Tesfaghiorghis (1993) and Luther, Gaminiratne and Gray (1995). The variant of the Luther-Retherford method that is used for the first two of these analyses, and for the analysis in this paper, has now been employed several times. It is sufficiently different in detail from the original version to warrant explanation which is not given in any of the other sources. The balancing equations which are used are as follows:

$$K2.N2_{0\text{-}4} = KB.B - KD.(0.8D_{0\text{-}4})$$
$$K2.N2_{5\text{-}9} = K1.\ N1_{0\text{-}4} - KD.(0.2D_{0\text{-}4} + 0.5D_{5\text{-}9})$$
$$K2.N2_{10\text{-}14} = K1.\ N1_{5\text{-}9} - KD.(0.5D_{5\text{-}9} + 0.5D_{10\text{-}14})$$

(as above for each age group 10–14 to 70–74)

$$K2.N2_{75+} = K1.\ N1_{70+} - KD.(0.5D_{70\text{-}74} + D_{75+})$$

Here, cohort deaths are initially estimated as combinations of segments of deaths within age groups in the intercensal period. There are four initial correction factors:

K1: Estimated completeness of first census enumeration against second census enumeration (as given in Table B.1);

K2: Estimated completeness of second census enumeration, with a value set to 1 so that all correction factors are at first assumed to be relative to this level;

KB: Estimated completeness of births relative to second census enumeration, initially set to 1 in previous analyses but in the current analysis set to equal 1 plus the proportion needed to include births to non-Aboriginal mothers (see discussion in text of paper); and

KD: Estimated completeness of deaths relative to second census enumeration, set in various ways in previous analyses but set to 1 for the current analysis.

Values of K1, K2 and KD for each age cohort and for KB are calculated so as to make the above set of equations balance and minimise the distance between the initial estimates of the correction factors and the final estimates, where the distance is calculated as the square root of a weighted sum of differences. The weights used in this variant of the method are the relative sizes of corresponding population quantities and 0.4 times the relative sizes of deaths estimates, expressed relative to the estimated number of births. The factor of 0.4 in the weights for death estimates reflects the extent to which estimates of deaths figure in calculation of death rates for five-year age groups over a five-year period:

$$ {}_5M_x = 0.4 \times {}_5D_x/({}_5P_{x,t-5}+{}_5P_{x,t}) $$

Examples of the results obtained with this method of analysis are shown in Table B.2, for New South Wales and the Australian Capital Territory. The results have been set out for birth cohorts, reflecting the estimation method. It can be seen that the final estimates of correction factors reflect the initial estimates quite closely, except for the births correction factor (reduced from the initial estimate of 1.51 to 1.35 for both sexes) and the corresponding factor for deaths in the 0–4 age group. The reason for this is that the number of births was initially estimated from the assumed level of fertility in the 1986–91 period (Gray and Tesfaghiorghis 1993), which was assuredly too high even for that period. The upward correction to the number of deaths for the age group reflects the correction for births to non-Aboriginal mothers. Because of the uncertainties introduced by these large corrections, population estimates for the 0–4 age group in 1996 were calculated more directly, using estimated fertility in the 1991–96 period and survival ratios based on the Luther-Retherford analysis, as explained further below.

Table B.2. Example of results obtained from Luther-Retherford analysis: initial and final correction factors[a], New South Wales and Australian Capital Territory, 1991–96

		Males			Females		
		K1	K2	KD	K1	K2	KD
Initial value (a)		1.268456	1.000000	1.000000	1.279442	1.000000	1.000000
Final values: (1991–96)							
Births	0–4	1.346920	1.168232	1.323142	1.353844	1.161308	1.316506
0–4	5–9	1.294897	0.973555	0.921466	1.291685	0.987755	0.945634
5–9	10–14	1.304474	0.963983	0.982903	1.310537	0.968906	0.998464
10–14	15–19	1.246330	1.022128	1.074106	1.249882	1.029560	1.059376
15–19	20–24	1.231409	1.037049	1.108966	1.261517	1.017924	1.040855
20–24	25–29	1.218365	1.050089	1.071801	1.264637	1.014807	1.018019
25–29	30–34	1.261043	1.007413	0.999658	1.279884	0.999559	0.997302
30–34	35–39	1.276102	0.992351	0.947864	1.281239	0.998204	0.982286
35–39	40–44	1.302497	0.965960	0.914310	1.291843	0.987598	0.994222
40–44	45–49	1.302989	0.965468	0.933004	1.271657	1.007784	0.973826
45–49	50–54	1.287534	0.980922	0.970786	1.308171	0.971270	0.977760
50–54	55–59	1.272742	0.995714	0.938591	1.268500	1.010942	0.976374
55–59	60–64	1.313299	0.955157	0.901214	1.309281	0.970160	0.942595
60–64	65–69	1.302643	0.965813	0.994292	1.295518	0.983925	0.985543
65–69	70–74	1.238835	1.029620	0.973604	1.274935	1.004508	0.931369
70+	75+	1.319192	0.949263	0.873159	1.338856	0.940587	0.851467

[a]The initial value of KB for both sexes was 1.515152 for both sexes in New South Wales and the Australian Capital Territory

This analysis was carried out separately for each State/Territory group and aggregated to produce estimates for Australia as a whole. The value of the approach used was that it would ensure that the population estimates would satisfy the basic relationship expressed in equation 1. A by-product of the analysis is the set of life tables reproduced in Appendix C, based on direct application of the results for each State/Territory group, and Torres Strait Islanders living in Queensland, exemplified for the case of New South Wales and the Australian Capital Territory in Table B.2.

For all age groups in 1991, and all age groups except 0–4 in 1996, population estimates corrected using these factors were also used as the final estimates of this exercise. For the 0–4 age group, estimates were calculated more directly, using fertility estimates for the 1986–96 period for the whole of Australia (Gray 1997) and estimated adjustments for non-Aboriginal mothers from the same source. The State/Territory estimates of births to Aboriginal mothers were adjusted proportionately age group by age group (15–19 to 45–49) to agree with the estimates for the whole of Australia, as no direct estimation of 1986–96 age-

specific rates had been carried out. Similarly, the State/Territory estimates of the additional component of births to non-Aboriginal mothers were adjusted to conform with the estimates for Australia as a whole. This procedure incidentally produced a set of estimates of age-specific fertility rates for the State/Territory groupings, as shown in Table B.3.

Table B.3. Fertility estimates derived from State/Territory analyses, 1991–96

	New South Wales & ACT	Victoria & Tasmania	Queens-land	South Australia	Western Australia	Northern Territory	Australia
15–19	104	83	103	104	149	141	113
20–24	166	140	184	150	204	166	173
25–29	127	134	149	143	110	113	130
30–34	75	95	84	98	39	78	76
35–39	23	47	26	31	20	28	27
40–44	4	30	16	12	5	16	12
45–49	4	28	14	11	5	14	11
TFR	2.51	2.79	2.88	2.74	2.66	2.78	2.71
Adjustment for non-Aboriginal mothers (per cent)	+56	+58	+38	+32	+25	+13	+39

These fertility estimates should be regarded as no more than by-products of the estimation process and elements of the projection process; they are heavily influenced by the relative levels of estimates for the 1981–86 period, which might or might not reflect more recent relativities. The substantial adjustments for non-indigenous mothers are shown in the last row of the table.

The final set of population estimates for 1991 and 1996 are set out in Table B.4, for Australia as a whole, compared with the original census estimates and experimental Aboriginal and Torres Strait Islander population figures calculated by the ABS (1997). The most evident difference between the estimates produced here and those of the ABS is that the ABS's estimates are uniformly higher by similar proportions, except for the 0–4 age group. The exception for the 0–4 age group no doubt reflects different assumptions about fertility.

Table B.4. Population estimates used as basis for population projection, compared with 1991 and 1996 Censuses, and with experimental estimates[a] of the Aboriginal population, 1996

	1991		1996		
	Census	Estimate	Census	Estimate	Experimental estimates (a)
Males					
0–4	20,275	24,348	25,583	28,582	27,429
5–9	17,915	21,380	24,801	24,125	26,062
10–14	15,931	18,182	21,777	21,271	22,852
15–19	14,681	16,799	17,468	17,992	18,542
20–24	13,208	15,203	16,083	16,537	17,492
25–29	11,081	12,981	14,495	14,810	15,614
30–34	9,445	11,163	12,526	12,528	13,326
35–39	7,513	9,004	10,737	10,643	11,422
40–44	6,020	7,216	8,642	8,410	9,118
45–49	4,444	5,311	6,818	6,663	7,181
50–54	3,377	3,958	4,887	4,789	5,125
55–59	2,601	3,119	3,395	3,390	3,576
60–64	1,894	2,253	2,598	2,514	2,705
65–69	1,352	1,536	1,734	1,694	1,815
70–74	833	1,042	1,023	1,056	1,076
75+	873	1,087	1,263	1,149	1,310
Total	131,443	154,580	173,830	176,154	184,645
Females					
0–4	19,240	23,132	24,689	27,399	26,205
5–9	17,241	20,666	23,404	22,973	24,414
10–14	15,153	17,615	21,093	20,634	21,908
15–19	14,249	16,881	17,209	17,528	18,085
20–24	14,178	16,533	16,743	16,708	17,809
25–29	12,008	14,178	16,142	16,334	16,892
30–34	10,227	12,108	13,990	13,975	14,570
35–39	8,258	9,751	11,902	11,853	12,335
40–44	6,503	7,717	9,456	9,458	9,789
45–49	4,527	5,437	7,335	7,300	7,578
50–54	3,614	4,251	5,054	4,955	5,225
55–59	2,764	3,351	3,813	3,839	3,955
60–64	2,293	2,690	2,995	2,897	3,095
65–69	1,507	1,799	2,231	2,235	2,301
70–74	1,001	1,255	1,342	1,324	1,403
75+	1,259	1,574	1,794	1,655	1,843
Total	134,022	158,937	179,192	181,069	187,407

[a]ABS (1997: 17)

As noted earlier, the estimates produced here as the basis for population projections were designed to reflect the *level* of enumeration in the 1996 Census, with minimal corrections to the age distribution. The fact that these minimal corrections produced a slightly higher population total than the Census has no other significance. Certainly the total should not be regarded as an estimate of indigenous population size, which the total for the experimental estimates does purport to be.

Appendix C. Life tables for the indigenous population of Australia, 1991–96

Table C.1. New South Wales and the Australian Capital Territory

Males

x	n	${}_nM_x$	${}_nq_x$	l_x	${}_nd_x$	${}_nL_x$	T_x	e_x
0	5	0.0064	0.0310	100000	3099	487604	5841615	58.4
5	5	0.0004	0.0021	96901	200	484005	5354011	55.3
10	5	0.0016	0.0077	96701	748	481636	4870006	50.4
15	5	0.0026	0.0128	95953	1231	476688	4388370	45.7
20	5	0.0038	0.0190	94722	1801	469108	3911682	41.3
25	5	0.0062	0.0307	92921	2852	457473	3442574	37.0
30	5	0.0070	0.0343	90068	3086	442626	2985101	33.1
35	5	0.0120	0.0580	86982	5049	422288	2542475	29.2
40	5	0.0121	0.0587	81933	4809	397642	2120187	25.9
45	5	0.0166	0.0796	77124	6136	370279	1722545	22.3
50	5	0.0205	0.0973	70988	6910	337663	1352266	19.0
55	5	0.0368	0.1683	64077	10787	293419	1014603	15.8
60	5	0.0451	0.2026	53290	10794	239466	721184	13.5
65	5	0.0552	0.2425	42496	10307	186713	481718	11.3
70	5	0.0751	0.3162	32189	10179	135500	295005	9.2
75	ω	0.1380	1.0000	22011	22011	159505	159505	7.2

Females

0	5	0.0049	0.0242	100000	2421	490317	6493703	64.9
5	5	0.0002	0.0012	97579	118	487601	6003386	61.5
10	5	0.0004	0.0018	97461	172	486876	5515785	56.6
15	5	0.0017	0.0085	97289	829	484375	5028909	51.7
20	5	0.0024	0.0119	96461	1149	479430	4544534	47.1
25	5	0.0022	0.0108	95311	1029	473985	4065104	42.7
30	5	0.0030	0.0150	94283	1416	467875	3591119	38.1
35	5	0.0052	0.0255	92867	2363	458427	3123244	33.6
40	5	0.0062	0.0305	90504	2765	445607	2664817	29.4
45	5	0.0157	0.0754	87739	6613	422162	2219211	25.3
50	5	0.0165	0.0791	81126	6418	389585	1797048	22.2
55	5	0.0221	0.1048	74708	7831	353963	1407463	18.8
60	5	0.0347	0.1595	66877	10664	307726	1053500	15.8
65	5	0.0323	0.1493	56213	8393	260084	745774	13.3
70	5	0.0732	0.3095	47820	14802	202097	485690	10.2
75	ω	0.1164	1.0000	33018	33018	283593	283593	8.6

${}_nM_x$ Death rate between age x and x+n
${}_nq_x$ Probability of dying between age x and x+n
l_x Survivors from a birth cohort of 100,000, at age x
${}_nd_x$ Deaths between age x and x+n from a birth cohort of 100,000
${}_nL_x$ Person-years lived between age x and x+n, from a birth cohort of 100,000
T_x Person-years lived above age x, from a birth cohort of 100,000
e_x Expected years of life remaining at age x

Table C.2. Victoria and Tasmania

Males

x	n	${}_nM_x$	${}_nq_x$	l_x	${}_nd_x$	${}_nL_x$	T_x	e_x
0	5	0.0030	0.0151	100000	1506	493977	6135259	61.4
5	5	0.0004	0.0018	98494	174	492036	5641282	57.3
10	5	0.0011	0.0056	98320	551	490223	5149246	52.4
15	5	0.0021	0.0106	97769	1039	486248	4659023	47.7
20	5	0.0034	0.0169	96730	1634	479565	4172775	43.1
25	5	0.0055	0.0271	95096	2579	469031	3693210	38.8
30	5	0.0066	0.0326	92517	3013	455050	3224179	34.8
35	5	0.0090	0.0438	89503	3918	437722	2769129	30.9
40	5	0.0128	0.0621	85586	5313	414644	2331407	27.2
45	5	0.0157	0.0756	80272	6065	386197	1916763	23.9
50	5	0.0180	0.0862	74207	6395	355045	1530566	20.6
55	5	0.0261	0.1225	67812	8307	318289	1175520	17.3
60	5	0.0430	0.1942	59504	11555	268633	857231	14.4
65	5	0.0712	0.3021	47949	14486	203531	588598	12.3
70	5	0.0661	0.2837	33463	9495	143579	385068	11.5
75	ω	0.0993	1.0000	23968	23968	241488	241488	10.1
Females								
0	5	0.0023	0.0114	100000	1140	495440	6814286	68.1
5	5	0.0002	0.0009	98860	85	494086	6318846	63.9
10	5	0.0002	0.0011	98775	105	493611	5824760	59.0
15	5	0.0012	0.0062	98670	611	491821	5331149	54.0
20	5	0.0022	0.0109	98059	1070	487617	4839328	49.4
25	5	0.0021	0.0103	96988	1003	482434	4351710	44.9
30	5	0.0027	0.0134	95985	1288	476705	3869277	40.3
35	5	0.0050	0.0248	94697	2345	467622	3392571	35.8
40	5	0.0066	0.0322	92352	2977	454317	2924950	31.7
45	5	0.0145	0.0701	89375	6267	431207	2470633	27.6
50	5	0.0112	0.0547	83108	4543	404180	2039426	24.5
55	5	0.0181	0.0865	78564	6793	375840	1635246	20.8
60	5	0.0262	0.1229	71772	8820	336809	1259406	17.5
65	5	0.0269	0.1262	62952	7944	294899	922597	14.7
70	5	0.0721	0.3053	55008	16793	233058	627698	11.4
75	ω	0.0968	1.0000	38215	38215	394639	394639	10.3

${}_nM_x$ Death rate between age x and x+n
${}_nq_x$ Probability of dying between age x and x+n
l_x Survivors from a birth cohort of 100,000, at age x
${}_nd_x$ Deaths between age x and x+n from a birth cohort of 100,000
${}_nL_x$ Person-years lived between age x and x+n, from a birth cohort of 100,000
T_x Person-years lived above age x, from a birth cohort of 100,000
e_x Expected years of life remaining at age x

Table C.3. Queensland

Males

x	n	$_nM_x$	$_nq_x$	l_x	$_nd_x$	$_nL_x$	T_x	e_x
0	5	0.0075	0.0366	100000	3658	485369	5641468	56.4
5	5	0.0005	0.0023	96342	218	481166	5156099	53.5
10	5	0.0017	0.0083	96124	798	478626	4674933	48.6
15	5	0.0026	0.0130	95326	1239	473535	4196307	44.0
20	5	0.0040	0.0200	94088	1883	465731	3722771	39.6
25	5	0.0069	0.0340	92205	3136	453183	3257041	35.3
30	5	0.0069	0.0338	89069	3011	437817	2803857	31.5
35	5	0.0127	0.0617	86058	5311	417012	2366041	27.5
40	5	0.0157	0.0756	80747	6100	388484	1949028	24.1
45	5	0.0189	0.0900	74647	6721	356431	1560544	20.9
50	5	0.0247	0.1164	67926	7906	319864	1204113	17.7
55	5	0.0401	0.1824	60020	10949	272727	884249	14.7
60	5	0.0527	0.2328	49071	11422	216799	611522	12.5
65	5	0.0701	0.2981	37649	11221	160190	394723	10.5
70	5	0.0835	0.3453	26427	9126	109322	234533	8.9
75	ω	0.1382	1.0000	17302	17302	125211	125211	7.2
Females								
0	5	0.0061	0.0298	100000	2977	488091	6281310	62.8
5	5	0.0003	0.0013	97023	127	484795	5793219	59.7
10	5	0.0004	0.0018	96895	178	484031	5308423	54.8
15	5	0.0017	0.0087	96717	839	481488	4824393	49.9
20	5	0.0026	0.0127	95878	1216	476350	4342905	45.3
25	5	0.0025	0.0126	94662	1195	470322	3866555	40.8
30	5	0.0032	0.0160	93467	1495	463597	3396232	36.3
35	5	0.0055	0.0272	91972	2498	453617	2932635	31.9
40	5	0.0070	0.0342	89474	3064	439711	2479019	27.7
45	5	0.0182	0.0872	86410	7537	413207	2039307	23.6
50	5	0.0196	0.0936	78873	7385	375902	1626100	20.6
55	5	0.0271	0.1269	71488	9071	334763	1250199	17.5
60	5	0.0382	0.1745	62417	10891	284858	915435	14.7
65	5	0.0450	0.2022	51526	10418	231586	630577	12.2
70	5	0.0870	0.3574	41108	14690	168816	398991	9.7
75	ω	0.1148	1.0000	26418	26418	230176	230176	8.7

$_nM_x$ Death rate between age x and x+n
$_nq_x$ Probability of dying between age x and x+n
l_x Survivors from a birth cohort of 100,000, at age x
$_nd_x$ Deaths between age x and x+n from a birth cohort of 100,000
$_nL_x$ Person-years lived between age x and x+n, from a birth cohort of 100,000
T_x Person-years lived above age x, from a birth cohort of 100,000
e_x Expected years of life remaining at age x

Table C.4. South Australia

Males

x	n	${}_nM_x$	${}_nq_x$	l_x	${}_nd_x$	${}_nL_x$	T_x	e_x
0	5	0.0088	0.0427	100000	4272	482912	5625983	56.3
5	5	0.0005	0.0027	95728	258	477996	5143071	53.7
10	5	0.0017	0.0083	95470	797	475359	4665075	48.9
15	5	0.0025	0.0123	94673	1165	470454	4189716	44.3
20	5	0.0037	0.0186	93509	1736	463204	3719261	39.8
25	5	0.0071	0.0348	91773	3191	450886	3256057	35.5
30	5	0.0080	0.0391	88582	3464	434247	2805171	31.7
35	5	0.0137	0.0662	85117	5639	411489	2370924	27.9
40	5	0.0165	0.0792	79478	6297	381650	1959435	24.7
45	5	0.0171	0.0819	73182	5995	350922	1577785	21.6
50	5	0.0262	0.1229	67187	8258	315290	1226863	18.3
55	5	0.0424	0.1916	58929	11288	266424	911573	15.5
60	5	0.0449	0.2020	47641	9625	214142	645149	13.5
65	5	0.0506	0.2245	38016	8536	168738	431007	11.3
70	5	0.0710	0.3015	29480	8889	125175	262269	8.9
75	ω	0.1502	1.0000	20590	20590	137094	137094	6.7
Females								
0	5	0.0068	0.0329	100000	3291	486838	6388694	63.9
5	5	0.0003	0.0014	96709	133	483214	5901856	61.0
10	5	0.0003	0.0016	96576	156	482489	5418643	56.1
15	5	0.0014	0.0071	96420	680	480399	4936153	51.2
20	5	0.0023	0.0115	95740	1106	475935	4455755	46.5
25	5	0.0026	0.0127	94634	1202	470166	3979819	42.1
30	5	0.0039	0.0191	93432	1787	462693	3509653	37.6
35	5	0.0062	0.0305	91645	2791	451248	3046960	33.2
40	5	0.0068	0.0332	88854	2949	436897	2595713	29.2
45	5	0.0163	0.0783	85905	6726	412709	2158816	25.1
50	5	0.0190	0.0907	79179	7179	377946	1746107	22.1
55	5	0.0232	0.1097	72000	7896	340258	1368161	19.0
60	5	0.0244	0.1149	64103	7366	302101	1027903	16.0
65	5	0.0331	0.1528	56737	8671	262009	725802	12.8
70	5	0.0842	0.3478	48066	16716	198543	463793	9.6
75	ω	0.1182	1.0000	31351	31351	265250	265250	8.5

${}_nM_x$ Death rate between age x and x+n
${}_nq_x$ Probability of dying between age x and x+n
l_x Survivors from a birth cohort of 100,000, at age x
${}_nd_x$ Deaths between age x and x+n from a birth cohort of 100,000
${}_nL_x$ Person-years lived between age x and x+n, from a birth cohort of 100,000
T_x Person-years lived above age x, from a birth cohort of 100,000
e_x Expected years of life remaining at age x

Table C.5. Western Australia

Males

x	n	${}_nM_x$	${}_nq_x$	l_x	${}_nd_x$	${}_nL_x$	T_x	e_x
0	5	0.0096	0.0462	100000	4615	481538	5474576	54.7
5	5	0.0006	0.0030	95385	287	476206	4993038	52.3
10	5	0.0020	0.0098	95098	934	473154	4516832	47.5
15	5	0.0027	0.0133	94164	1248	467700	4043678	42.9
20	5	0.0041	0.0204	92916	1892	459851	3575978	38.5
25	5	0.0078	0.0384	91024	3499	446373	3116127	34.2
30	5	0.0076	0.0375	87525	3281	429424	2669754	30.5
35	5	0.0139	0.0670	84244	5642	407117	2240330	26.6
40	5	0.0177	0.0848	78602	6664	376351	1833213	23.3
45	5	0.0204	0.0972	71938	6994	342205	1456862	20.3
50	5	0.0263	0.1233	64944	8005	304708	1114657	17.2
55	5	0.0438	0.1974	56939	11239	256598	809949	14.2
60	5	0.0484	0.2160	45700	9869	203826	553350	12.1
65	5	0.0714	0.3031	35831	10860	152003	349524	9.8
70	5	0.0970	0.3904	24971	9748	100482	197521	7.9
75	ω	0.1569	1.0000	15222	15222	97039	97039	6.4
Females								
0	5	0.0070	0.0339	100000	3387	486451	6210296	62.1
5	5	0.0003	0.0016	96613	150	482689	5723845	59.2
10	5	0.0004	0.0022	96463	212	481783	5241156	54.3
15	5	0.0018	0.0090	96250	867	479085	4759373	49.4
20	5	0.0028	0.0139	95384	1325	473605	4280288	44.9
25	5	0.0029	0.0143	94058	1342	466938	3806683	40.5
30	5	0.0036	0.0176	92717	1632	459502	3339745	36.0
35	5	0.0055	0.0273	91084	2484	449212	2880243	31.6
40	5	0.0074	0.0365	88600	3233	434919	2431031	27.4
45	5	0.0188	0.0897	85367	7659	407690	1996112	23.4
50	5	0.0208	0.0989	77709	7686	369328	1588421	20.4
55	5	0.0225	0.1064	70022	7447	331495	1219094	17.4
60	5	0.0387	0.1765	62576	11047	285261	887599	14.2
65	5	0.0433	0.1954	51529	10069	232471	602338	11.7
70	5	0.1108	0.4337	41460	17982	162343	369867	8.9
75	ω	0.1131	1.0000	23478	23478	207524	207524	8.8

${}_nM_x$ Death rate between age x and x+n
${}_nq_x$ Probability of dying between age x and x+n
l_x Survivors from a birth cohort of 100,000, at age x
${}_nd_x$ Deaths between age x and x+n from a birth cohort of 100,000
${}_nL_x$ Person-years lived between age x and x+n, from a birth cohort of 100,000
T_x Person-years lived above age x, from a birth cohort of 100,000
e_x Expected years of life remaining at age x

Table C.6. Northern Territory

Males

x	n	${}_nM_x$	${}_nq_x$	l_x	${}_nd_x$	${}_nL_x$	T_x	e_x
0	5	0.0089	0.0431	100000	4307	482770	5538227	55.4
5	5	0.0006	0.0031	95693	297	477719	5055457	52.8
10	5	0.0019	0.0093	95395	883	474769	4577738	48.0
15	5	0.0022	0.0108	94513	1022	470007	4102968	43.4
20	5	0.0036	0.0179	93490	1675	463264	3632962	38.9
25	5	0.0082	0.0402	91815	3692	449847	3169698	34.5
30	5	0.0078	0.0380	88123	3351	432239	2719850	30.9
35	5	0.0143	0.0691	84772	5858	409216	2287611	27.0
40	5	0.0161	0.0775	78914	6116	379282	1878396	23.8
45	5	0.0180	0.0861	72798	6266	348326	1499114	20.6
50	5	0.0282	0.1319	66532	8777	310718	1150788	17.3
55	5	0.0394	0.1795	57755	10367	262858	840069	14.5
60	5	0.0572	0.2504	47388	11865	207278	577212	12.2
65	5	0.0748	0.3152	35523	11198	149622	369933	10.4
70	5	0.0887	0.3631	24326	8833	99545	220311	9.1
75	ω	0.1283	1.0000	15492	15492	120766	120766	7.8

Females

0	5	0.0067	0.0328	100000	3276	486898	6273310	62.7
5	5	0.0003	0.0017	96724	167	483206	5786412	59.8
10	5	0.0004	0.0019	96558	179	482342	5303207	54.9
15	5	0.0013	0.0064	96379	619	480348	4820865	50.0
20	5	0.0025	0.0125	95760	1201	475799	4340517	45.3
25	5	0.0030	0.0148	94559	1402	469293	3864718	40.9
30	5	0.0040	0.0198	93158	1845	461177	3395425	36.4
35	5	0.0061	0.0299	91313	2726	449749	2934249	32.1
40	5	0.0070	0.0342	88587	3032	435352	2484500	28.0
45	5	0.0186	0.0888	85554	7598	408776	2049147	24.0
50	5	0.0213	0.1009	77956	7865	370117	1640371	21.0
55	5	0.0173	0.0829	70091	5810	335929	1270254	18.1
60	5	0.0428	0.1934	64281	12434	290319	934325	14.5
65	5	0.0570	0.2495	51847	12937	226893	644006	12.4
70	5	0.0765	0.3211	38910	12492	163321	417113	10.7
75	ω	0.1041	1.0000	26418	26418	253793	253793	9.6

${}_nM_x$ Death rate between age x and x+n
${}_nq_x$ Probability of dying between age x and x+n
l_x Survivors from a birth cohort of 100,000, at age x
${}_nd_x$ Deaths between age x and x+n from a birth cohort of 100,000
${}_nL_x$ Person-years lived between age x and x+n, from a birth cohort of 100,000
T_x Person-years lived above age x, from a birth cohort of 100,000
e_x Expected years of life remaining at age x

Table C 7. Australia

Males

x	n	${}_nM_x$	${}_nq_x$	l_x	${}_nd_x$	${}_nL_x$	T_x	e_x
0	5	0.0073	0.0356	100000	3557	485772	5700342	57.0
5	5	0.0005	0.0024	96443	231	481637	5214570	54.1
10	5	0.0016	0.0082	96212	790	479082	4732934	49.2
15	5	0.0025	0.0124	95421	1184	474145	4253851	44.6
20	5	0.0039	0.0191	94237	1800	466686	3779706	40.1
25	5	0.0069	0.0339	92437	3137	454344	3313020	35.8
30	5	0.0072	0.0352	89300	3148	438632	2858677	32.0
35	5	0.0125	0.0607	86153	5229	417689	2420045	28.1
40	5	0.0147	0.0708	80923	5728	390297	2002355	24.7
45	5	0.0178	0.0852	75196	6407	359960	1612058	21.4
50	5	0.0235	0.1108	68788	7620	324890	1252099	18.2
55	5	0.0383	0.1748	61168	10689	279116	927208	15.2
60	5	0.0491	0.2187	50478	11042	224788	648092	12.8
65	5	0.0659	0.2828	39437	11154	169296	423305	10.7
70	5	0.0816	0.3390	28282	9588	117440	254008	9.0
75	ω	0.1369	1.0000	18694	18694	136568	136568	7.3

Females

0	5	0.0057	0.0276	100000	2764	488945	6381316	63.8
5	5	0.0003	0.0013	97236	129	485858	5892370	60.6
10	5	0.0004	0.0018	97107	173	485102	5406512	55.7
15	5	0.0016	0.0080	96934	779	482723	4921410	50.8
20	5	0.0025	0.0124	96155	1190	477800	4438687	46.2
25	5	0.0025	0.0124	94965	1180	471875	3960887	41.7
30	5	0.0033	0.0164	93785	1535	465087	3489012	37.2
35	5	0.0055	0.0270	92250	2487	455030	3023925	32.8
40	5	0.0067	0.0332	89762	2978	441366	2568896	28.6
45	5	0.0171	0.0819	86784	7110	416145	2127529	24.5
50	5	0.0182	0.0871	79674	6942	381014	1711384	21.5
55	5	0.0225	0.1066	72732	7754	344274	1330370	18.3
60	5	0.0360	0.1652	64978	10737	298048	986096	15.2
65	5	0.0404	0.1835	54241	9952	246327	688048	12.7
70	5	0.0839	0.3469	44290	15364	183037	441721	10.0
75	ω	0.1118	1.0000	28925	28925	258684	258684	8.9

${}_nM_x$ Death rate between age x and x+n
${}_nq_x$ Probability of dying between age x and x+n
l_x Survivors from a birth cohort of 100,000, at age x
${}_nd_x$ Deaths between age x and x+n from a birth cohort of 100,000
${}_nL_x$ Person-years lived between age x and x+n, from a birth cohort of 100,000
T_x Person-years lived above age x, from a birth cohort of 100,000
e_x Expected years of life remaining at age x

Table C.8. Torres Strait Islanders (Queensland)

Males

x	n	${}_nM_x$	${}_nq_x$	l_x	${}_nd_x$	${}_nL_x$	T_x	e_x
0	5	0.0069	0.0334	100000	3342	486632	5628617	56.3
5	5	0.0005	0.0023	96658	225	482727	5141986	53.2
10	5	0.0017	0.0086	96433	825	480102	4659259	48.3
15	5	0.0025	0.0125	95608	1194	475053	4179157	43.7
20	5	0.0039	0.0194	94413	1827	467498	3704104	39.2
25	5	0.0069	0.0339	92586	3142	455074	3236607	35.0
30	5	0.0070	0.0344	89444	3075	439531	2781532	31.1
35	5	0.0132	0.0639	86369	5516	418054	2342001	27.1
40	5	0.0170	0.0816	80853	6594	387779	1923947	23.8
45	5	0.0195	0.0929	74259	6900	354044	1536168	20.7
50	5	0.0245	0.1155	67359	7781	317341	1182125	17.5
55	5	0.0405	0.1837	59578	10943	270531	864783	14.5
60	5	0.0479	0.2140	48634	10406	217156	594253	12.2
65	5	0.0701	0.2983	38228	11404	162629	377096	9.9
70	5	0.0925	0.3756	26824	10076	108929	214467	8.0
75	ω	0.1587	1.0000	16748	16748	105538	105538	6.3

Females

0	5	0.0057	0.0281	100000	2806	488776	6277180	62.8
5	5	0.0003	0.0013	97194	125	485658	5788404	59.6
10	5	0.0004	0.0019	97069	186	484881	5302746	54.6
15	5	0.0017	0.0083	96883	808	482396	4817866	49.7
20	5	0.0024	0.0119	96075	1145	477513	4335470	45.1
25	5	0.0025	0.0123	94930	1165	471738	3857957	40.6
30	5	0.0033	0.0164	93765	1536	464987	3386219	36.1
35	5	0.0056	0.0277	92230	2557	454755	2921232	31.7
40	5	0.0071	0.0350	89672	3138	440518	2466477	27.5
45	5	0.0192	0.0914	86535	7912	412894	2025959	23.4
50	5	0.0209	0.0994	78623	7814	373581	1613065	20.5
55	5	0.0286	0.1336	70809	9463	330390	1239484	17.5
60	5	0.0389	0.1771	61347	10867	279566	909094	14.8
65	5	0.0487	0.2172	50480	10962	224995	629528	12.5
70	5	0.0799	0.3329	39518	13157	164698	404533	10.2
75	ω	0.1099	1.0000	26361	26361	239835	239835	9.1

${}_nM_x$ Death rate between age x and x+n
${}_nq_x$ Probability of dying between age x and x+n
l_x Survivors from a birth cohort of 100,000, at age x
${}_nd_x$ Deaths between age x and x+n from a birth cohort of 100,000
${}_nL_x$ Person-years lived between age x and x+n, from a birth cohort of 100,000
T_x Person-years lived above age x, from a birth cohort of 100,000
e_x Expected years of life remaining at age x

Notes

1. The reason for slight difference from the 1996 Census total is explained in Appendix B.
2. If these improvements occur, male Aboriginal life expectancy would reach 67.5 years in the 2006–11 period and female life expectancy would reach 74.3 years. These would be improvements of just over ten years of survival, for each sex, compared with the period 1991–96. This outcome is the optimistic limit of possible achievement.
3. While it has not been emphasised in the text, estimation of the population characteristics of Torres Strait Islanders in Queensland was undertaken as part of the analysis and the appendix tables (B.1, C.8) contain considerable detail about this topic.
4. No data were available for Queensland, and the proportion for Australia as a whole was assumed for that State.
5. Mortality levels do not usually change in so simple a fashion. The projection estimates for these periods should be regarded as illustrative rather than predictive.
6. A closed population is a population in which there is no migration either in or out.
7. Marked inconsistency is observed for the Australian Capital Territory if separated from New South Wales, and for Tasmania if separated from Victoria. Also, no reasonable results can be obtained for Torres Strait Islanders outside Queensland.
8. In the case of the age group 0-4 in 1996, equation (1) becomes $N2_e = B - D_e$, where B refers to births in the intercensal period.

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