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Issues in estimating small area populations

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ABSTRACT

In Australia, the Statistical Local Area (SLA) is the base spatial unit used to collect and disseminate statistics other than those collected from the Population Census. Population estimates for SLAs are provided by the Australian Bureau of Statistics as at 30 June each year.

Data from the 1991 Census was used to produce SLA population estimates as at 30 June 1991. These were then used as a base to provide preliminary estimates for 1992 to 1996, by applying estimation techniques to various data sources such as buildings approvals and Medicare enrolments.

Following the release of 1996 Census data, population estimates for 30 June 1996 were recalculated. These are customarily adopted as the 'true', or final, 1996 estimates.

The inevitable discrepancies that occurred between the preliminary and final 1996 SLA estimates can be attributed to several factors, including: the inherent characteristics of the region (such as population size and growth rate); changes in the geographic boundaries; the quality of input data; the estimation method; and adjustments to State and Territory totals. This paper investigates the differences between the preliminary and final 1996 SLA estimates by assessing the magnitude and nature of these discrepancies.

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1 OVERVIEW

The Australian Bureau of Statistics (ABS) compiles and publishes estimates of the population and its components. Here, population is defined according to the concept of Estimated Resident Population (ERP), which links people to their place of usual residence within Australia. Population estimates are of fundamental importance to the community and receive specific mention in the *Census and Statistics Act 1905*.

ERPs are produced annually for Statistical Local Areas (SLAs). The SLA is the base spatial unit used to collect and disseminate statistics other than those collected from the Population Census. In aggregate, SLAs cover the whole of Australia without gaps or overlaps.

The estimated resident populations in SLAs – which generally conform to or combine to form Local Government Areas (LGAs) – are critical for State and Territory local government grant bodies and local government authorities. In addition, population estimates for SLAs are used as a base for population projections. ABS population surveys use SLA–based population estimates and projections as benchmarks. SLA population projections are also used by the Commonwealth and State electoral commissions. SLA population estimates and projections are also extensively used by health analysts, in private enterprise and for research purposes.

ERPs for SLAs are produced annually, as at 30 June. The ABS first publishes SLA population totals, which are generally released seven months after the reference date. Later these SLA population totals are disaggregated into age and sex components, and are generally released within twelve months of the reference date.

Annual LGA/SLA population estimates have been published for New South Wales and Queensland since 1911, Victoria since 1875, South Australia since 1915, Western Australia since 1926, Tasmania since 1923, the Northern Territory since 1981 and the Australian Capital Territory since 1968.

2 METHOD

The method used to produce the annual SLA population estimates depends on whether a Census of Population and Housing was conducted that year.

2.1 SLA population estimates – census years

Census data is used to produce ERPs for SLAs as at 30 June of the Census year which are validated in conjunction with State and Territory offices of the ABS. Census year SLA population estimates are produced by Demography Section, ABS Canberra.

Census counts of usual residents by SLA are adjusted for undercounting using data from the census Post–Enumeration Survey[1].

[1] The Post–Enumeration Survey is a sample survey conducted immediately after the census to estimate the number of people (and their characteristics) who for one reason or another did not complete or were not included on a census form. It also detects instances of double counting of individuals, but the number of such cases is far outweighed by the number of people who are not counted. The net undercount is therefore the excess of the undercount (people not counted) over the number of instances of double counting. In 1996 the net undercount for Australia was 1.6 per cent (ABS 1997a).

Estimates of the number of Australian residents temporarily overseas, derived from residential addresses reported by these residents upon returning to Australia after the census, are added to the appropriate SLAs.

If the census does not occur on 30 June (for example the 1996 Census was held on 6 August) then a further adjustment is made to produce estimates at the nearest 30 June reference date. A variation of the component method is used for this adjustment.

2.2 SLA population estimates – non–census years

Based on census year SLA population estimates, ERPs for SLAs are updated as at 30 June in following years. Although annual births and deaths data are available for SLAs, the absence of migration data for non–census years means that it is not possible to use the component method to update SLA population totals.

Until 1996, ERPs for SLAs for non–census years were calculated by State and Territory ABS offices. A variety of procedures and techniques were applied, the most popular technique being a regression–based methodology.

Regression techniques first establish a relationship, based on past data, between population growth and the growth in symptomatic indicator(s). Symptomatic indicators are any available set of data which in some way relates to changes in population size. The choice of symptomatic indicators varies across the States and Territories. Some examples are: dwellings, Medicare enrolments, drivers licenses and electricity connections. The relationships between population growth and symptomatic indicators are expressed mathematically in terms of regression coefficients which, with the knowledge of the growth in the indicators for the current time period, enable population growth to be estimated.

Due to the fact that there can be considerable differences between SLAs in terms of population growth rates, stratification is applied to the modelling procedure. This involves separating the SLAs within a State or Territory into subsets based on factors such as location (urban or rural), population growth (high or otherwise), and house per dwelling ratio (number of houses in relation to number of dwellings). More accurate estimates may then be calculated based on relationships existing within these subsets of more homogenous SLAs.

From 1997, provisional ERPs for all SLAs for non–census years have been calculated by the Small Area Population Unit (SAPU), located in the Adelaide office of the ABS. The SAPU almost exclusively adopts a regression–based methodology.

Despite the centralisation in the production of ERPs for SLAs in non–census years, each State and Territory office of the ABS has the discretion to adjust the figures produced by the SAPU. These adjustments may be made by State and Territory offices based on local knowledge, alternative procedures and/or other data sources.

All SLA population estimates are constrained to add to their State or Territory population totals.

3 RELEASE PROCEDURE

Three series of SLA estimates are produced. The release procedure again depends on whether a census is conducted in that year.

The three series generally fall under the categories of preliminary, revised, and final.

3.1 SLA population estimates – census years

In the interests of providing timely data, *preliminary* ERPs, updated from the previous census, are calculated. Later, when some census results become available, *revised* estimates for the census year are made. When final census results are available and State/Territory totals are finalised, *final* ERPs for SLAs are produced.

TABLE 1: TIMETABLE FOR RELEASE OF ESTIMATED RESIDENT POPULATION, STATISTICAL LOCAL AREAS, 30 JUNE 1996

Type	*Comment*	*Release date*
Preliminary	Updated from 1991 Census estimates	January – February 1997
Revised	Based on release of some 1996 Census data	July 1997
Final	Based on release of all 1996 Census data	December 1997

3.2 SLA population estimates – non–census years

As is the case in census years, *preliminary* ERPs are published seven to eight months after the reference date. When State and Territory totals are revised (about 15 months after the reference date), *revised* SLA totals are also calculated (to add to new State/Territory totals). This revision is usually made by pro–rating the SLA estimates to the new State/Territory total. However the adjustments to preliminary SLAs are, in most cases, fairly minimal, because revisions to the State/Territory totals are generally small.

Once the following census year ERPs have been finalised, and to overcome the break in continuity between the two data series (ie. preliminary non–census year– and final census year population estimates), all ERPs updated from the previous census are then re–calculated to become *final*. In doing so, it is generally assumed that the discrepancy as at the census year accumulates by an equal number each year over the intercensal period.

ERPs for SLAs as at 30 June 1992 to 1995 were finalised in February 1998.

4 DISTRIBUTION OF SLA SIZE

It is important to become familiar with the distribution of SLA size (in terms of population) in each State and Territory.

The nature of SLA geography across Australia is such that SLAs range in population size from zero to well over 200,000 persons. The SLA with the largest population in 1996 was Blacktown (C), in the north–west of Sydney, with 239,818 persons. Several SLAs had zero population in 1996.

The SLAs included in this analysis are those as defined by the 1996 Australian Standard Geographical Classification, excluding the three SLAs that make up 'Other Territories'.

TABLE 2: DISTRIBUTION OF STATISTICAL LOCAL AREAS BY POPULATION, 30 JUNE 1996

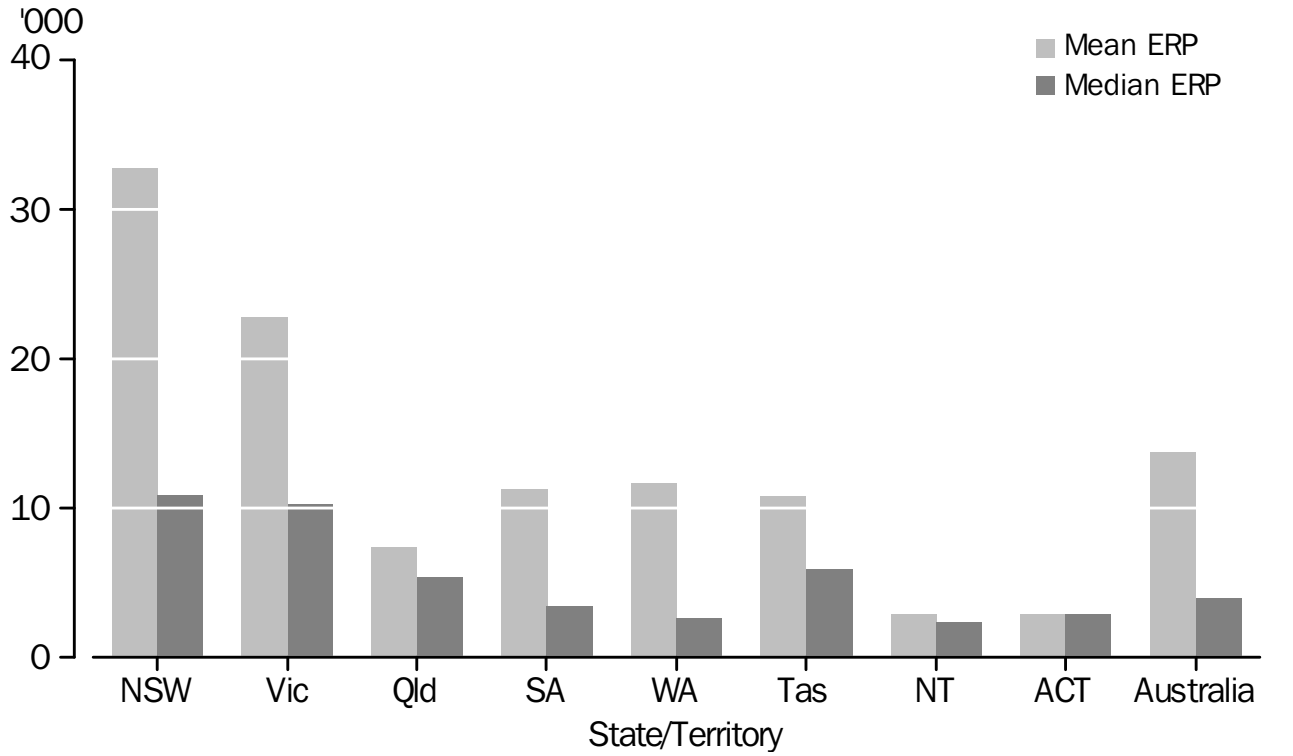
Number of SLAs	Estimated Resident Population as at 30 June 1996									*Total number of SLAs*
	zero	*1 – 499*	*500 – 1249*	*1250 – 2499*	*2500 – 4999*	*5000 – 9999*	*10000 – 19999*	*20000 – 49999*	*50000+*	
NSW	1	3	3	14	37	33	22	35	41	189
Vic	2	3	3	2	34	48	30	54	24	200
Qld	2	17	30	49	110	130	91	17	3	449
SA	3	9	11	31	21	23	14	12	6	130
WA	1	12	38	22	18	18	14	18	10	151
Tas	1	2	4	5	7	12	7	5	1	44
NT	1	2	10	20	21	8	1	0	0	63
ACT	1	19	6	15	54	11	1	0	0	107
Australia	12	67	105	158	302	283	180	141	85	1 333

TABLE 3: MEAN AND MEDIAN SIZE OF STATISTICAL LOCAL AREAS, 30 JUNE 1996

	Estimated Resident Population ('000)		
	Total	Mean	Median
NSW	*6 204.7*	32.8	10.9
Vic	*4 560.2*	22.8	10.3
Qld	*3 338.7*	7.4	5.4
SA	*1 474.3*	11.3	3.5
WA	*1 765.3*	11.7	2.6
Tas	*474.4*	10.8	5.9
NT	*181.8*	2.9	2.4
ACT	*308.3*	2.9	2.9
Australia	*18 307.6*	13.7	4.0

In 1996, the six States had a mean SLA ERP much larger than the median, indicating that in those States, a relatively small number of SLAs had a relatively large proportion of the population. In fact, over 50 per cent of the population of South Australia and Western Australia resided in only 8 and 9 per cent of the SLAs respectively. At the other extreme, the Australian Capital Territory and the Northern Territory (where the median SLA size was much closer to the average SLA size) had half of their population in 27 and 25 per cent of SLAs respectively.

FIGURE 1: MEAN AND MEDIAN POPULATION OF STATISTICAL LOCAL AREAS, 30 JUNE 1996



5 ASSESSMENT

To assess the accuracy of the estimates, a comparison can be made between preliminary and final census year SLA population estimates. The difference between preliminary and final 30 June 1996 ERPs for each SLA is referred to as the **intercensal discrepancy** (sometimes referred to as the intercensal error or the estimation error).

The preliminary 1996 SLA population estimates were those published by each State and Territory office of the ABS in January – February 1997 (ABS 1997b–i). The final 1996 ERPs were those published by the ABS in February 1998 (ABS 1998a). The census–based (final) 1996 estimates are implicitly assumed to be correct.

The intercensal discrepancy is a valuable tool for assessing the performance of the method used to calculate ERPs since the previous census. For instance, the 30 June 1996 intercensal discrepancies are not only a measure of the differences between preliminary and final ERPs in 1996, it reflects the accuracy (or otherwise) of all population estimates produced for those regions since, and including, 1992.

Method of evaluation

Several measures of the intercensal discrepancy can be considered. The most common measure is a percentage difference. However, a numeric difference may also be useful. Other difference measures can be obtained by transforming the differences, for example, by calculating the log of the difference. There are pros and cons in each approach.

TABLE 4: MEASURES OF ERROR

Type of error	Formula P_p = preliminary ERP P_f = final ERP	*Example, where:* *P_p = 10,500* *P_f = 10,000*
Percentage error	$\frac{100 \times (P_p - P_f)}{P_f}$	*5%*
Numeric error	$P_p - P_f$	*500 persons*
Log error	$\frac{\log(P_p - P_f)}{\log(P_f)}$	*0.675*

Measures of error may be dependent on the size of the populations being considered. The wide range of SLA size means that in the process of evaluating intercensal discrepancies, care should be taken to ensure that no particular group of SLAs (in terms of size) is disadvantaged by conclusions made for other groups.

Evaluation based purely on percentage (or numeric) error assumes that each area's per–centage (or numeric) error is as significant as each other's, despite the range of SLA size.

In 1996, SLAs ranged in size from zero to well over 200,000 persons (section 4). The following table (table 5) considers various measures of error associated with populations of size 2,000, 20,000 and 200,000.

From table 5 it can be seen that the definition of an 'acceptable' error is not obvious. For a small area, an error of five per cent might be acceptable, eg. an error of 100 in an SLA of 2000 persons. However, an error of five per cent in a region of 200,000 persons (10,000) is generally less 'acceptable'.

TABLE 5: EXAMPLES OF ERRORS AND MEASURES OF ERROR ASSOCIATED WITH POPULATIONS OF SIZE 2,000, 20,000 AND 200,000

Final ERP	Preliminary ERP	Percentage error	Numeric error	Log error(a)
		PERCENTAGE ERROR = +5 per cent		
2 000	2 100	*5.0*	100	0.61
20 000	21 000	*5.0*	1 000	0.70
200 000	210 000	*5.0*	10 000	0.75
		NUMERIC ERROR = +1000 persons		
2 000	3 000	50.0	*1 000*	0.91
20 000	21 000	5.0	*1 000*	0.70
200 000	201 000	0.5	*1 000*	0.57
		LOG ERROR = 0.67		
2 000	2 163	8.1	163	*0.67*
20 000	20 762	3.8	762	*0.67*
200 000	203 562	1.8	3 562	*0.67*

(a) 'Log error' is defined as the logarithm of the error divided by the logarithm of the final ERP

The concept of the percentage error is universally understood. However percentage errors are not generally suited to analysis of SLAs which have a wide range of populations, since percentage errors are generally higher for small SLAs.

Analysis of numeric errors assists in understanding magnitude of variation where per capita issues are important. Again however, evaluation purely based on numeric error is not suited to States/Territories with a large range of SLA populations. Numeric errors are generally higher for large SLAs.

A logarithmic transformation may be considered a 'compromise' between a percentage and numeric error, because large SLAs are scaled downwards. However the concept of the log error is more difficult to understand, and an acceptable threshold is not obvious.

An important consideration when evaluating discrepancies is the effect that one area's error has on other areas. This is especially relevant when funds are allocated based on the share of the total State/Territory population that each area has. For instance, if a relatively large LGA was significantly over–estimated, then the remaining LGAs would receive less share of the available pool of funding.

Nash (1950) attempts to account for this by deriving a criterion function which recognises the need to choose an allocation scheme which is a jointly acceptable compromise for all members of a community. This function suggests that a chi–squared statistic may be the most appropriate measure of error.

Despite its shortcomings, the traditional measure of intercensal discrepancy is the percentage error. The tendency for percentage error to over–emphasise the degree of error for small SLAs may be reduced by simply excluding very small SLAs from analysis. In evaluating the accuracy of population estimates, the remainder of this paper will focus mainly on the percentage error.

When combining a number of discrepancies to produce a consolidated figure such as the average SLA intercensal discrepancy for a State, the *absolute value* of the error must be used. If both positive (over–estimates) and negative (under–estimates) discrepancies were summed together, the errors may well cancel each other out.

6 ASSESSMENT OF 1996 POPULATION ESTIMATES

6.1 National, State and Territory

The estimated resident population of Australia at 30 June 1996 derived by updating the previous census fell short of the 1996 census–based population by 21,572 persons[2]. In other words, the intercensal discrepancy was –21,572, or –0.1 per cent, at the national level. The size and direction of discrepancies varied across the States and Territories.

TABLE 6: INTERCENSAL DISCREPANCY, STATES, TERRITORIES AND AUSTRALIA, 30 JUNE 1996

	Estimated Resident Population ('000)		*Discrepancy*	
	Preliminary	Final	Number ('000)	*Per cent*
NSW	6 190.2	6 204.7	-14.5	*–0.2*
Vic	4 541.0	4 560.2	-19.2	*–0.4*
Qld	3 354.7	3 338.7	16.0	*+0.5*
SA	1 479.2	1 474.3	4.9	*+0.3*
WA	1 762.7	1 765.3	-2.6	*–0.1*
Tas	473.4	474.4	-1.0	*–0.2*
NT	177.7	181.8	-4.1	*–2.4*
ACT	307.5	308.3	-0.8	*–0.2*
Australia	18 289.1	18 310.7	-21.6	*–0.1*

6.2 Below state

Population estimates at below the State/Territory level are generally produced at the SLA level, then aggregated to broader regions.

6.2.1 Statistical Local Areas[3]

Direction of intercensal discrepancies

Despite an under–estimate of the total Australian population, a larger number of SLA totals were over–estimated (positive intercensal discrepancy) than were under–estimated (negative intercensal discrepancy). The number of SLAs where the population was over–estimated was 709, while 607 were under–estimated. The national under–estimate combined with the fact that a majority of SLAs were over–estimated means that smaller SLAs tended to be over–estimated more than larger SLAs.

[2] The preliminary figure used to calculate the total Australia intercensal discrepancy quoted above was later updated using final 1991–96 births, deaths and category jumping. Using the updated preliminary figure, the national intercensal discrepancy is closer to –27,500, or –0.15 per cent (ABS 1998b). However, SLA populations were not updated this way, and so preliminary national and State/Territory population figures have been used in this analysis.

[3] Note that the following SLAs were combined to produce preliminary SLA population estimates: *Sydney (C) – Inner* and *Sydney (C) – Remainder* were combined to form *Sydney (C);* *Newcastle (C) – Inner* and *Newcastle (C) – Remainde*r were combined to form *Newcastle (C);* *Melbourne (C) – Inner* and *Melbourne (C) – Remainder* were combined to form *Melbourne (C)*.

TABLE 7: DIRECTION OF INTERCENSAL DISCREPANCY, STATISTICAL LOCAL AREAS, 30 JUNE 1996

	Number of SLAs(a)	*Over–estimate*		*Under–estimate*	
		No.	*%*	No.	*%*
NSW	186	123	*66.1*	63	*33.9*
Vic	197	104	*52.8*	92	*46.7*
Qld	448	243	*54.2*	203	*45.3*
SA	127	57	*44.9*	69	*54.3*
WA	150	76	*50.7*	73	*48.7*
Tas	43	22	*51.2*	21	*48.8*
NT	63	24	*38.1*	39	*61.9*
ACT	107	60	*56.1*	47	*43.9*
Australia	1 321	709	*53.7*	607	*46.0*

(a) Excludes SLAs where preliminary and final ERP was zero. Some SLAs were combined to conform with published preliminary ERPs. Five SLAs had zero intercensal discrepancy in 1996: Campaspe (S) – Kyabram (in Victoria; 1996 ERP 12,380), Manly (Queensland; 3,550), Bray Park (Queensland; 8,374), Tanunda (DC) (South Australia; 4,230) and Nungarin (S) (Western Australia; 288).

Range of intercensal discrepancies

69 per cent of SLAs in Australia had an intercensal discrepancy of less than five per cent in 1996. And in all States and Territories except the Northern Territory, 65 per cent or more of the preliminary SLA estimates were within five per cent of their final figures. South Australia had the highest percentage of SLAs with less than five per cent discrepancy (82 per cent), while Northern Territory had the lowest percentage (48 per cent). Tasmania had the highest percentage of preliminary SLA estimates within two per cent of their final ERP (51 per cent of SLAs in Tasmania).

TABLE 8: ABSOLUTE INTERCENSAL DISCREPANCY, STATISTICAL LOCAL AREAS, 30 JUNE 1996(a)

	Number of SLAs	*0% ≤ aid ≤ 2%*		*2% ≤ aid < 5%*		*aid ≥ 5%*	
		No.	*%*	No.	*%*	No.	*%*
NSW	186	73	*39.2*	66	*35.5*	47	*25.3*
Vic	197	74	*37.6*	63	*32.0*	60	*30.5*
Qld	448	150	*33.5*	153	*34.2*	144	*32.1*
SA	127	63	*49.6*	41	*32.3*	23	*18.1*
WA	150	60	*40.0*	37	*24.7*	53	*35.3*
Tas	43	22	*51.2*	10	*23.3*	11	*25.6*
NT	63	14	*22.2*	16	*25.4*	32	*50.8*
ACT	107	33	*30.8*	37	*34.6*	36	*33.6*
Australia	1 321	489	*37.0*	423	*32.0*	406	*30.7*

(a) Excludes SLAs where preliminary and final ERP was zero. Percentage errors for SLAs with non–zero preliminary ERP and zero final ERP are undefined. Some SLAs were combined to conform with published preliminary ERPs.

Average intercensal discrepancies

As discussed in section 5, to include very small SLAs in the calculation of average discrepancy for States or Territories may result in misleading conclusions.

For example, the SLA of Kowen, a sparsely populated SLA on the outskirts of the Australian Capital Territory, had a preliminary 1996 estimate of 47 persons – close to its 1991 estimate of 50 persons. However, the final 1996 ERP for Kowen was 16. The intercensal discrepancy for Kowen was therefore 194 per cent, or 31 persons. Given that this was a tiny SLA (in terms of population), this further confirms that, in the case of very small SLAs, a large percentage error does not necessarily imply a large numeric error. To include these very small SLAs which are more prone to high percentage errors when summarising ACT would give an unfair representation of the performance of SLA population estimates in the ACT.

For this reason, SLAs in all States and Territories with a finalised 1996 population less than 500 are excluded in the calculation of average absolute percentage errors in some parts of this paper. The population residing in these SLAs in 1996 was less than 0.1 per cent of the total Australian population.

TABLE 9: AVERAGE ABSOLUTE INTERCENSAL DISCREPANCY, STATISTICAL LOCAL AREAS, 30 JUNE 1996

	Number of SLAs	*Average SLA size*	*Average absolute discrepancy(a)*	
			Numeric	Percentage(b)
NSW	189	*32 829*	774	3.4
Vic	200	*22 801*	962	6.3
Qld	449	*7 436*	271	4.5
SA	130	*11 340*	168	2.7
WA	151	*11 690*	303	5.1
Tas	44	*10 783*	224	3.2
NT	63	*2 886*	196	7.9
ACT	107	*2 881*	102	3.9
Australia	1 333	*13 734*	420	4.6

(a) Some SLAs combined to conform with published estimates.
(b) Excludes SLAs with 1996 ERP less than 500.

6.2.2 Local Government Areas

SLAs generally conform to, or combine to form, LGAs. The analysis of population estimates for LGAs is important given that allocation of funds by governments often depends on the distribution of LGA populations.

The LGA structure covers only *incorporated* areas of Australia. Incorporated areas are legally designated areas over which incorporated local governments have responsibility. The major areas of Australia not covered by incorporated bodies are the northern parts of South Australia, most of the Northern Territory and all of the Australian Capital Territory and the Other Territories.

In 1996, the LGA structure closely resembled the SLA structure in New South Wales, South Australia and Western Australia. Hence for these three states, the patterns observed with LGA population errors are similar to those errors associated with SLA population estimates.

TABLE 10: NUMBER AND AVERAGE SIZE OF LOCAL GOVERNMENT AREAS, 30 JUNE 1996

	Estimated Resident Population			*Local Government Areas*	
	In unincorporated areas	Total	*Per cent of ERP in unincorporated areas*	No.	*Average*
NSW	1 253	6 204 728	*0.0*	177	35 048
Vic	83	4 560 155	*0.0*	78	58 462
Qld	–	3 338 690	–	125	26 710
SA	8 679	1 474 253	*0.6*	118	12 420
WA	–	1 765 256	–	142	12 431
Tas	–	474 443	–	29	16 360
NT	41 699	181 843	*22.9*	8	17 518
ACT	308 251	308 251	*100.0*	–	–
Australia	359 965	18 307 619[1]	*2.0*	677	26 511

The trend for particular States and Territories to have a majority of SLAs over– or under–estimated at the LGA level (table 11) resembles the trend at the SLA level (table 7). The only State/Territory where the majority of intercensal discrepancies for LGAs are in the opposite direction to that of SLAs is Tasmania, where the majority of LGAs were under–estimated (55.2 per cent) but the majority of SLAs were over–estimated (51.2 per cent).

TABLE 11: INTERCENSAL DISCREPANCY, LOCAL GOVERNMENT AREAS, 30 JUNE 1996

	Number of LGAs(a)	*Over–estimate*		*Under–estimate*	
		No.	*%*	No.	*%*
NSW	177	117	*66.1*	60	*33.9*
Vic	78	40	*51.3*	38	*48.7*
Qld	125	72	*57.6*	53	*42.4*
SA	118	50	*42.4*	67	*56.8*
WA	142	71	*50.0*	70	*49.3*
Tas	29	13	*44.8*	16	*55.2*
NT	8	2	*25.0*	6	*75.0*
ACT	–	–	–	–	–
Australia	677	365	*53.9*	310	*45.8*

(a) Two LGAs had zero intercensal discrepancy in 1996: Tanunda (DC) (South Australia; 1996 ERP 4,230) and Nungarin (S) (Western Australia; 288)

The average absolute percentage discrepancies for LGAs (table 12) are similar to those for SLAs (table 9) for those States where the LGA structure closely resembles the SLA structure, ie. New South Wales, South Australia and Western Australia.

The remaining States and Territories, where SLAs generally combined to form LGAs, had LGA percentage errors less than SLA percentage errors. This again implies that percentage errors are especially dependent on population size (discussed in section 5). Of greatest improvement was Victoria, whose average absolute discrepancy was reduced from 6.3 per cent for SLAs to 2.1 per cent for LGAs (the average population size increased from 22,801 for SLAs to 58,462 for LGAs).

TABLE 12: AVERAGE INTERCENSAL DISCREPANCY, LOCAL GOVERNMENT AREAS, 30 JUNE 1996

	Number of LGAs	*Average LGA size*	*Average absolute discrepancy*	
			Numeric	Percentage(a)
NSW	177	35 048	812	3.3
Vic	78	58 462	885	2.1
Qld	125	26 710	517	4.0
SA	118	12 420	181	2.6
WA	142	12 431	254	4.6
Tas	29	16 360	307	2.7
NT	8	17 518	553	5.8
ACT	–	–	–	–
Australia	677	26 511	514	3.4

(a) Excludes LGAs with 1996 ERP less than 500.

6.2.3 Parts of state

Overall, capital city Statistical Divisions were under–estimated by around 96,400 persons, or –0.8 per cent. The population residing outside capital cities was over–estimated by almost 74,700, or +1.1 per cent.

TABLE 13: INTERCENSAL DISCREPANCY, PART OF STATE, 30 JUNE 1996

	Capital city				*Balance of State*			
	ERP ('000)		Difference		ERP ('000)		Difference	
	Preliminary	Final	('000)	*Per cent*	Preliminary	Final	('000)	*Per cent*
NSW	3 821.4	3 881.1	–59.7	*–1.5*	2 368.8	2 323.6	+45.2	*+2.0*
Vic	3 248.8	3 283.3	–34.5	*–1.1*	1 292.2	1 276.9	+15.3	*+1.2*
Qld	1 525.5	1 520.0	+5.5	*+0.4*	1 828.9	1 818.7	+10.2	*+0.6*
SA	1 086.5	1 079.1	+7.4	*+0.7*	392.6	395.1	–2.5	*–0.6*
WA	1 282.8	1 295.1	–12.3	*–1.0*	480.0	470.2	+9.8	*+2.1*
Tas	195.0	195.7	–0.7	*–0.4*	278.4	278.7	–0.4	*–0.1*
NT	80.9	82.2	–1.3	*–1.6*	96.6	99.6	–3.0	*–3.0*
ACT	307.1	307.9	–0.8	*–0.3*	0.4	0.3	+0.1	*+17.1*
Australia	11 548.1	11 644.5	–96.4	*–0.8*	6 737.8	6 663.1	+74.7	*+1.1*

Sections 8.1 and 8.2 discusses the fact that smaller and declining SLAs tend to be over–estimated. SLAs located in rural areas are generally small, and declining SLAs tend to be located in rural areas. These two factors appear to contribute to the 'Balance of States' (mainly rural areas) being over–estimated.

7 COMPARISON OF 1991 AND 1996 DISCREPANCIES

TABLE 14: AVERAGE ABSOLUTE INTERCENSAL DISCREPANCY, 30 JUNE 1991 AND 1996

	1991(a)		*1996(a)*	
	SLA(b)	LGA	SLA(b)	LGA
NSW	3.2	3.1	3.4	3.3
Vic	3.2	2.7	6.3	2.1
Qld	5.4	4.4	4.5	4.0
SA	3.0	2.8	2.7	2.6
WA	6.1	5.7	5.1	4.6
Tas	4.7	2.1	3.2	2.7
NT	5.3	6.3	7.9	5.8
ACT	4.0	–	3.9	–
Australia	4.4	3.5	4.6	3.4

(a) Excludes areas with ERP less than 500.
(b) Some SLAs combined to conform with published estimates.

Table 14 compares the 1996 SLA and LGA intercensal discrepancies with those for 1991. As was the case for the 30 June 1996 population estimates, preliminary SLA estimates for 30 June 1991 based on the previous census (1986) were produced, and were later finalised using the results of the 1991 Census.

While the average SLA absolute discrepancy for most States and Territories in 1996 had declined since 1991, the overall average discrepancy increased.

In contrast, discrepancies for LGAs have, overall, slightly improved.

SLA estimates were, on average, more accurate in 1996 in Queensland, South Australia, Western Australia, Tasmania and the Australian Capital Territory, while estimates for New South Wales, Victoria and the Northern Territory were, on average, less accurate.

Victoria's average absolute SLA discrepancy nearly doubled between 1991 and 1996 and, as discussed elsewhere in this paper, the restructure of SLAs in 1994–96 appears to be the dominant factor. While most States and Territories had some SLA's boundaries change in the 1986 to 1991 intercensal period (with Queensland incurring the most changes), no State or Territory had SLA boundary changes in 1986–91 anywhere near the extent of Victoria's 1994–96 boundary upheaval. Interestingly Tasmania, which also went through a massive round of SLA boundary changes around 1993, saw an improvement in SLA population estimates in the 1991–96 period compared to the 1986–91 period.

New South Wales and Tasmania were the only two States or Territories which had an increase in average absolute intercensal discrepancies at the LGA level from 1991 to 1996.

8 FACTORS AFFECTING 1996 DISCREPANCIES

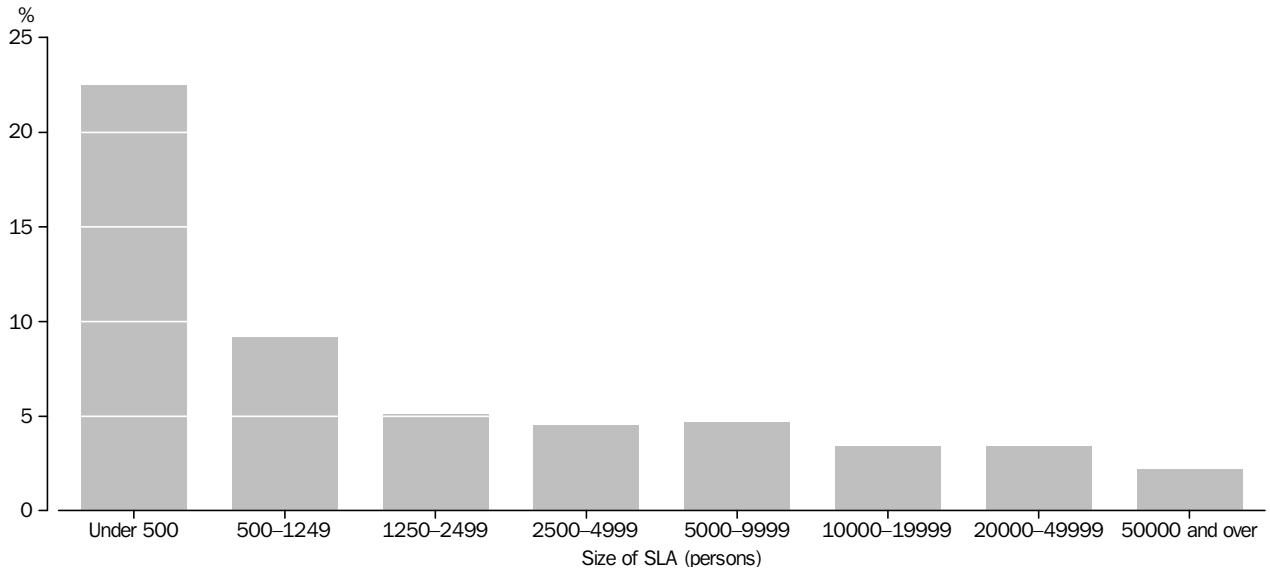
Several factors can influence the accuracy of a population estimate. Some SLAs are by nature more difficult to estimate accurately than others. This section attempts to categorise some underlying characteristics and factors of SLAs which potentially hinder the accuracy of population estimates, by assessing the 1996 SLA intercensal discrepancies.

8.1 Population size

8.1.1 Size of errors

As previously discussed, *larger populations tend to be more accurately estimated than small populations*, assuming the measure of accuracy is the percentage error. Table 2 indicates the range of SLA size by State and Territory. Note that larger SLAs tend to lie in urban areas.

FIGURE 2: AVERAGE ABSOLUTE INTERCENSAL DISCREPANCY, STATISTICAL LOCAL AREAS, BY SIZE OF STATISTICAL LOCAL AREA, 30 JUNE 1996



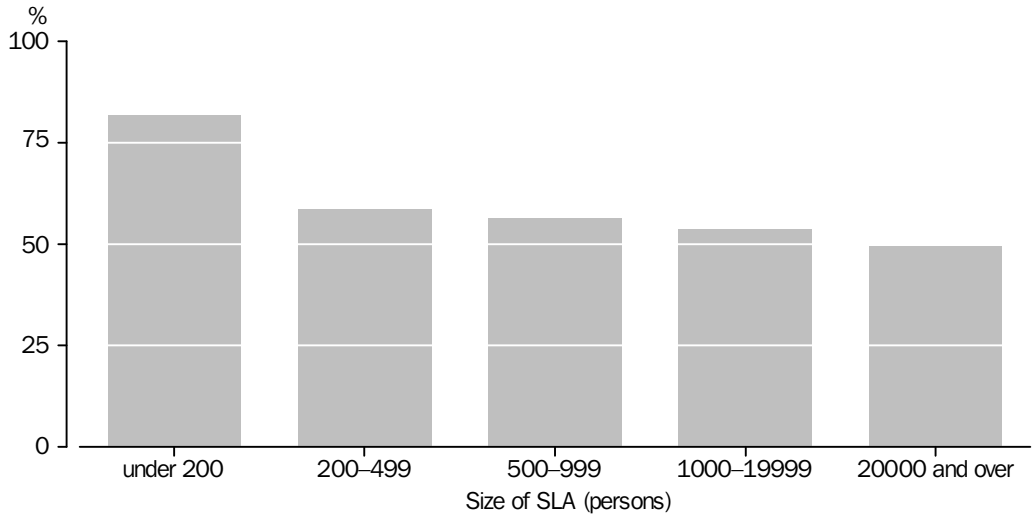
As the size of a population increased, there was a steady decline in an estimate's percentage error. The average absolute discrepancy for SLAs with populations of less than 500 was 24 per cent, and 37 per cent of these SLAs have discrepancies greater than 20 per cent. But for SLAs with populations of 50,000 or more, the average discrepancy was only two per cent, and only ten per cent of these SLAs had discrepancies more than five per cent.

This trend was also observed in the United States (US Bureau of the Census 1994). For all 3,141 counties in the US in 1990, the average absolute error was 3.6 per cent. The 105 counties with a population less than 2,500 had an average error of 7.7 per cent, while the average error for the 414 counties with more than 100,000 persons was 2.0 per cent.

8.1.2 Direction of errors

Another feature regarding population size is that *the populations of smaller regions are more likely to be over–estimated than the populations of larger regions*.

FIGURE 3: PERCENTAGE OF STATISTICAL LOCAL AREAS OVER-ESTIMATED, BY SIZE OF STATISTICAL LOCAL AREA, 30 JUNE 1996



Of the SLAs with less than 500 persons, 68 per cent were over–estimated. However, of the SLAs with a population more than 50,000, only 46 per cent were over–estimated.

8.2 Population growth

It is useful to get an idea of the distribution of SLAs where the ERP declined or grew, and the extent of the decline/growth, between 1991 and 1996.

TABLE 15: DISTRIBUTION OF STATISTICAL LOCAL AREAS, BY POPULATION GROWTH 1991–96

	Change in Estimated Resident Population, 1991 to 1996								Total number of SLAs	*State/ Territory 1991–96 increase (%)*
Number of SLAs	*Below –10%*	*–10 to <–5%*	*–5 to <0%*	*0 to 5%*	*5 to 10%*	*10 to 20%*	*20 to 50%*	*50% & over*(a)		
NSW	3	22	48	61	27	24	2	2	189	*5.2*
Vic	3	24	60	58	26	18	7	4	200	*3.2*
Qld	24	53	76	69	56	72	67	32	449	*12.8*
SA	10	17	38	39	11	13	0	2	130	*1.9*
WA	25	26	29	20	15	25	8	3	151	*7.9*
Tas	4	4	11	10	6	7	2	0	44	*1.7*
NT	5	9	6	13	4	14	9	3	63	*9.9*
ACT	23	31	18	9	3	7	5	11	107	*6.7*
Australia	97	186	286	279	148	180	100	57	1 333	*5.9*

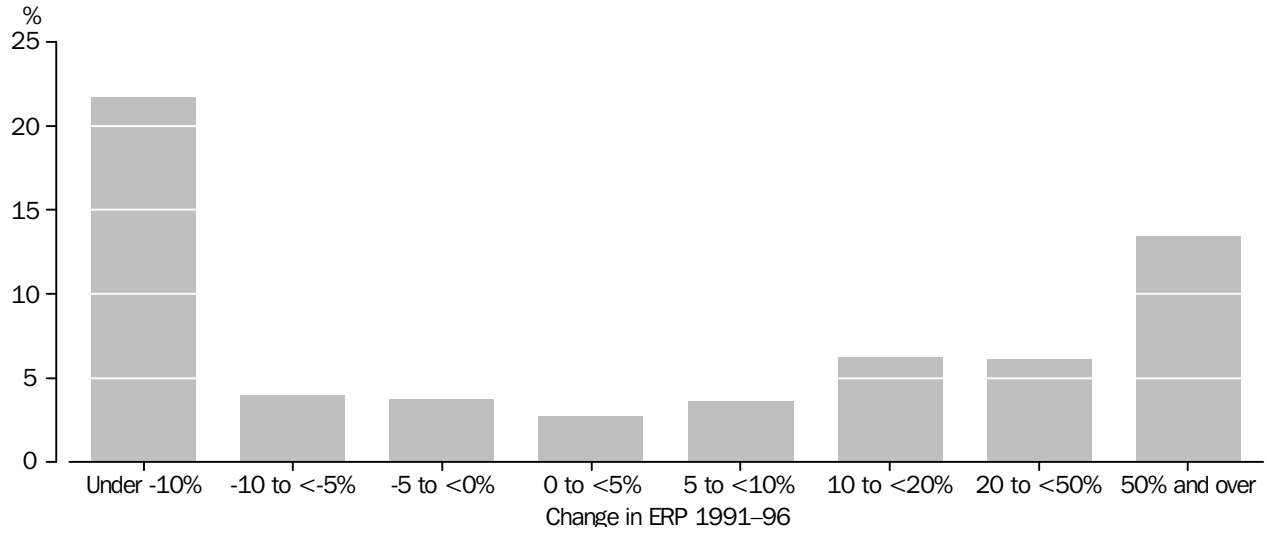
(a) SLAs which increased from a zero population in 1991 (this increase is mathematically undefined) are categorised as having 50%+ increase.

8.2.1 Size of errors

Moderately growing populations can be estimated more accurately than rapidly growing or declining populations.

1996 SLA estimates for populations that had declined by more than 10 per cent since 1991 had an average absolute intercensal discrepancy of 18 per cent. For populations that grew by 20 per cent or more, average discrepancy was 7.5 per cent. Yet the average discrepancy for populations that grew, but by less than 10 per cent, was only 3.0 per cent.

FIGURE 4: AVERAGE ABSOLUTE PERCENTAGE DISCREPANCY, STATISTICAL LOCAL AREAS, BY POPULATION GROWTH 1991–96

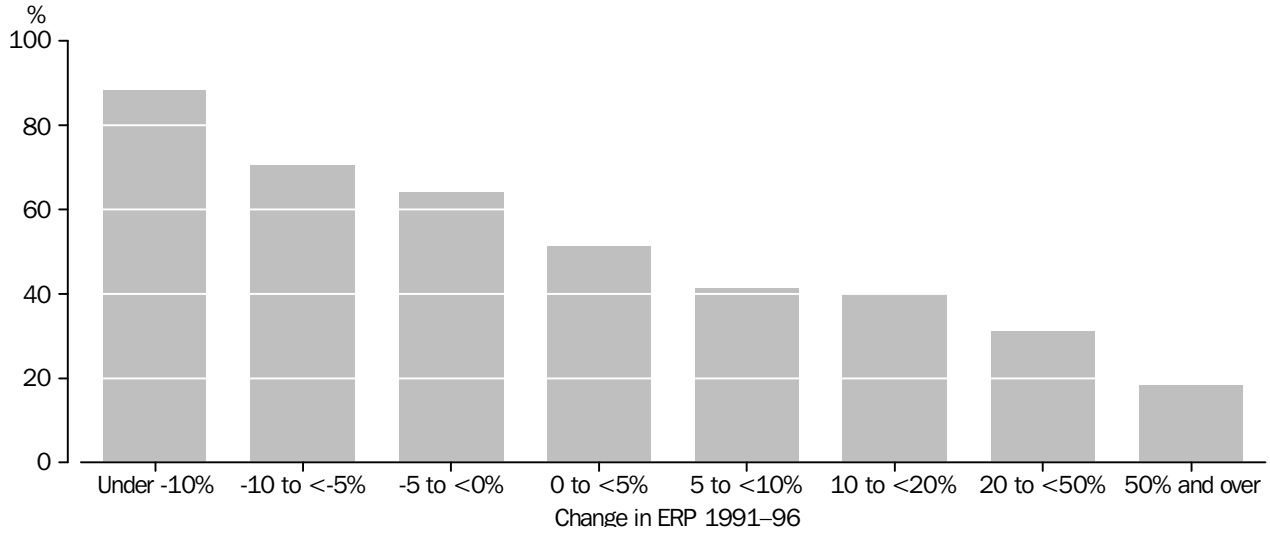


In the 1990 United States county population estimates, counties which declined by more than five per cent between 1980 and 1990 had an average error of 3.8 per cent, and those counties that grew by more than 25 per cent had an average error of 4.9 per cent. Counties which grew between zero and ten per cent had an average error of 3.2 per cent.

8.2.2 Direction of errors

Regions with declining populations are much more likely to be over–estimated than those that grew rapidly. This may be one reason for the trend for capital cities to be under–estimated and balance of states over–estimated (as seen in table 13).

FIGURE 5: PERCENTAGE OF STATISTICAL LOCAL AREAS OVER-ESTIMATED IN 1996, BY POPULATION GROWTH 1991–96

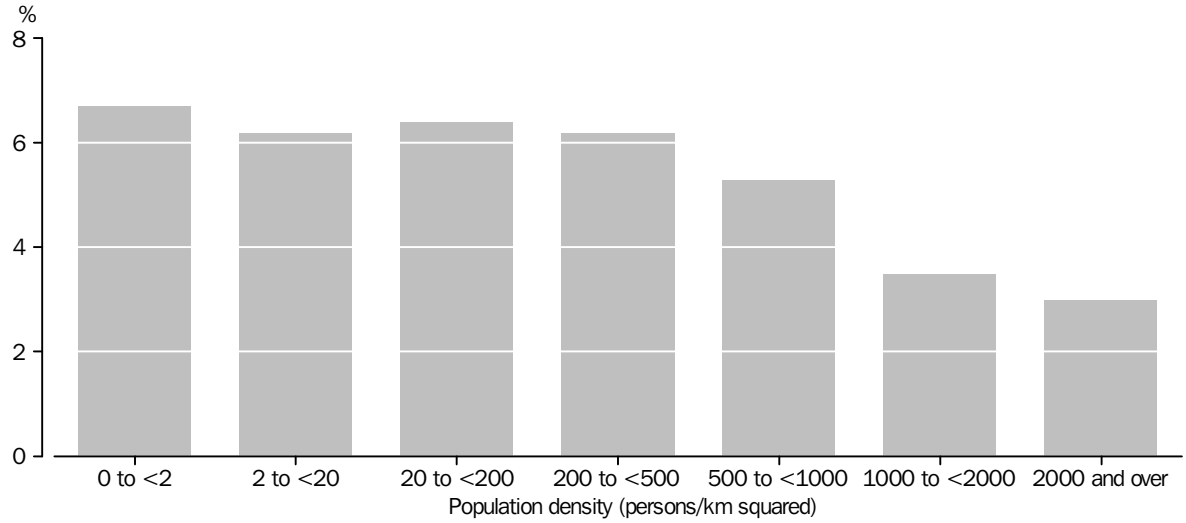


88 per cent of the SLAs which lost more than 10 per cent of their population between 1991 and 1996 were over–estimated. However only 24 per cent of the SLAs that grew by 25 per cent or more were over–estimated.

8.3 Population density

High density populations tend to be estimated more accurately than less dense populations.

FIGURE 6: AVERAGE ABSOLUTE INTERCENSAL DISCREPANCY, STATISTICAL LOCAL AREAS, 30 JUNE 1996



Less dense SLAs tend to have lower populations and for this reason the average discrepancy may be higher. However it is interesting to note that the average 1996 ERP for SLAs with a density between 200 and 500 persons per km^2 (25,000) was similar to SLAs with greater than 2,000 persons per km^2 (26,000), yet the average absolute discrepancy for the former (6.2 per cent) is more than two times the discrepancy for the latter (3.0 per cent). A similar contrast exists for SLAs with 20 to 200 persons per km^2 (average ERP 17,000; average discrepancy 6.2 per cent) and those with 1,000 to 2,000 persons per km^2 (average ERP 17,000; average discrepancy 3.5 per cent).

The trend for sparse areas to be estimated less accurately suggests that some population indicators (for example dwellings, Medicare enrolments) may not have been as reliable in those areas as they are in more built up areas.

8.4 Changes in boundaries

All States and Territories have SLAs in 1996 which were part of different areas, or did not exist, in 1991. The degree of changes in SLA boundaries varied markedly between the States and Territories.

Between 1991 and 1996, Tasmania and Victoria had wholesale LGA restructuring affecting almost the entire state. This in turn led to major SLA boundary changes. Queensland has had many new SLAs created and some large LGAs split because of rapid population growth. Western Australia, South Australia and New South Wales have had a few adjustments to existing boundaries. However, Western Australia had some restructuring of large LGAs such as Perth, Fremantle and Stirling and the splitting of Wanneroo into five SLAs. In Northern Territory, Alice Springs was also split into five SLAs. Seven new SLAs were created in the ACT.

When an adjustment is made to an SLA boundary, the ERP based on the new boundary must be calculated (rebased) as at the previous census year, to establish a consistent time series on the current boundaries. It is essential to obtain good quality estimates of the previous census year's SLA populations. This relies on accurate information about the boundary changes and the distribution of dwellings and population to the new areas.

Boundary changes are potentially more of a problem when the changes occur around high growth areas (and often this is the case). It is not normally straightforward to determine precisely where the major areas of growth are.

Factors which affected the rebased 1991 population estimates included:

- the degree to which the new boundaries aligned with the existing 1991 Census Collector District (CD) boundaries. (The CD is the base for collection and dissemination of Population Census data);
- the validity of the assumptions made in the calculation of the 1991 ERP such as the homogeneity of the CD or SLA losing the population;
- the ability to distinguish between dwellings which existed at 30 June 1991 from those constructed since.

Further complications may arise when SLAs are subject to more than one set of boundary changes in the intercensal period. In this case, population estimates based on the first set of boundary changes are unable to be verified sufficiently until a census is held. If SLA population estimates made after the first round of boundary changes are found to be inaccurate, then this will impact on subsequent changes made following additional boundary changes.

There were approximately 330 SLAs in 1996 which did not exist with the same boundary in 1991 and where the change in boundary involved population change. The average intercensal discrepancy for these SLAs was 6.5 per cent, compared with 4.2 per cent for those SLAs with no boundary change.

This disparity was even more marked for Victoria. There were about 160 SLAs which underwent boundary changes between 1991 and 1996, with an average absolute intercensal discrepancy of 7.1 per cent. The remaining Victorian SLAs had an average absolute discrepancy of 2.6 per cent.

8.5 Census rebasing error

This category is closely related to 'changes in boundaries' discussed above. After the 1996 SLA boundaries were finalised, a 1991 estimate was calculated on 1996 boundaries. Based on these 1991 estimates, yearly updates of the population were calculated for 30 June 1992 through to 1996. When some 1996 Census results became available, it was apparent that some of the rebased 1991 figures were incorrect. Some States, namely Victoria, Queensland and Tasmania found it necessary to issue some revised 1991 SLA ERPs.

After adjusting for this 'census rebasing error', the average absolute percentage error for Victorian SLAs decreased markedly from 6.3 per cent to about 4.0 per cent.

The large improvement in intercensal discrepancies for Victoria after omitting SLAs with boundary changes, or adjusting for census rebasing error, is an important consideration when evaluating the intercensal discrepancies, because it implies that most of the error in comparing preliminary to final Victorian 1996 SLA population estimates is explained by these factors. Much smaller errors could then be attributed to factors such as the estimation technique.

8.6 Quality of input data

Estimation methods used to update population estimates from the census year generally establish a relationship between population change and symptomatic indicator(s). Symptomatic indicators are any available set of data which in some way relate to population change. With knowledge of the change in indicators since the previous census, population change is able to be estimated.

The choice of symptomatic indicators varies across the States and Territories. Some examples include dwellings, Medicare enrolments, drivers licenses and residential electricity connections. However, the data sources must satisfy several criteria to be able to be confidently applied to the estimation process.

For instance, in calculating SLA population estimates, the input data needs to be available at the SLA level, or at least capable to be converted to SLA level.

Several potentially useful data sources are available at the postcode level rather than SLA level. Medicare enrolments, family allowance recipients and drivers licenses are examples of data that are available by postcode. However this data must be converted to SLAs. It is important that this conversion is made accurately.

To establish the relationship between the indicator data and population, the data sources need to be available for an appropriate period of time to enable the relationship to be confidently established. Underlying this condition is that the data needs to be indicative of population change as it occurs.

In addition, the data sources need to be consistent in terms of timing and collection procedure and have had no major definitional change over the period when the relationship was being established, or the population estimated.

To be able to assist in the production of timely population estimates, the input data must be made available very soon after the reference period for which the population estimate is required.

Changes in boundaries can have an impact on the indicator data, especially when recalculating historical SLA population indicator data on new boundaries.

8.7 Method of estimation

Given reasonable quality indicator data, the regression approach (discussed in section 2.2) is usually reliable. This estimation procedure is well documented and is used extensively overseas (ABS 1982, ABS 1994, McCullagh and Zidek 1988, Statistics Canada 1992, US Bureau of the Census 1994).

Another method which has been used to estimate SLA populations is to obtain SLA occupancy ratios from the previous census, and estimate populations based on updated dwelling counts (from buildings approvals, electricity connections and/or other related data).

All methodologies depend on reasonably good quality indicator data, where impacts of boundary changes are taken into account. Where an SLA falls into one or more of the 'troublesome' categories (eg. small population, rapid growth, boundary changes) extra scrutiny of the input data must be applied.

No matter what mathematical models are used, all SLA population estimates that are produced from these models need to be scrutinised individually by ABS officers. In fact, some estimates may need to be derived without the assistance of mathematical techniques. This approach requires extensive knowledge of a region in terms of availability of data, history, etc. It is also critical that population estimates are made independently of external influences (eg. political).

8.8 State/Territory totals

The preliminary SLA population estimates used in this analysis were constrained to preliminary State and Territory totals. The final SLA estimates were constrained to final State and Territory totals. Table 6 shows that there was a variation of –2.4 per cent between the preliminary and final Northern Territory total population in 1996 (ie. the total Northern Territory population was under–estimated by 2.4 per cent), while the remaining States and Territory incurred total intercensal discrepancies between –0.4 and +0.5 per cent.

It may be more appropriate to think of an SLA population in terms of its share of the State/Territory population, rather than in terms of the actual number of persons. This is especially relevant when funding, resources etc are allocated on a share of State's population basis. In this sense the preliminary State/Territory population should be adjusted upwards/ downwards to match the final State/Territory population, with the SLA population estimates – which, due to their mutually exhaustive nature, add up to the State/Territory total – adjusted accordingly.

The most straightforward way to account for changes to State and Territory totals is to apportion the percentage revision made to the State/Territory population across all SLAs in that State/Territory, ie. on a pro–rata basis. For example if a State total increased by 0.2 percent, then increase each SLA population within that State by 0.2 per cent.

Table 16 shows that pro–rating changes to final State/Territory totals across SLAs made minimal differences to the average absolute SLA intercensal discrepancies. Reflecting the relatively large adjustment of –2.4 per cent for total Northern Territory, the average absolute discrepancy for SLAs within the Northern Territory decreased slightly from 7.9 to 7.7 per cent. No other State or Territory had a change in average absolute discrepancy of more than 0.1 per cent.

TABLE 16: INTERCENSAL DISCREPANCY, 30 JUNE 1996

	Intercensal discrepancy – State/Territory total		*Average absolute intercensal discrepancy – Statistical Local Areas*	
	Number ('000)	Per cent	Unadjusted (per cent)	Adjusted to final State/ Territory ERP (per cent)
NSW	-14.5	–0.2	3.4	3.5
Vic	-19.2	–0.4	6.2	6.3
Qld	16.0	+0.5	4.5	4.4
SA	4.9	+0.3	2.6	2.7
WA	-2.6	–0.1	5.1	5.1
Tas	-1.0	–0.2	3.2	3.2
NT	-4.1	–2.4	7.9	7.7
ACT	-0.8	–0.2	3.9	3.9
Australia	-21.6	–0.1	4.6	4.6

It should be noted that this apportionment (pro–rating) is not the only way that SLA estimates change due to revisions of State/Territory totals. In some cases, only particular SLAs may be adjusted.

8.9 Administrative

There are several SLAs which are formed mainly for census purposes rather than estimated resident population purposes. In 1996, each State and the Northern Territory had an 'Off–Shore and Migratory' SLA, which encompasses off–shore, shipping and migratory Census Collector Districts within the State/Territory. Prior to the series of preliminary 1996 SLA population estimates, some Off–Shore and Migratory SLAs were considered to have an estimated resident population greater than zero.

The preliminary 1996 estimates for the Off–Shore and Migratory SLAs of Queensland and the Northern Territory were 259 and 175 respectively. The remaining States had zero preliminary ERP for their respective Off–Shore and Migratory SLAs.

However, in the production of final 1996 SLA estimates, the ABS decided that ERPs for all Off–Shore and Migratory SLAs would be set to zero.

8.10 Don't estimate!

It seems some populations are just not worth estimating. Overall, in 29 per cent of SLAs it was just as accurate in 1996 to use the 1991 estimate than the 1996 estimate. For 35 per cent of SLAs with a population under 500, it was just as accurate in 1996 to use the 1991 estimates as the 1996 population estimate. In 21 per cent of SLAs with a population of 50,000 or more, the 1991 final estimate was a more accurate reflection of the final 1996 population than was the 1996 preliminary estimate.

In the United States, 21 per cent of 1990 county estimates were better estimated by using the 1980 estimate instead of the 1990 estimates as updated from the 1980 Census-based estimates.

It is still necessary to estimate the populations of all SLAs of course, as we do not have the advantage of hindsight at the time of estimation.

8.11 Assessment

Table 17 presents a guide as to what the average absolute intercensal discrepancy would have been if the SLAs with particular characteristics are excluded.

TABLE 17: AVERAGE ABSOLUTE INTERCENSAL DISCREPANCY, STATISTICAL LOCAL AREAS, 30 JUNE 1996

	NSW	Vic	Qld	SA	WA	Tas	NT	ACT	Australia
AVERAGE ABSOLUTE INTERCENSAL DISCREPANCY (%)									
Category									
Excluding very small SLAs(a)	**3.4**	**6.3**	**4.5**	**2.7**	**5.1**	**3.2**	**7.9**	**3.9**	**4.6**
Excluding small SLAs(b)	3.3	5.9	4.1	2.5	3.5	3.1	6.6	3.8	4.2
Excluding very small SLAs and:									
– rapidly declining SLAs(c)	3.4	6.3	4.1	2.6	4.0	3.0	7.4	3.7	4.3
– rapidly increasing SLAs(d)	3.2	6.0	4.2	2.7	4.6	3.2	7.0	3.3	4.3
– rapidly decreasing or increasing SLAs	3.2	5.9	3.8	2.6	3.4	3.0	6.5	3.0	3.9
– sparsely populated SLAs(e)	3.2	6.5	4.3	2.0	4.0	3.2	8.2	3.9	4.5
– SLAs that incurred boundary changes(f)	3.4	2.6	4.3	2.9	6.0	0.4	4.6	2.8	4.0
– adjusted for 1991 Census rebasing(g)	na	4.0	na	na	na	na	na	na	na
– SLAs forced to final State/Territory total	3.5	6.3	4.4	2.7	5.1	3.2	7.7	3.9	4.6
NUMBER OF STATISTICAL LOCAL AREAS									
All SLAs(h)	187	199	449	130	151	44	63	107	1 330
Excluding very small SLAs(a)	183	194	430	117	138	41	60	87	1 250
Excluding small SLAs(b)	180	191	400	107	100	37	50	81	1 146
Excluding very small SLAs and:									
– rapidly declining SLAs(c)	180	191	409	111	120	38	58	76	1 183
– rapidly increasing SLAs(d)	182	192	399	117	135	41	57	77	1 200
– rapidly decreasing or increasing SLAs	179	189	378	111	117	38	55	66	1 133
– sparsely populated SLAs(e)	118	167	365	74	57	29	44	87	941
– SLAs that incurred boundary changes(f)	183	37	348	127	136	2	58	99	990
– adjusted for 1991 Census rebasing(g)	na	129	na	na	na	na	na	na	na

(a) Very small SLAs are those with 1996 ERP less than 500.
(b) Small SLAs are those with 1996 ERP less than 1250.
(c) Rapidly declining SLAs are those that declined by greater than 10 per cent between 1991 and 1996.
(d) Rapidly increasing SLAs are those that increased by more than 50 per cent between 1991 and 1996.
(e) Sparsely populated SLAs are those with 1996 population density less than 2 persons per square kilometre.
(f) SLAs that incurred boundary changes are those that incurred changes in both area and population between 1991 and 1996.
(g) The average absolute percentage error for SLAs that incurred 1991 Census rebasing was approximated for the purposes of this paper only.
(h) Some SLAs combined to conform with published preliminary estimates.

This table highlights the particular factors which influenced the accuracy of estimates for each State and Territory. For instance, this table implies that a major reason for the relatively high average error for Victoria was the massive upheaval in SLA boundaries between 1991 and 1996. The average error declined from 6.3 per cent to 3.5 per cent when the effect of boundary changes was removed; and to approximately 4.0 per cent when the adjustment of 1991 Census rebasing was made. This scenario was similar for the Northern Territory, with a drop from 7.9 per cent to 4.6 per cent after accounting for boundary changes.

9 INTERNATIONAL COMPARISON

TABLE 18: INTERNATIONAL COMPARISON OF INTERCENSAL DISCREPANCY

	Type of "small area"	*Reference year*	*Average population*	*Average absolute discrepancy (per cent)*
Australia	Statistical Local Area	1996	13 900(a)	4.6(a)
	Statistical Subdivision	1996	99 500	2.2
Canada(b)	Census Division	1991	108 200	3.6
England & Wales(c)	County District	1991	127 000	2.5
USA(b,c)	County	1990	79 200	3.6
New Zealand(b)	Territorial Authority	1996	50 200	2.3

(a) Excludes SLAs with population less than 500.
(b) Equates with error of closure which is the difference between population estimates produced prior to a census and corresponding census counts. (No account is taken of variations in the undercount between censuses.)
(c) Census held at 10 yearly intervals
Sources: Statistics Canada (1995); Simpson et al (1996); US Bureau of the Census (1994); Statistics New Zealand (1998).

Table 18 presents a comparison of intercensal discrepancies in a number of countries. A comparison of small area population estimates is not a straightforward one due to major differences in aspects such as the structure of the small areas, estimation period and availability and accuracy of input data.

To account for size differentials, intercensal discrepancies for both Statistical Local Areas and Statistical Subdivisions (SSDs) have been included for Australia. While SLAs are the basic units of estimation in Australia, SSDs, which are amalgamations of SLAs, are on average closer in size to small areas in other countries. Consequently, it is perhaps more meaningful, for comparison purposes, to use the intercensal discrepancies for SSDs in this type of analysis. It can be seen from Table 18 that average absolute percentage errors for Australian SSDs compare favourably with those for small areas in other countries.

10 STATE AND TERRITORY ANALYSIS

This section provides an brief summary of SLA intercensal discrepancies for each State and Territory. A full analysis would involve a case–by–case study of each of the 1,330 SLAs and their discrepancies. Each SLA was estimated and validated separately, and each estimate was the result of various processes, techniques and population indicators. A thorough analysis would therefore require the scrutiny of all these factors for each SLA, and clearly this is beyond the scope of this paper.

However, it is generally found that SLAs with the largest discrepancies fall into one, or (usually) more than one, of the categories discussed in section 8.

This section discusses, for each State and Territory: (i) the average absolute intercensal discrepancy and how it compares to all SLAs in Australia; (ii) which of the broad categories listed in section 8 appear to contribute most to overall SLA discrepancies; (iii) briefly, which SLAs had the largest discrepancies; and (iv) discrepancies for the largest SLAs and LGAs (in terms of population). Intercensal discrepancies for large areas are noteworthy in that such discrepancies represent larger numbers of people. Analysis of LGA population estimates is particularly important in the allocation of funds, resources etc. It is therefore important to consider large LGAs (or SLAs) because where large areas were over–funded (due to an over–estimated population) this impacts on the remainder of the population, whose share of funding/resources is consequently less (and vice-versa).

For convenience, and in accordance with table 17, the definition of a 'very small' SLA is one with a 1996 ERP under 500, and a 'small' SLAs is one with less than 1,250 persons.

Unless otherwise specified, the populations referred to in this section are the *final* 1996 ERPs. For brevity, some SLA and LGA names have been abbreviated.

10.1 New South Wales

The average absolute intercensal discrepancy for SLAs in New South Wales in 1996 was 3.4 per cent, which was 1.2 percentage points lower than the figure for all SLAs in Australia. The accuracy of New South Wales population estimates was aided by the lack of small and/or rapidly declining/growing SLAs.

This is not to say that there are no rapidly declining or growing areas in New South Wales – the large nature of New South Wales SLAs (with an average 1996 population of 33,000 compared with the average of 14,000 for all SLAs in Australia) tends to hide pockets of major decline or growth within SLAs.

The SLA in New South Wales with the largest intercensal discrepancy in 1996 was Sydney (C). This SLA had grown by 90 per cent, from a population of 7,281, since 1991. The preliminary 1996 estimate for Sydney was 7,960, 42.5 per cent under the final estimate of 13,846 persons.

Interestingly, the inner city SLAs of Victoria (Melbourne (C) – under-estimated by 7 per cent), South Australia (Adelaide (C) – under–estimated by 6 per cent) and the Northern Territory (City–Inner and City–Remainder combined were under–estimated by 13 per cent) were also significantly under–estimated.

Other New South Wales SLAs with large discrepancies in 1996 were the relatively high growth SLAs in Sydney's south-west of Camden (under–estimated by 11 per cent) and Liverpool (under–estimated by 8 per cent). The 1991–96 growth rates for these SLAs were 41 and 23 per cent respectively, and these significant under–estimates are typical for rapidly growing SLAs (discussed in section 8.2).

Of the largest SLAs, Blacktown (239,818 persons) was under-estimated by 1.6 per cent, Sutherland Shire (203,753) was under by 0.2 per cent, and Fairfield (189,108) was under by 0.5 per cent. These three SLAs, which all correspond to LGAs, are located on the outer-suburban ring of the Sydney metropolitan area.

The 1996 population in the six largest SLAs in New South Wales (Blacktown, Sutherland Shire, Fairfield, Wollongong, Lake Macquarie and Penrith) constitute one-fifth of the total State population. In total, these SLAs were under–estimated by 0.08 per cent, or –871 out of 1,160,794 persons.

With LGAs generally corresponding to SLAs in New South Wales, the three largest LGAs were also Blacktown, Sutherland Shire and Fairfield.

10.2 Victoria

The overall accuracy of Victoria's SLA population estimates in 1996 was drastically affected by the complete overhaul of LGA/SLA boundaries that occurred in the early 1990s. Table 17 shows that the average 1996 discrepancy of 6.3 per cent was cut by more than half (to 2.6 per cent) when SLAs that incurred boundary changes between 1991 and 1996 are excluded from the calculation of the average discrepancy.

On a related matter, the average absolute discrepancy for all SLAs in Victoria, after some 1991 SLA estimates were revised (discussed in section 8.5) was reduced to around 4.0 per cent.

This reduction in error due to 1991 Census rebasing suggests that the relatively large 1996 SLA intercensal discrepancies for Victoria were more a consequence of the 1991 SLA estimates (which had to be backcast based on the new boundaries), rather than the 1996 estimates (based on the unrevised 1991 estimates).

Two of the SLAs with highest discrepancies in Victoria fell within the LGA of Wyndham, situated in Melbourne's western suburbs. Wyndham – Bal (5,425 persons) was over–estimated by 192 per cent, and Wyndham – North-West (692) was over-estimated by 51 per cent. However, the ERP of the remainder of the LGA of Wyndham (ie. the SLA of Wyndham – Werribee) was under–estimated by 11,581 persons (–17 per cent). The net error for the LGA was therefore a much more accurate –1.1 per cent (or –834 persons out of a total LGA population of 76,239). Not surprisingly, the three SLAs contained within the LGA of Wyndham all had their 1991 estimates rebased. Wyndham – North–West had its 1991 estimate revised downwards from 876 to 627, Wyndham – Werribee was revised upwards from 49,160 to 57,956, and Wyndham – Bal was extensively revised downwards from 13,384 to 4,832. The preliminary 1996 estimates were calculated based on the unrevised 1991 estimates. Had the 1996 preliminary estimates for the three Wyndham SLAs been based on the revised 1991 estimates then the large discrepancies quoted above would have been drastically reduced.

The SLAs that comprised Wyndham in 1996 incurred one round of boundary changes in 1995 and another in 1996. This potential further source of error – of SLAs having more than one set of boundary changes in an intercensal period – is discussed in section 8.4.

A similar scenario to Wyndham existed for the SLA with the second largest percentage error, the Central Highlands SLA of Moorabool – West. The preliminary 1996 estimate of 6,519 was well above the final estimate of 3,571. However, the 1991 Census rebasing, which revised the 1991 estimate of Moorabool – West from 5,883 to 3,576, implies that the problem was again largely associated with the unrevised 1991 estimate for this SLA rather than the calculation of the 1996 estimate.

The remaining SLA in Victoria with a 1996 intercensal discrepancy above 50 per cent was the western Melbourne SLA of Melton – East. The preliminary estimate was 2,261 but the final estimate was 4,653, revealing a discrepancy of –51.4 per cent (or –2,392 persons). However, like the LGA of Wyndham, the remaining SLA within the LGA of Melton (Melton – Bal), was over-estimated by about the same extent (+2,284).

The intercensal discrepancy for the LGA of Melton was –0.3 per cent (–108 from a total ERP of 40,612), which was quite small especially considering that Melton was a growth area (with a 1991–96 increase of over 12 per cent).

The largest SLA in Victoria was Yarra Ranges – South–West, located in the eastern suburbs of Melbourne. The 1996 final estimate was 109,777, which was 81 persons above the preliminary figure of 109,696.

The next largest SLA was Knox – North (eastern Melbourne). The final ERP for Knox – North was 109,337 and the preliminary estimate had over–estimated the final figure by 6,492 persons (the discrepancy for Knox – South was –7,176, which, when added to the discrepancy for Knox – North, combined to result in a discrepancy of –684 for the LGA of Knox. The final 1996 ERP for Knox was 136,141. These two SLAs within Knox also incurred boundary changes between 1991 and 1996.

The problems associated with Victoria's 1996 SLA intercensal discrepancies highlights the need for accurate rebasing of historical populations due to boundary changes. As discussed in section 8.4, a major factor in rebasing SLA populations is the degree to which the new SLA boundaries align with census Collector District (CD) boundaries. In Victoria's case, many boundaries of the new SLAs did not align with the 1991 Census CD boundaries.

Despite the major round of LGA boundary changes, the average absolute intercensal discrepancy for LGAs (2.1 per cent), a potentially more relevant issue for grants commission funding allocations, was the lowest of all States/Territories (although it should be noted that the average LGA size was the largest of any State/Territory in 1996).

The largest LGA, Greater Geelong (183,728 persons), was over–estimated by +0.7 per cent. The next largest, Monash (in Melbourne's eastern suburbs and with an ERP of 160,677), was over–estimated by +0.3 per cent.

10.3 Queensland

Small SLAs, combined with relatively high growth overall for Queensland and the general decline of some rural SLA populations Australia–wide, puts a relatively large proportion of Queensland SLAs into the rapidly decreasing or increasing population categories. Unlike large SLAs (eg. in NSW), small SLAs are, in percentage terms, more susceptible to major decline and growth.

In fact, 27 per cent of Queensland SLAs either declined by greater than 10 per cent or increased by over 20 per cent (table 15) between 1991 and 1996. For the remaining States/Territories, only 15 per cent of SLAs fall into these categories.

In spite of these inherent SLA characteristics, which would tend to suggest that Queensland SLA populations are relatively difficult to estimate, the average absolute intercensal discrepancy of 4.5 per cent in 1996 was slightly lower than the figure for all SLAs in Australia (4.6 per cent).

Table 17 shows that the average absolute intercensal discrepancy declines markedly to 3.8 per cent if rapidly declining and growing SLAs are excluded.

Seven SLAs had a 1996 intercensal discrepancy greater than +20 per cent. Six of these were 'small' SLAs (under 1,250 persons) including three SLAs that were 'very small' (under 500 persons). Four of these seven SLAs were rapidly declining (ie. population declined by greater than 10 per cent in the five years to 1996). The SLA with population greater than 1,250 was South Townsville, whose preliminary 1996 estimate of 2,179 over–estimated the final ERP by 364 persons (+20.1 per cent). The population of this SLA decreased significantly between 1991 (2,088 persons) and 1996 (1,815 persons) – a decrease of 13 per cent. This large under–estimate was in line with the trends for declining populations as discussed in section 8.2

Another seven SLAs have a 1996 intercensal discrepancy below –20 per cent. Five of these were 'small' SLAs including four that were 'very small'. All seven of these SLAs increased by 22 per cent or more between 1991 and 1996, including three that increased by greater than 50 per cent. The two SLAs with 1996 populations greater than 1,250 were the two southern Brisbane SLAs of Parkinson–Drewvale (2,488 persons) and Ellen Grove (2,586), which were under–estimated by 845 and 669 persons respectively. However, it should be noted that Parkinson–Drewvale had a 1991 ERP of just 168, hence the increase over the next five years was a very high 1,381 per cent. Similarly, Ellen Grove had a 1991 ERP of 621, and thus this population grew by 316 per cent between 1991 and 1996.

The SLA of Doolandella–Forest Lake (located between Parkinson–Drewvale and Ellen Grove) revealed a similar story. Its very small 1991 ERP of 437 increased to a final figure of 6,559 in 1996, representing a increase of 1,401 per cent between 1991 and 1996. The preliminary 1996 estimate of 5,254, which under–estimated the final 1996 population by 1,305 persons, effectively estimated the growth rate to be 1,102 per cent.

It is generally much more difficult to estimate populations with such high growth rates (discussed in section 8.2).

The largest SLA in Queensland in 1996 was Ipswich – Central, which, with a population of 67,690, was over–estimated by 2.4 per cent. The next largest SLA, Mackay – Pt A (61,078 persons), was over–estimated by 0.8 per cent.

One quarter of Queenslanders live in the Brisbane LGA. With a 1996 population of 819,592, Brisbane increased by 7.1 per cent since 1991. The preliminary estimate for Brisbane LGA was 820,590, an over–estimate of 0.1 per cent.

The next largest LGA in terms of 1996 population was Gold Coast, with the 1991 ERP increasing by 26.1 per cent to reach 356,441 persons in 1996. This rapidly growing area was under–estimated by 3.8 per cent, or 13,492 persons.

10.4 South Australia

A relatively stable population between 1991 and 1996, combined with a limited number of rapidly declining and increasing SLAs and only minor adjustments to SLA boundaries contributed to the average absolute intercensal discrepancy for SLAs in South Australia being the lowest of all States/Territories.

Despite its relatively small average absolute discrepancy, South Australia still has its problem areas. Table 17 shows that the effect of removing sparsely populated SLAs (ie. those with less than two persons per km^2) was to reduce the average error by 0.7 percentage points to 2.0 per cent. (For all Australian SLAs, the improvement was only 0.1 percentage points.) This suggests that sparse populations in South Australia were relatively difficult to estimate. Low-density SLAs tend to be located in rural areas.

Further investigation of South Australian SLA intercensal discrepancies confirm that the most inaccurate estimates occurred within rural areas: 28 of the 29 SLAs in South Australia that were under–estimated by greater than three per cent were located outside of the Adelaide Statistical Division. The largest under–estimate (excluding very small SLAs) occurred for the Murray Lands SLA of Morgan, with a preliminary 1996 estimate of 1,142 persons. This was 16.5 per cent below the final figure (1,368). The next worst 1996 figure, in terms of percentage intercensal discrepancy, was the Far North SLA of Coober Pedy, with a final ERP of 2,668 being under–estimated by 14.4 per cent, or 385 persons.

The largest SLA in South Australia in 1996 was Salisbury, situated in Adelaide's northern suburbs. The intercensal discrepancy for Salisbury, which had a final 1996 ERP of 111,778, was +1.0 per cent. The next largest SLA was the neighbouring Tea Tree Gully, which grew by 9.2 per cent from 1991 (87,478 persons) to 1996 (95,563). The intercensal discrepancy for Tea Tree Gully was +1.6 per cent. A similar growth rate and discrepancy existed for the third largest SLA, Noarlunga, located in the southern suburbs of Adelaide. Its 1991 population of 83,752 increased 10.6 per cent to a 1996 figure of 92,599, and the intercensal discrepancy was +1.7 per cent.

With LGAs generally corresponding to SLAs in South Australia in 1996, the three largest LGAs were also Salisbury, Tea Tree Gully and Noarlunga.

10.5 Western Australia

The average absolute intercensal discrepancy for SLAs in Western Australia (5.1 per cent) was higher that the Australian average (4.6 per cent). From table 17 it can be seen that the relatively high number of small SLAs in Western Australia appears to have had a significant impact on the average absolute discrepancy in 1996.

Table 2 shows that Western Australia had 151 SLAs in 1996, and 51 of these SLAs had a population less than 1,250. This puts 34 per cent of SLAs in Western Australia in the 'small SLAs' category, compared with 11 per cent for the remaining States/Territories.

Table 3 presents another perspective on the number of small SLAs in Western Australia – where the median SLA population (2,613) was only 22 per cent the size of the average SLA (11,690). This proportion of median to mean population was the lowest for any State or Territory.

The effect of excluding the 'small' SLAs (those with ERP between 500 and 1,249) was to reduce the average absolute discrepancy for Western Australia from 5.1 to 3.5 per cent – lower than the average for all Australia's – excluding small – SLAs (4.2 per cent).

The two small inner–city SLAs of Perth–Inner (420 persons) and Fremantle–Inner (698 persons) had the largest over–estimates, in contrast to the relatively large under–estimated populations for the inner city SLAs of Sydney, Melbourne, Adelaide and Darwin. Note that the populations of these two SLAs had declined rapidly, by 42 and 30 per cent respectively, since 1991.

Another major cause of Western Australia's relatively high average discrepancy appears to be the existence of rapidly declining SLAs. The effect of excluding rapidly declining SLAs was to reduce the error by 1.1 percentage points, from 5.1 to 4.0 per cent. For all SLAs in Australia, the improvement after excluding rapidly declining SLAs was 0.3 percentage points.

Excluding very small SLAs, the largest intercensal discrepancy was for the sparsely settled Wiluna (1,162 persons). With a small population, a very rapid growth rate (increase of 195 per cent since 1991), low population density (0.006 persons per km^2) and an extensive boundary change in 1995 (reducing the 1991 ERP from 1,597 to 394), Wiluna falls under several 'hindrance' categories discussed in section 8. The preliminary 1996 figure of 428 under–estimated the final ERP by 63.2 per cent.

Excluding small SLAs, East Pilbara (located in the Pilbara area, towards the north of the state) had the largest inter–censal discrepancy (+30.0 per cent). This SLA, the largest in terms of area in Western Australia, had a 1996 ERP of 6,937. Its density was very low (0.02 persons per km^2) and the decrease in population since 1991 was quite dramatic (a decline of 3,174 persons, or –31 per cent, since 1991). Like Wiluna, this SLA falls into several categories discussed in section 8.

The largest SLA in Western Australia in 1996 was Wanneroo – South–West (ERP 109,504), located in the northern suburbs of Perth. The intercensal discrepancy for this SLA was –4.3 per cent. Another Wanneroo SLA with a high negative intercensal discrepancy was Wanneroo – North–West which was under–estimated by 8.9 per cent. Somewhat balancing for these under–estimates (in terms of the direction of the discrepancy) was Wanneroo – Central Coast, over–estimated by 6.8 per cent.

It should be noted that the LGA of Wanneroo was, until 1995, one SLA. The split of Wanneroo from one to five SLAs in 1996 was likely to be a hindering factor in the accuracy of 1996 preliminary population estimates for the five Wanneroo SLAs (as discussed in sections 8.4 and 8.5).

Wanneroo was the largest LGA in Western Australia. With a population of 213,368, Wanneroo contained 12 per cent of the population of Western Australia in 1996. And this LGA grew rapidly, by 56,022 persons, or 22 per cent, between 1991 and 1996. The 1996 intercensal discrepancy for Wanneroo was –1.8 per cent. Given the high growth rate, the direction of this intercensal discrepancy (ie. an under–estimate) was in line with preliminary estimates for growth areas (as discussed in section 8.2).

10.6 Tasmania

Despite enduring a major round of LGA and SLA boundary changes between 1991 and 1996, the average absolute intercensal discrepancy for SLAs in Tasmania (3.2 per cent) was well under the Australian average (4.6 per cent). In fact, over 50 per cent of SLAs in Tasmania had an absolute error below two per cent – the only State or Territory to have over 50 per cent of its SLAs estimated to within two per cent.

Table 17 shows that there was little room for further improvement based on factors discussed in section 8. The average absolute discrepancy for SLAs that did not undergo any boundary change between 1991 and 1996 was a very small 0.4 per cent, however there were only two SLAs that remained on the same boundaries in 1991 and 1996 – Waratah/Wynyard Pt A (with a 1996 discrepancy of +0.5 per cent) and West Tamar (–0.8 per cent).

Excluding rapidly declining SLAs (there were six of them), the average absolute discrepancy improved slightly from 3.2 to 3.0 per cent.

Meander Valley Pt A, a high growth SLA located in the north of the State, was the SLA with the largest 1996 intercensal discrepancy in Tasmania. The preliminary 1996 estimate of 5,400 under–estimated the final ERP by 1,456 (the final ERP was 6,856). This SLA saw population increase by 45 per cent between 1991 and 1996, by far the largest percentage increase of any SLA in Tasmania. Note also that the 1991 estimate for Meander Valley Pt A was rebased upwards, from 4,513 (the figure that the preliminary 1996 estimate was updated from) to 4,737 persons. Had the 1996 estimate been calculated based on the rebased 1991 ERP, the discrepancy (–1,456) for this SLA could well have been less.

The largest SLA, Launceston Pt B, was over–estimated by 2.2 per cent (preliminary ERP 61,990; final 60,670). The next largest SLA, Clarence – located in Hobart – was over–estimated by 0.3 per cent (final ERP 49,550). The third largest SLA in Tasmania was Hobart – Remainder (46,515), over–estimated by 0.5 per cent.

With 63,896 persons, Launceston (C) was the largest LGA in 1996. The preliminary figure of 65,310 over–estimated the final ERP by 2.2 per cent. The next largest LGA was Clarence, which conforms to the SLA of Clarence, discussed in the previous paragraph.

10.7 Northern Territory

The Northern Territory was the State/Territory with the largest average absolute percentage intercensal discrepancy (7.9 per cent).

What is striking for the Northern Territory from table 17 is that the average discrepancy was reduced extensively when SLAs that incurred boundary changes are excluded – despite the fact that there were only five SLAs involved in boundary changes (involving population change) between 1991 and 1996. The SLAs involved were all created by the 1996 split of Alice Springs (T) into the SLAs of: Charles; Heavitree; Larapinta; Ross and Stuart. The average absolute discrepancy for SLAs in the Northern Territory was reduced from 7.9 to 4.6 per cent with the exclusion of these new SLAs.

The intercensal discrepancy for the LGA of Alice Springs (the combination of the five SLAs mentioned above) was +2.6 per cent. The preliminary ERP of 25,700 had over–estimated the final ERP (25,040) by 660 persons. However, discrepancies for the SLAs within Alice Springs ranged from –34.0 per cent (Heavitree) to +21.0 per cent (Charles) and +19.0 per cent (Stuart). The two remaining Alice Springs SLAs, Larapinta (8,929 persons) and Ross (7,017), which together comprise 64 per cent of the total LGA population, had discrepancies of –1.4 per cent (Larapinta) and +1.2 per cent (Ross).

The largest SLA, Litchfield – Pt B (12,433 persons) was under–estimated by 4.4 per cent. This SLA had experienced 35 per cent growth between 1991 and 1996. The next largest SLA, Katherine (9,443 persons), was under–estimated by 6.7 per cent.

Two SLAs in the Northern Territory had discrepancies greater than 50 per cent. Lee Point–Leanyer Swamp, which consists entirely of a caravan park, was over–estimated by 94.0 per cent. East Arm, which includes Darwin prison, was over–estimated by 68.3 per cent. The ERPs of these SLAs were very small (128 and 227 respectively). Lee Point–Leanyer Swamp had declined by 46 per cent since 1991 (from an ERP of 235) and East Arm had declined by 37 per cent since 1991 (from an ERP of 360). This again highlights the problem of estimating very small areas, especially considering the nature of such SLA populations, and the considerable reduction of ERP which had occurred over the period in question.

The largest discrepancies for SLAs with ERP greater than 500 were for Litchfield – Pt A (preliminary: 602; final 1,164; and with a 1991–96 growth of 137 per cent), The Gardens (preliminary 820; final 606) and Elsey – Balance (preliminary 1,619; final 2,121; and a 1991–96 growth of 38 per cent).

The largest LGA, Darwin, was under–estimated by 1.4 per cent. In 1996, Darwin contained 38 per cent of the total population of the Northern Territory. The preliminary 1996 estimate of 67,934 was 955 below the final figure of 68,889.

10.8 Australian Capital Territory

With 20 SLAs having a 1996 ERP less than 500, the Australian Capital Territory was the State/Territory with the highest proportion of 'very small' SLAs. Had these very small SLAs been included in the calculation of average absolute percentage intercensal discrepancy (table 17), the Australian Capital Territory figure would have been well above 10 per cent.

Another potential problem with small SLAs in the Australian Capital Territory was that their populations tended to decline considerably between 1991 and 1996. Hence these SLAs are jointly affected by small population size (section 8.1) and large negative growth (section 8.2).

The 15 SLAs with 1996 ERP below 200 persons declined, on average, by 21 per cent between 1991 and 1996. The extreme cases were:

Statistical Local Area	Final ERP		Change	Preliminary ERP	Intercensal
	1991	1996	1991–96	1996	discrepancy
Russell	5	0	– 100%	5	undefined
Kowen	50	16	–69%	47	+194%
Parkes	27	13	–52%	27	+108%
Gungahlin–Hall SSD balance	94	47	–50%	61	+30%

On the other hand, Mitchell, which increased from 5 persons in 1991 to 8 in 1996, had incurred 60 per cent growth. The preliminary estimate of 5 persons under–estimated the final 1996 ERP by 38 per cent.

Clearly it is misleading to include these SLAs in a wider analysis.

A feature of table 17 for the Australian Capital Territory was the reduction in discrepancies when SLAs that incurred boundary changes are excluded, from 3.9 to 2.8 per cent.

These SLAs that had 'boundary changes' were in fact new SLAs – Banks (created 1992), Conder (1992), Palmerston (1993), Ngunnawal (1994), Nicholls (1994), Dunlop (1995) and Amaroo (1995). In other words, these seven SLAs did not have a 1991 base to work from, because these SLAs did not exist in 1991.

Excluding these SLAs established since 1991 and those with ERP less than 500, the largest discrepancy (+18.1 per cent) was for Acton, which consists almost entirely of residences for the Australian National University (1,482 persons). The next largest discrepancy was that for Braddon, with a preliminary ERP of 2,175 under–estimating the final ERP of 2,502 by –13.1 per cent (Braddon's population had increased by 23 per cent since 1991).

The largest SLA in the Australian Capital Territory was Kambah – with a 1996 ERP of 17,836, the preliminary figure (18,172) was an over–estimate of +1.9 per cent. The next largest SLA, Wanniassa (9,142 persons) was over–estimated by 1.4 per cent. The third largest SLA, Kaleen (8,583 persons) was over–estimated by +1.9 per cent. Interestingly, and in accordance with section 8.2.2, the populations of these three over–estimated SLAs all declined, by 3.3, 9.8 and 6.0 per cent respectively.

11 CONCLUSION

Population estimates at the Statistical Local Area level are provided annually by the Australian Bureau of Statistics. The accuracy of these estimates can best be gauged each time a population census is held. Although there is no overriding criteria to judge the accuracy of a set of small area population estimates, Australia's small area population estimates appear to be reasonable, although there is always room for improvement. In 1996, almost 73 per cent of Australia's 1,330 SLAs were estimated to within five per cent of their 'true' value.

A number of broad factors influence the degree of accuracy by which the populations of small areas can be estimated. These include very small populations, extreme population decline or growth, sparsely populated areas and limited availability of high quality population indicator data. External influences, such as changes to the spatial units for which population estimates are required, are also potentially obstructive.

Because of this, detailed analysis of intercensal discrepancy, such as that documented in this paper, is a crucial component of the estimation process. Such analysis provides a valuable insight into the overall accuracy of small area population estimates and assists in the identification and further investigation of problematic regions.

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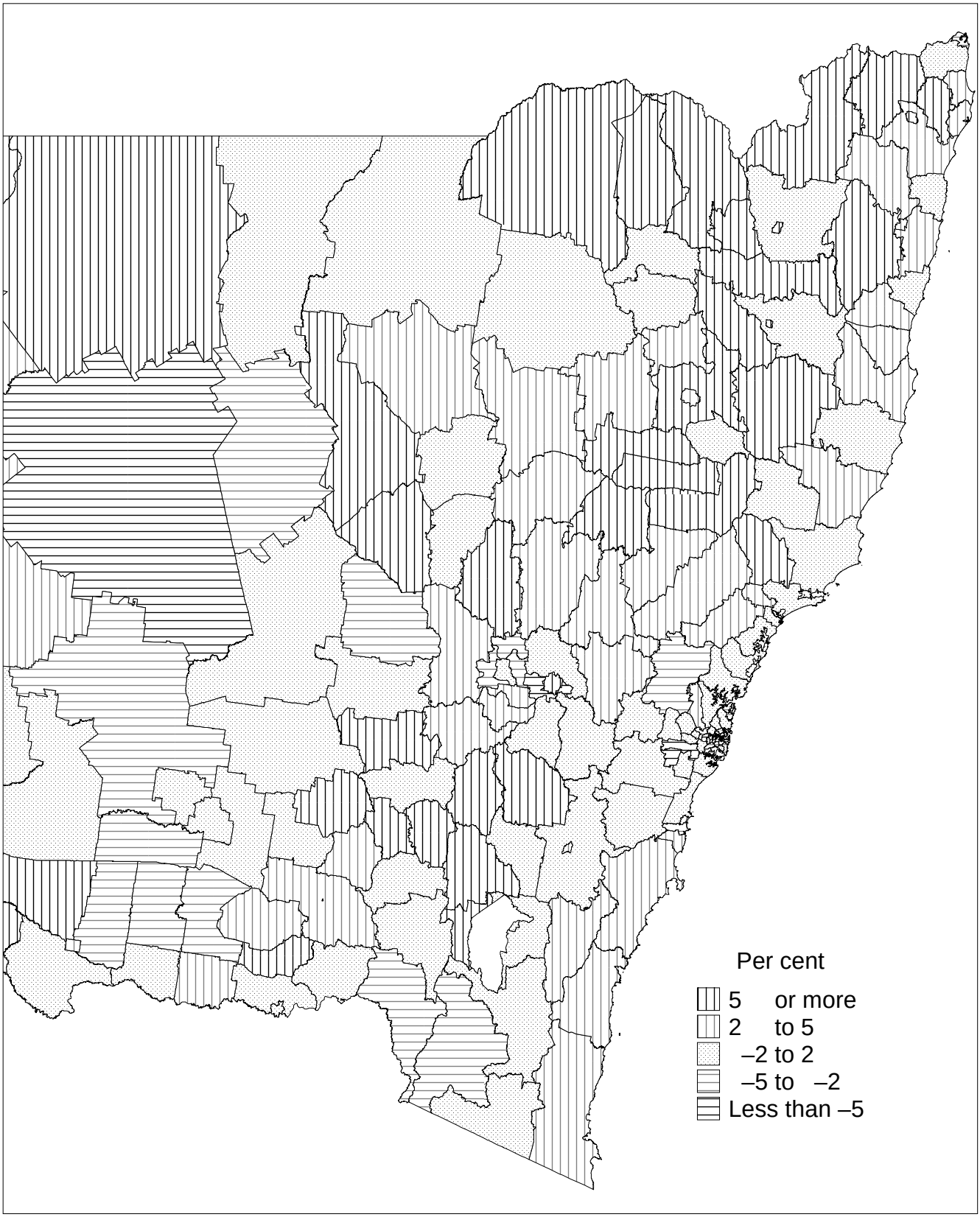
Intercensal discrepancies, 30 June 1996

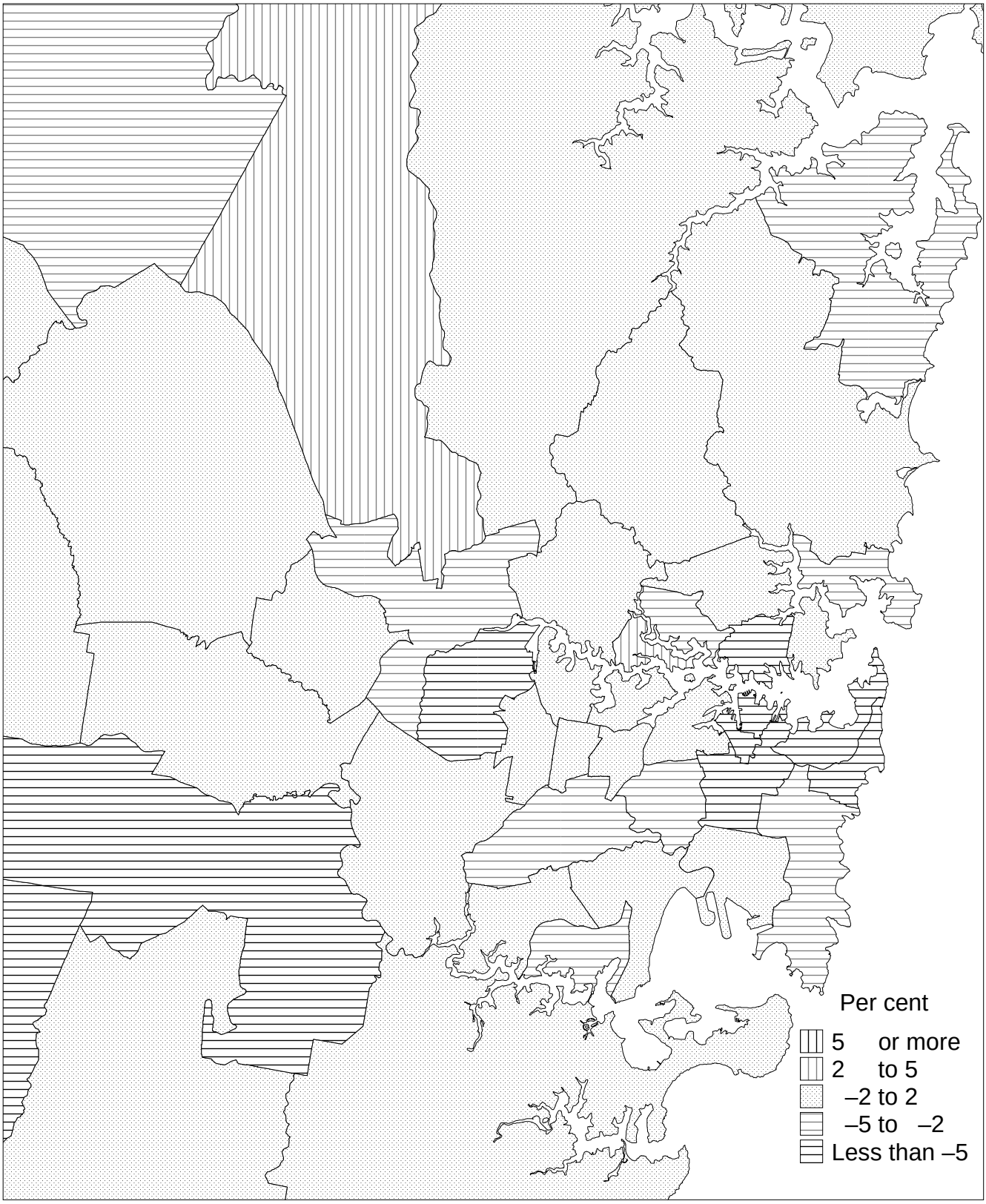
New South Wales



Based on 1996 Statistical Local Area Boundaries
Source: Estimated Resident Population
Produced by: Small Area Population Unit, ABS Adelaide

Intercensal discrepancies, 30 June 1996

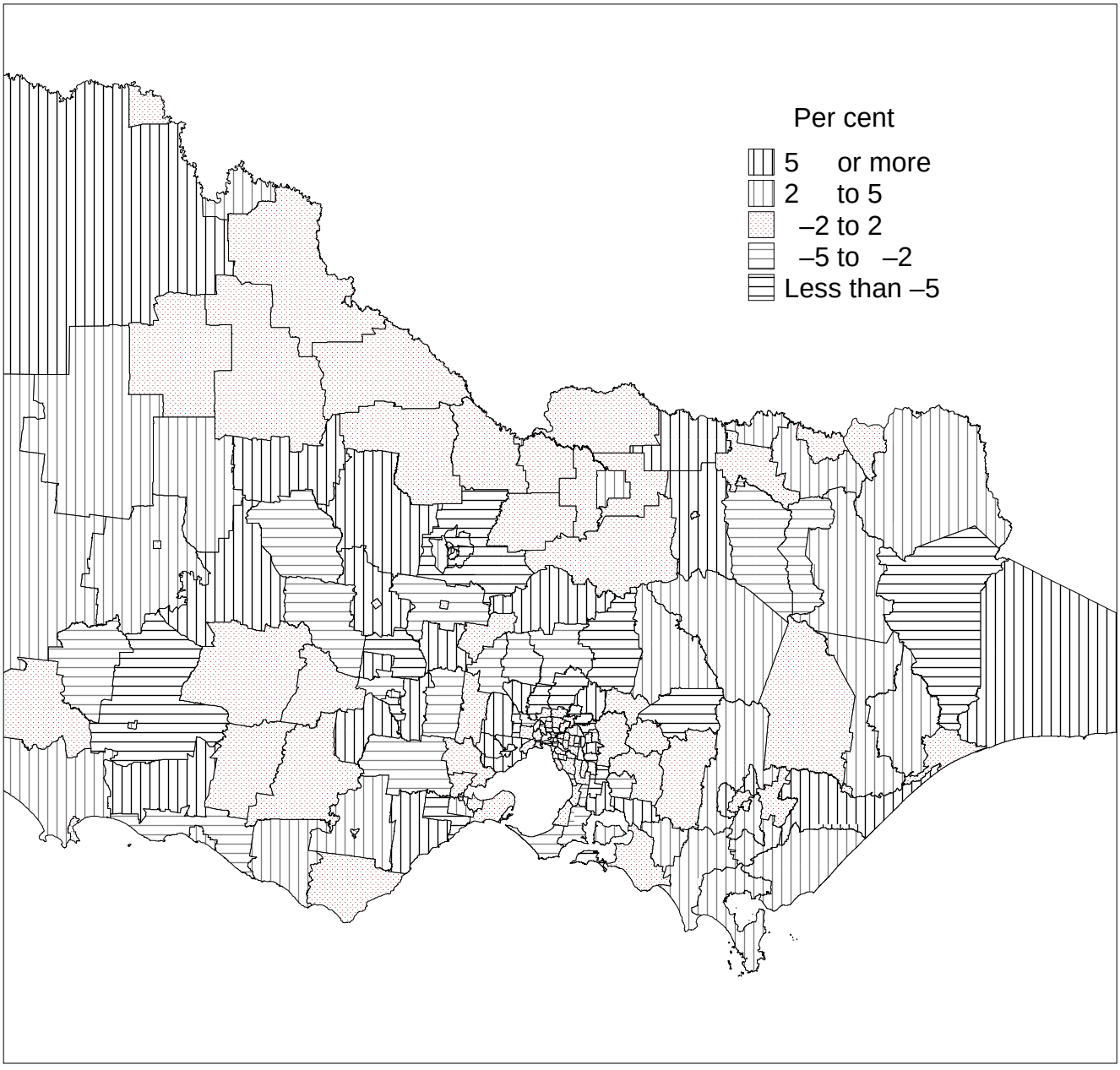
Sydney



Based on 1996 Statistical Local Area Boundaries
Source: Estimated Resident Population
Produced by: Small Area Population Unit, ABS Adelaide

Intercensal discrepancies, 30 June 1996

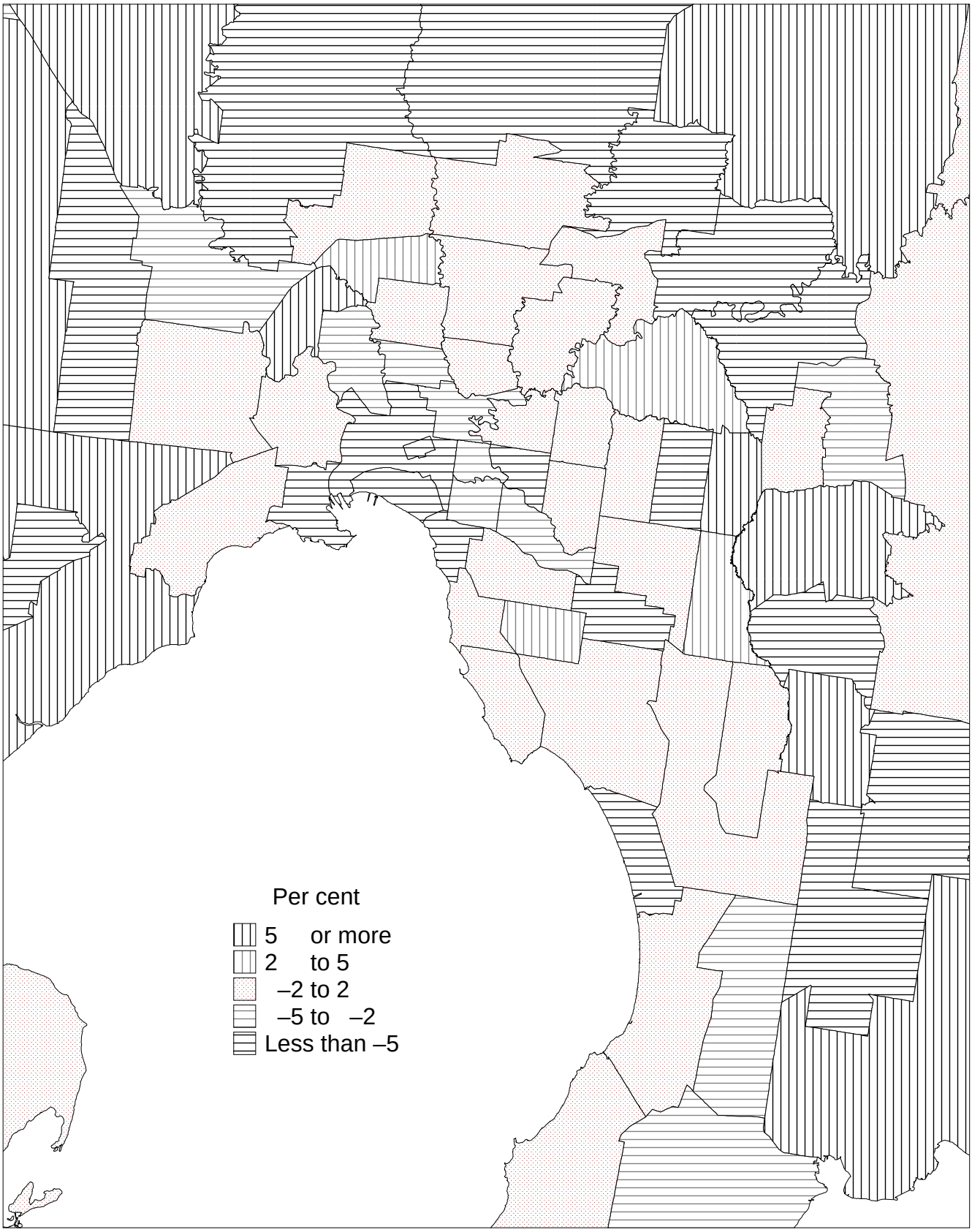
Victoria



Based on 1996 Statistical Local Area Boundaries
Source: Estimated Resident Population
Produced by: Small Area Population Unit, ABS Adelaide

Intercensal discrepancies, 30 June 1996

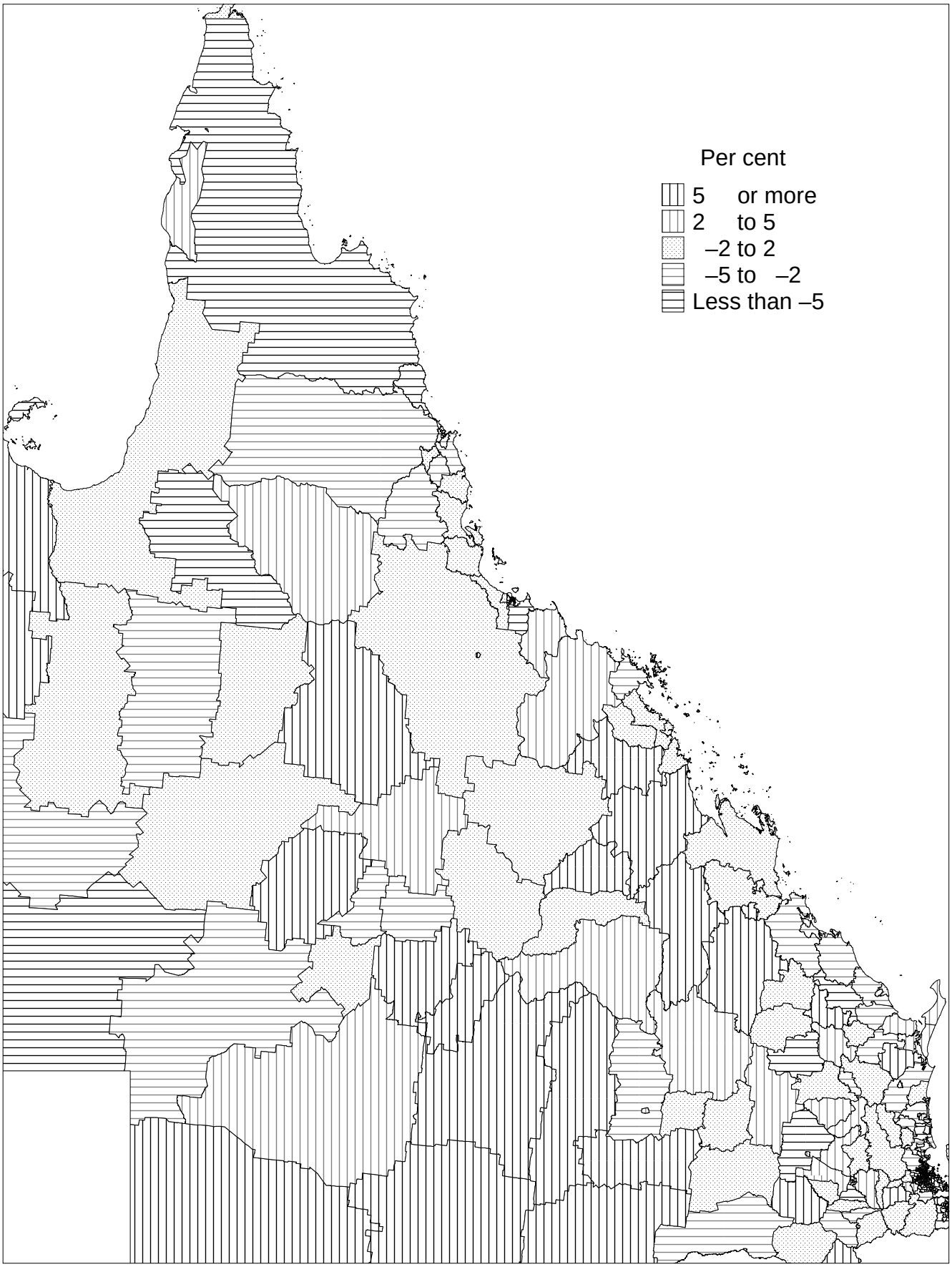
Melbourne



Based on 1996 Statistical Local Area Boundaries
Source: Estimated Resident Population
Produced by: Small Area Population Unit, ABS Adelaide

Intercensal discrepancies, 30 June 1996

Queensland



Based on 1996 Statistical Local Area Boundaries
Source: Estimated Resident Population
Produced by: Small Area Population Unit, ABS Adelaide

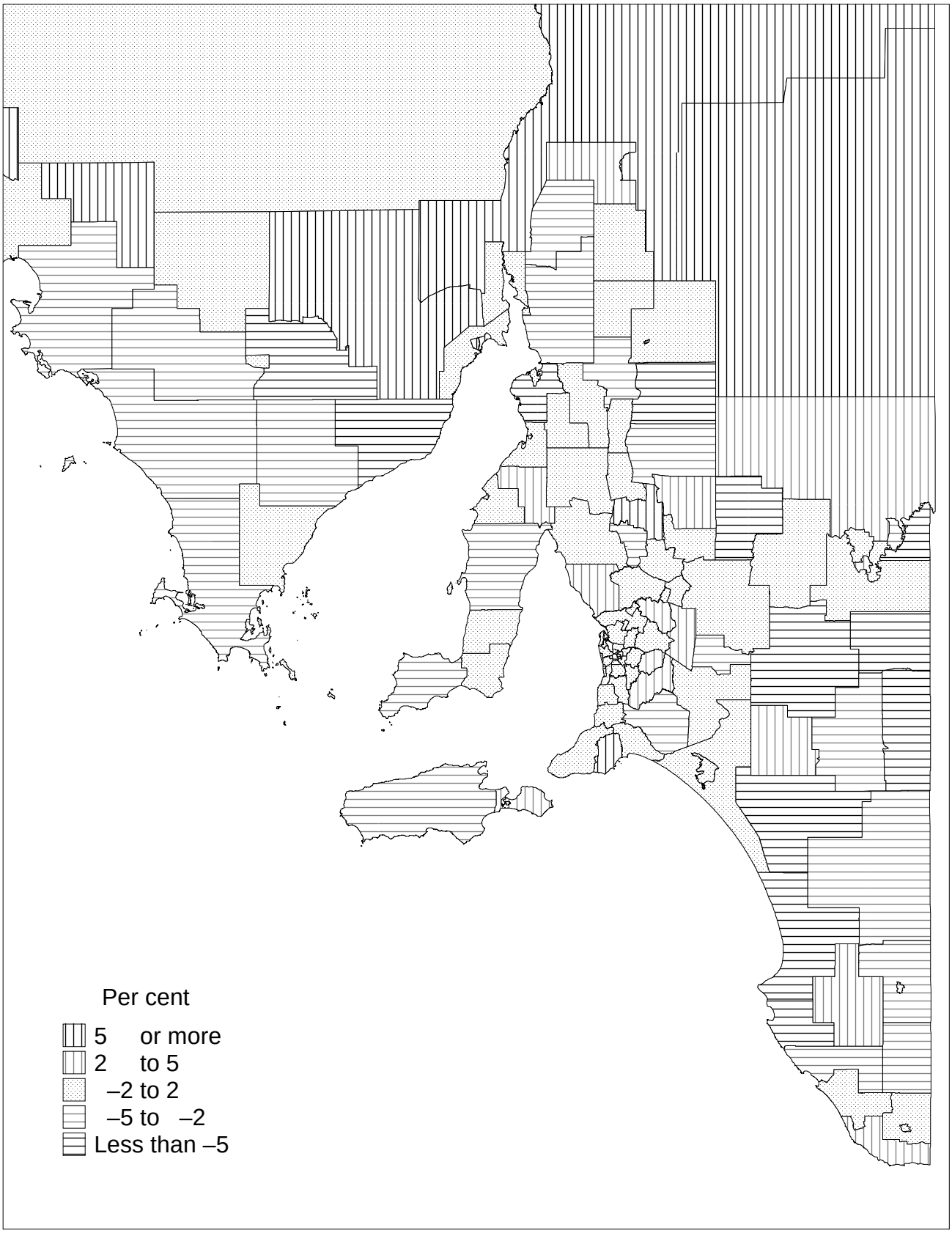
Intercensal discrepancies, 30 June 1996

Brisbane

Based on 1996 Statistical Local Area Boundaries
Source: Estimated Resident Population
Produced by: Small Area Population Unit, ABS Adelaide

Intercensal discrepancies, 30 June 1996

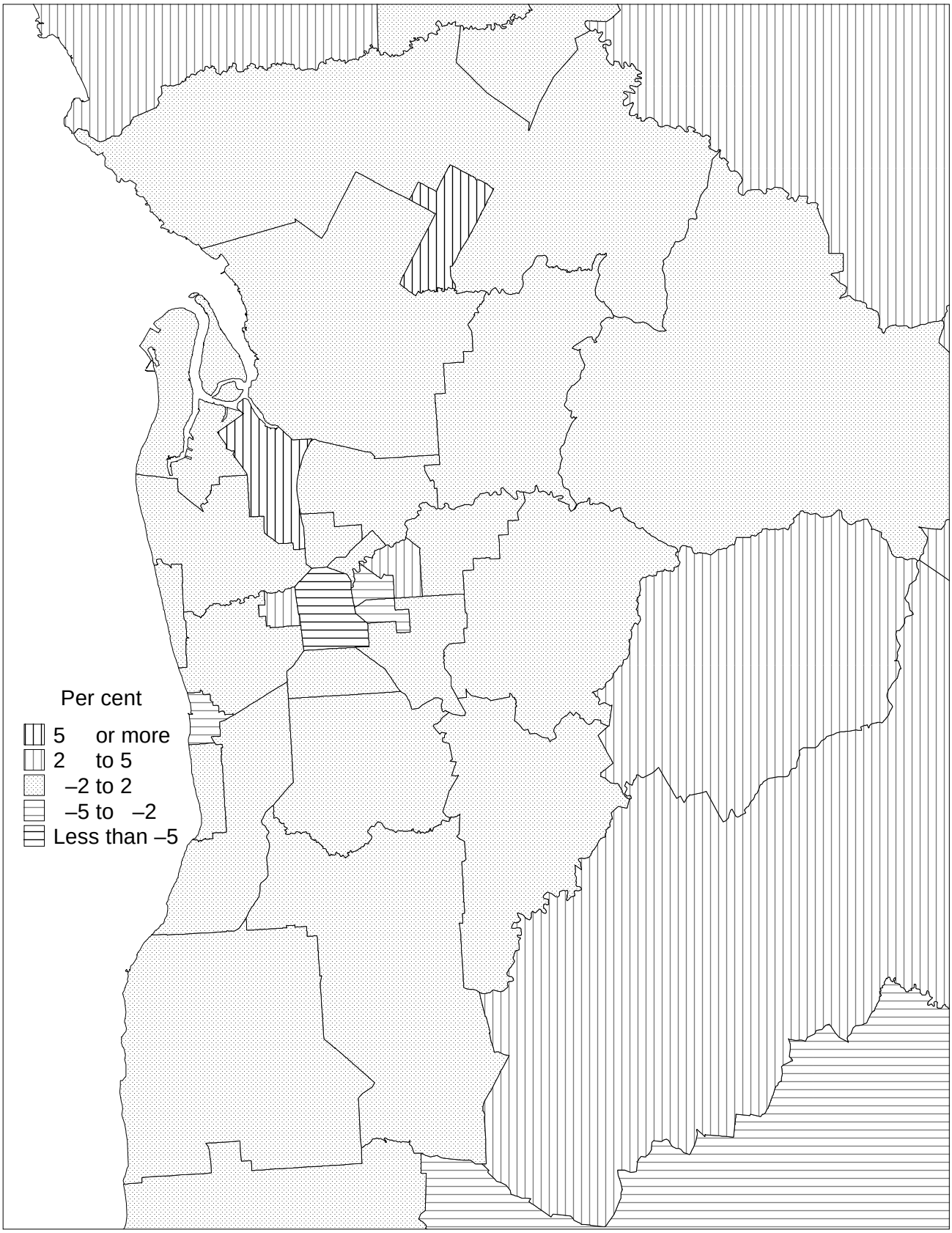
South Australia



Based on 1996 Statistical Local Area Boundaries
Source: Estimated Resident Population
Produced by: Small Area Population Unit, ABS Adelaide

Intercensal discrepancies, 30 June 1996

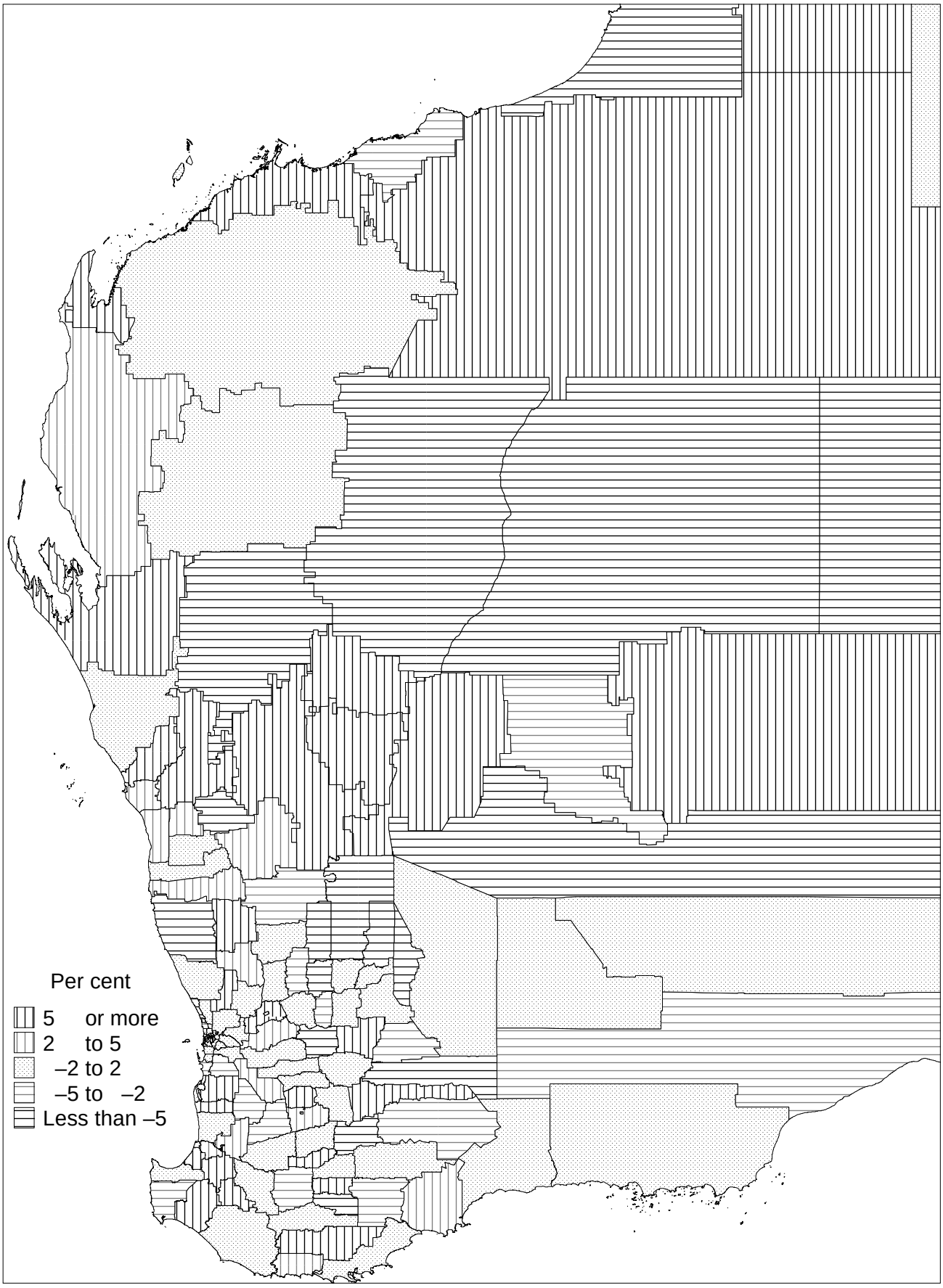
Adelaide



Based on 1996 Statistical Local Area Boundaries
Source: Estimated Resident Population
Produced by: Small Area Population Unit, ABS Adelaide

Intercensal discrepancies, 30 June 1996

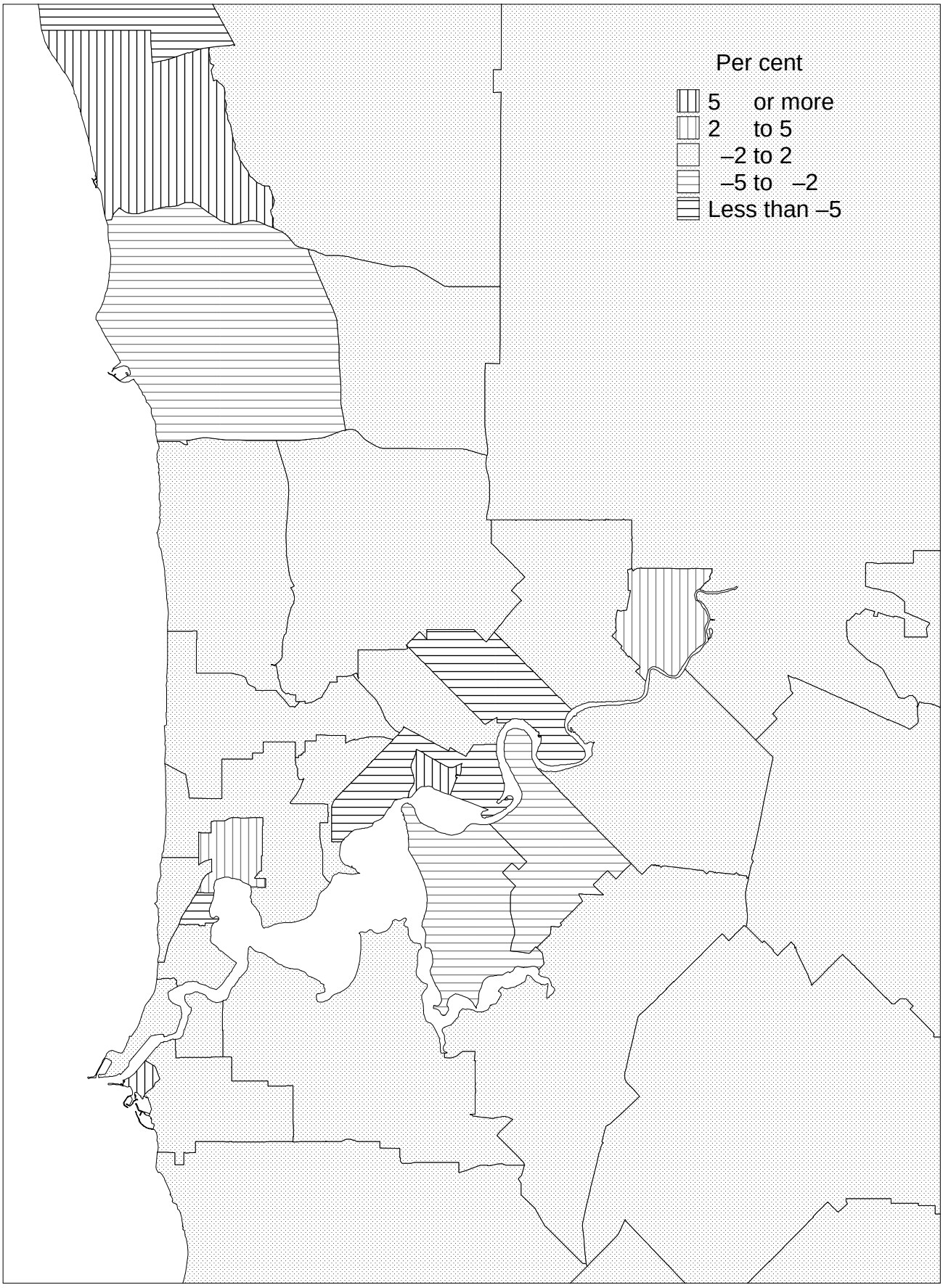
Western Australia



Based on 1996 Statistical Local Area Boundaries
Source: Estimated Resident Population
Produced by: Small Area Population Unit, ABS Adelaide

Intercensal discrepancies, 30 June 1996

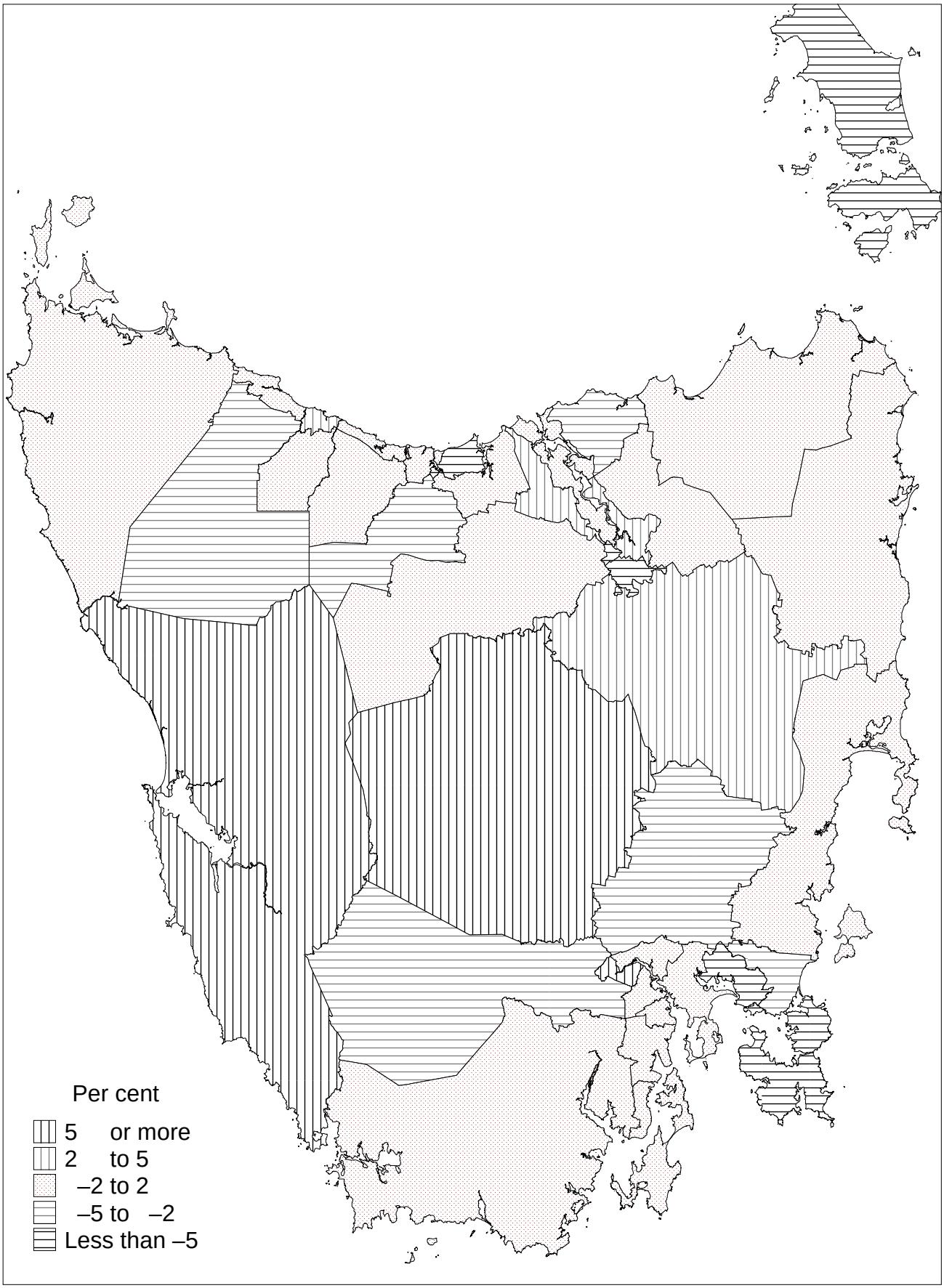
Perth



Based on 1996 Statistical Local Area Boundaries
Source: Estimated Resident Population
Produced by: Small Area Population Unit, ABS Adelaide

Intercensal discrepancies, 30 June 1996

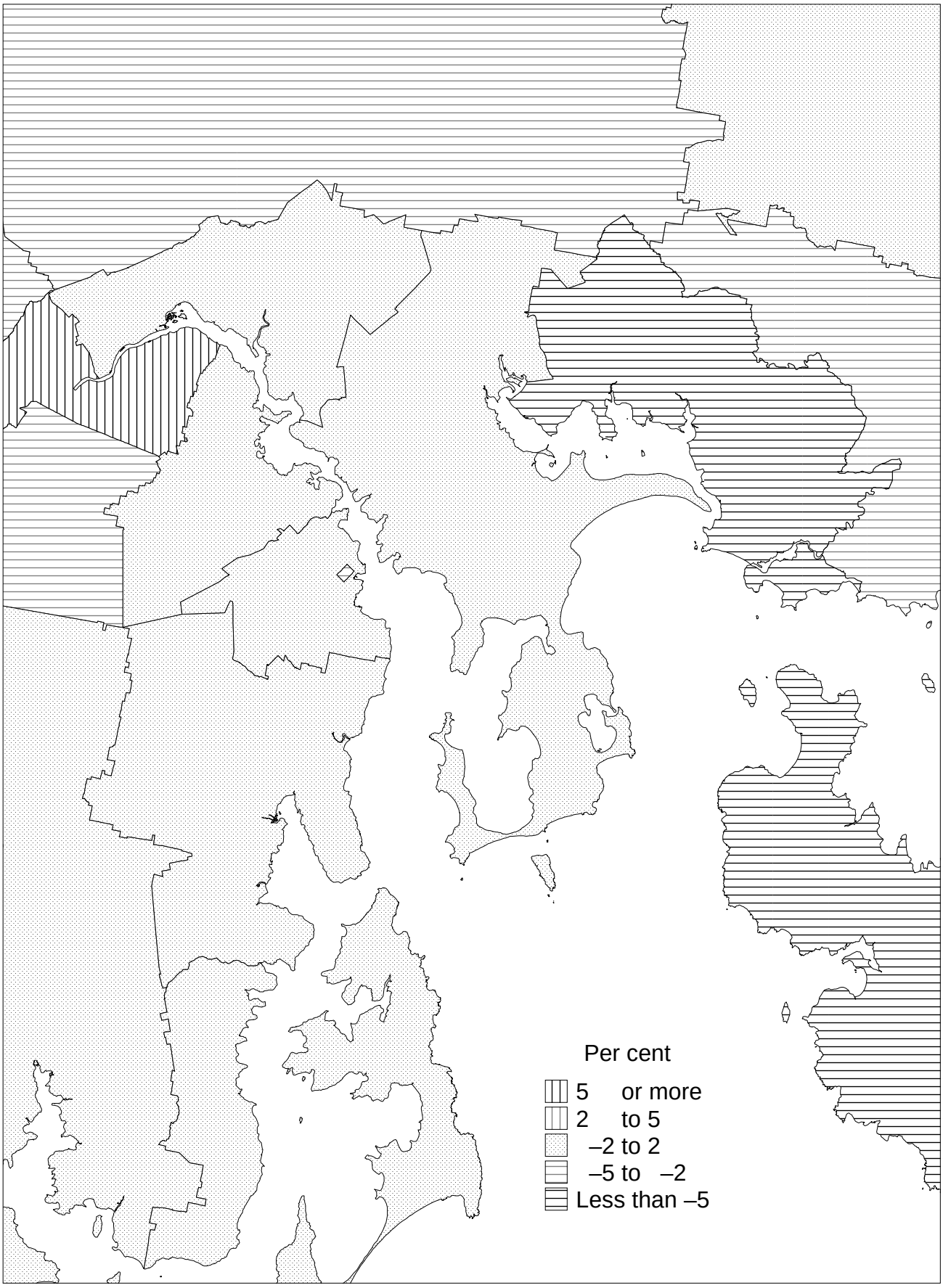
Tasmania



Based on 1996 Statistical Local Area Boundaries
Source: Estimated Resident Population
Produced by: Small Area Population Unit, ABS Adelaide

Intercensal discrepancies, 30 June 1996

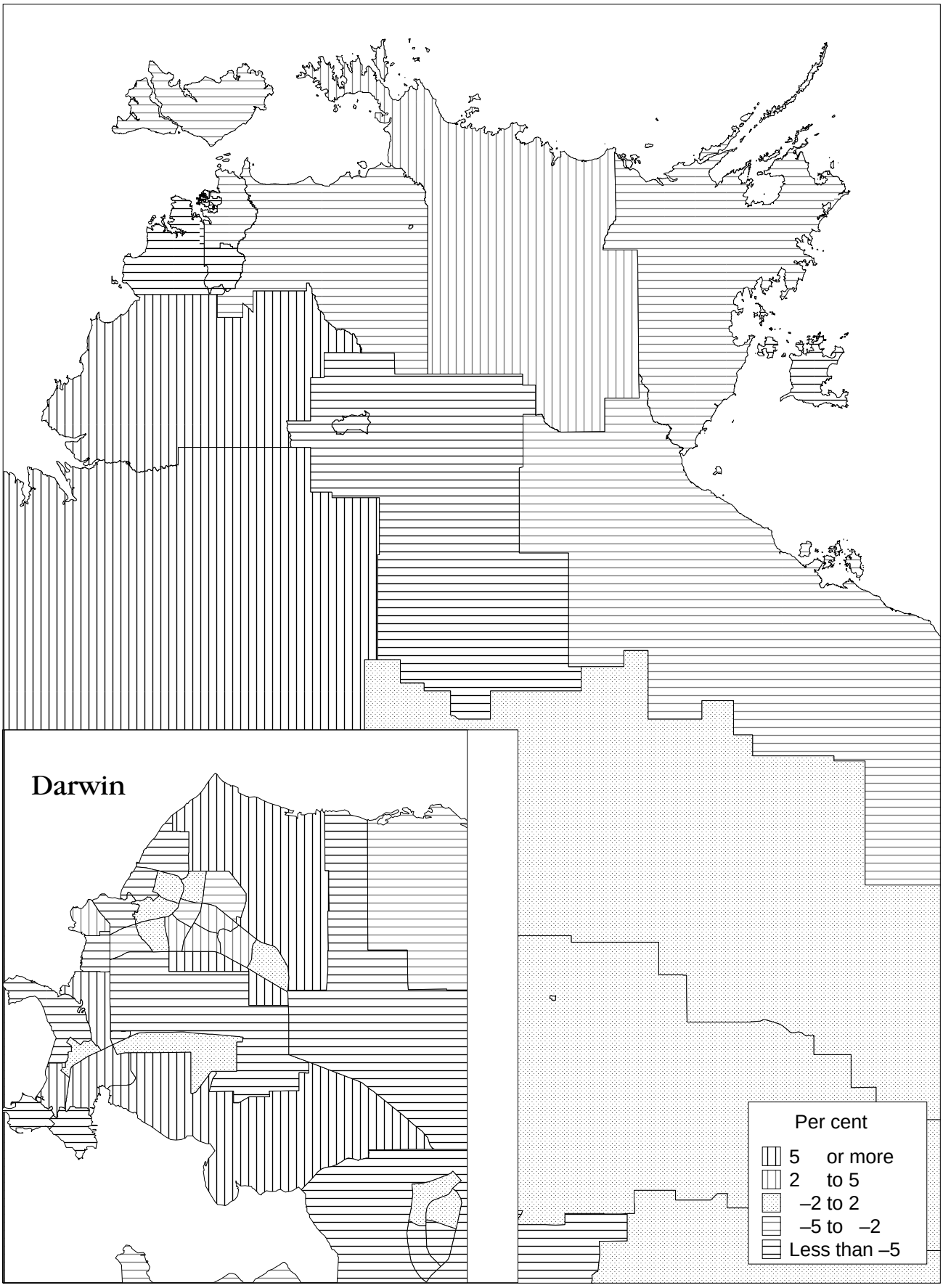
Hobart



Based on 1996 Statistical Local Area Boundaries
Source: Estimated Resident Population
Produced by: Small Area Population Unit, ABS Adelaide

Intercensal discrepancies, 30 June 1996

Northern Territory



Based on 1996 Statistical Local Area Boundaries
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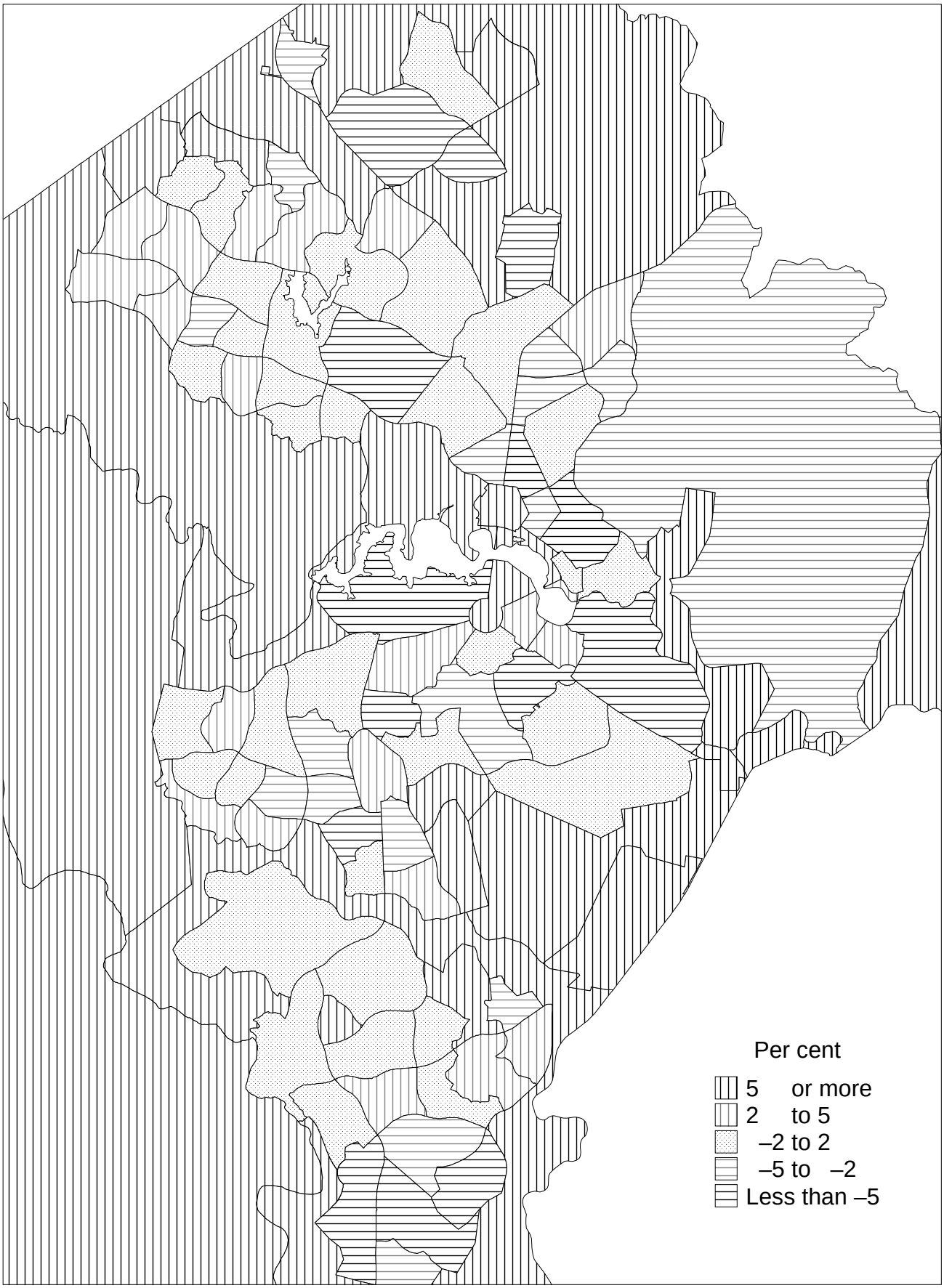
Australian Capital Territory



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