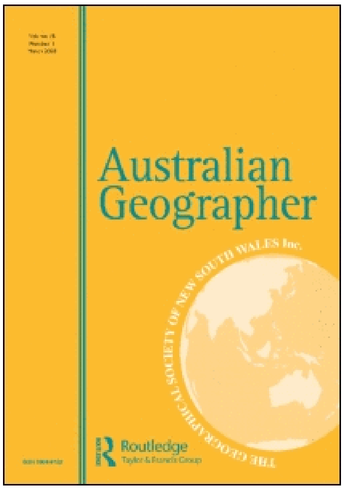

Australian Geographer
Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t713403176

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Online publication date: 24 November 2010

To cite this Article Taylor, John and Biddle, Nicholas(2010) 'Estimating the Accuracy of Geographic Variation in Indigenous Population Counts', Australian Geographer, 41: 4, 469 — 484
To link to this Article: DOI: 10.1080/00049182.2010.519695
URL: http://dx.doi.org/10.1080/00049182.2010.519695

Australian Geographer, Vol. 41, No. 4,
pp. 469–484, December 2010

Routledge
Taylor & Francis Group

Estimating the Accuracy of Geographic Variation in Indigenous Population Counts

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ABSTRACT *The ABS 2006 Post-Enumeration Survey was extended to include a sample of localities from the whole of Australia, thereby providing an estimate of census net undercount reflective of the enumeration in remote Indigenous settlements for the first time. The results revealed substantial undercounting of the Indigenous population in certain jurisdictions. At the same time, census counts in many locations were substantially higher than demographic factors could account for. The analytical and policy issues that arise from this revolve around a simple question: what credence can we give to observed spatial patterns of Indigenous population change? This paper seeks to provide an answer by establishing the spatial relationship between population change and net migration at the small area level. This reveals the detailed geography of census undercount and 'overcount' with the former common in remote areas and the latter most evident in regional towns and cities. The findings raise important policy issues about the proper interpretation of Indigenous population change data and the nature of estimates used to determine fiscal resourcing for Indigenous policies and programs.*

KEY WORDS *Indigenous population; Indigenous population change; net migration census; demography.*

Introduction

The significance of spatial context in influencing demographic, social and economic processes is increasingly recognised in social policy (Hugo 2007, p. 350). Put simply, where people live has important implications for outcomes and therefore needs. In Indigenous affairs, this recognition is now embodied in place-based strategies adopted by the Council of Australian Governments (COAG) Indigenous Reform process aimed at increasing Indigenous social and economic participation as part of its Closing the Gap agenda (COAG 2009). This focus underlines the need for accurate small area population data as a basis for sound policy making. For the most part, determination of changing population distribution by location type in Australia is straightforward enough involving well-established post-censal estimation techniques that are reasonably robust by international standards (Howe 1999). For the Indigenous population, however, reliable small area estimation has long been compromised by volatility in census

ISSN 0004-9182 print/ISSN 1465-3311 online/10/040469-16
DOI: 10.1080/00049182.2010.519695

counts and only a limited measure of census coverage. Thus, while census data are ideally suited to the measurement of absolute and relative spatial change in Indigenous circumstances, it is also true that they are deficient in ways that can diminish their utility for analysis and policy. In this regard, two issues stand out.

Firstly, we are now more certain than ever that substantial undercounting of the Indigenous population occurs in the Australian census and that this varies geographically. This surety arises from the fact that the household sample for the Australian Bureau of Statistics (ABS) 2006 Post-Enumeration Survey (PES) was drawn for the first time from a truly national frame, having been extended to include remote Indigenous settlements. From observations of census field operations in such locations (Morphy 2007a), it was not surprising to find that the overall PES estimate of Indigenous net undercount was relatively high compared to the total population (11.5 per cent as opposed to 2.8 per cent) and higher still in jurisdictions that have large Indigenous populations in remote areas (e.g. 16.6 per cent in Western Australia and 16 per cent in the Northern Territory) (ABS 2008a). This is one aspect of census error for which we now have reliable estimates, at least at the State and Territory level.

Secondly, there is another source of census error which can affect the geography of recorded population levels and this derives from the socially constructed nature of the census-identified Indigenous population. It arises where Indigenous numbers counted at one census are higher (often much higher) than expected on the basis of previous census levels and after accounting for intercensal change in basic demography—births, deaths and migration. For statistical shorthand, this error may be described as net census 'overcount' to contrast with net census 'undercount'. We emphasise that this shorthand refers to unexplained population increase and is a different concept from that of 'gross overcount' as used by the ABS in determining the net result of the Post-Enumeration Survey (ABS 2006). For this there have been no regular estimates or reliable predictors to date except to say that such an outcome has been quite common in Australia since 1971 and it is consistently evident in urban areas and in jurisdictions in the south and east of the continent as opposed to more remote areas.

Although reasons for overcounting remain uncertain, suggestions have included rising propensities for individuals to identify themselves as an Indigenous person on census forms (Ross 1999, p. 54), as well as improved census coverage of Indigenous dwellings (Gray 1997, 2002, pp. 109–14). As Kinfu and Taylor (2005) point out, the first of these suggests behavioural change while the latter alludes more to administrative factors. Either way, explanation is confounded by a lack of relevant data, although the systematic pattern of age-specific Indigenous growth rates for successive intercensal periods does tend to undermine the idea that behavioural factors are prominent (Kinfu & Taylor 2005, pp. 242–5). Whatever the sources of error in census counting, the key analytical and policy issues that arise revolve around a key question—how can we interpret the observed spatial pattern of change in population levels when we know that census error is present but we do not how this affects local counts?

To begin to provide an answer, this paper uses a regression framework to establish the strength of spatial association between changes in census counts and census measures of net migration based on the well-established observation for the general population that net inter-regional migration is the main demographic contributor to population change at the small area level (Bell & Hugo 2000). Using data at the Indigenous Area (IA) level of the Australian Indigenous Geographic Classification (AIGC) we estimate the extent and spatial pattern of census undercount and overcount as residuals from this regression. To reflect further on spatial outcomes and policy implications, we then apply these estimates to an experimental typology of Indigenous residential locations.

Indigenous area population change

An immediate difficulty when attempting to examine change in Indigenous census counts at the small area level is presented by reconfiguration of IA boundaries between the 2001 and 2006 AIGC. Boundary reclassification of this sort involved a total of 162 IAs, or 29 per cent of the 2001 total. In order to overcome this problem we deploy the 2001 version of the AIGC and then apply a quasi-population-based concordance for the 2006 data. The resulting spatial pattern of change in usual residence counts is shown in Figure 1 according to four categories: areas where the count declined, areas where the count increased slightly or at a rate below the national average (up to 10 per cent), areas where the count increased moderately above the national average (from 10 per cent to less than 30 per cent) and areas where the increase in the count was substantially above the national average (30 per cent or higher).

At first glance, the pattern of population change appears complex, with quite varied rates often juxtaposed. However, regularities do emerge. Thus, in major cities the majority of IAs show increases in census counts, with many well above 10 per cent. Relatively high rates of increase are also evident across much of the eastern half of Australia, including around Adelaide, throughout much of country

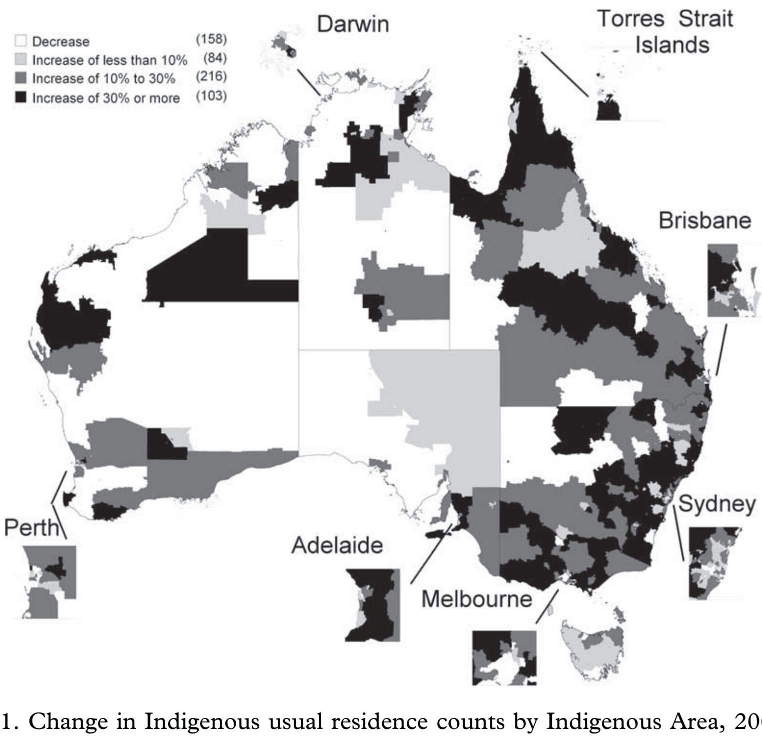

FIGURE 1. Change in Indigenous usual residence counts by Indigenous Area, 2001–2006.

Victoria, in eastern and select parts of northern New South Wales, variously in south-east Queensland, in central Queensland, the Mackay/Townsville area, and much of Cape York and the Queensland Gulf country. While similar occurrences appear in the western half of the continent in parts of north-east Arnhem Land, the Katherine region, the Iwupataka area west of Alice Springs, a few remote parts of the Kimberley, Pilbara, and Carnarvon, as well around Busselton, Bunbury and Coolgardie, these are geographically more sporadic and form the exception rather than the rule. For the most part, inland areas and much of the western half of the continent from top to bottom as well as the far west and parts of central New South Wales are more widely reflective of either a decline in population counts or below average increase. This is not inconsistent with the experience of inland Australia more generally in recent years (Argent & Walmsley 2008; Taylor 2007).

Overall, population decline was recorded in more than one-quarter of IAs (28 per cent), with an average reduction of 9.3 per cent. A further 15 per cent recorded an increase in population that was below the Indigenous national average. The largest single grouping (39 per cent) included areas with growth moderately above the national average while almost one-fifth (18 per cent) experienced growth substantially above the national average. The question arises as to how much of this diversity in population change reflects net migration.

The spatial relationship with net migration

In order to model the spatial pattern of change in Indigenous census counts we develop a regression framework with inter-regional net migration as the explanatory variable. This reveals a positive but very weak relationship with an adjusted *R*-squared at 0.046 (see Figure 2). This stands in stark contrast to a similar calculation of the relationship between regional population change and net migration for non-Indigenous Australians over the period 1996–2001, which revealed a very strong positive result with an *R*-squared of 0.888, albeit using a more aggregated level of geography (Taylor 2003).

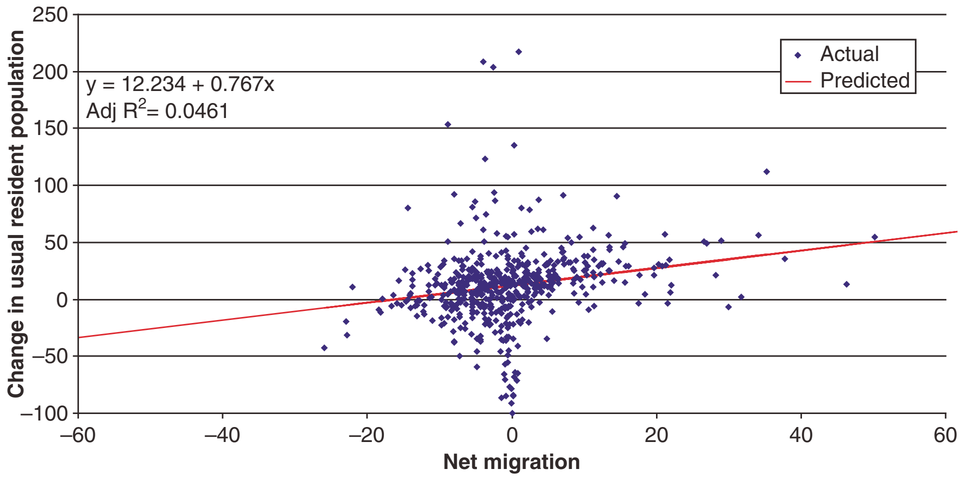

FIGURE 2. Net migration by actual and predicted percentage change in population, 2001–2006.

There are several reasons why the relationship between change in Indigenous census counts and intercensal net migration at the IA level is likely to be comparatively weak:

- changes in other demographic variables such as births, deaths and overseas migration;
- changes in the percentage of the population that did not report an Indigenous status;
- errors caused by matching 2001 and 2006 IA boundaries;
- errors caused by matching IA boundaries and the Statistical Local Area (SLA) boundaries that are used to measure migration;
- error in the 2001 or 2006 census counts caused by under-enumeration or increased Indigenous census capture;
- uncertainty around the concept or reporting of usual residence, especially place of usual residence 5 years ago (Morphy 2007b, pp. 42–4; Newbold 2004).

At the IA level, it is not possible to estimate Indigenous deaths between 2001 and 2006 but we can add those aged 0–4 years to the 2006 count to compensate for intercensal births. Indigenous overseas net migration is impossible to calculate although it is considered to be negligible. As for non-response to Indigenous status, we simply allocate this pro rata to the 2001 and 2006 counts in line with ABS practice and in the absence of any further information. As noted, we can also remove the influence of changes in census boundaries. With these adjustments in place the relationship between net migration and population change in these now temporally stable geographic areas becomes more robust as indicated by an adjusted R-squared of 0.2049 as well as a greater clustering of data points along the regression line representing predicted values (see Figure 3). However, even with these adjustments, substantial variation remains unexplained and attention therefore falls on the final two possibilities, namely enumeration error and mis-reporting of intercensal migration. Accordingly, this lack of fit between population change

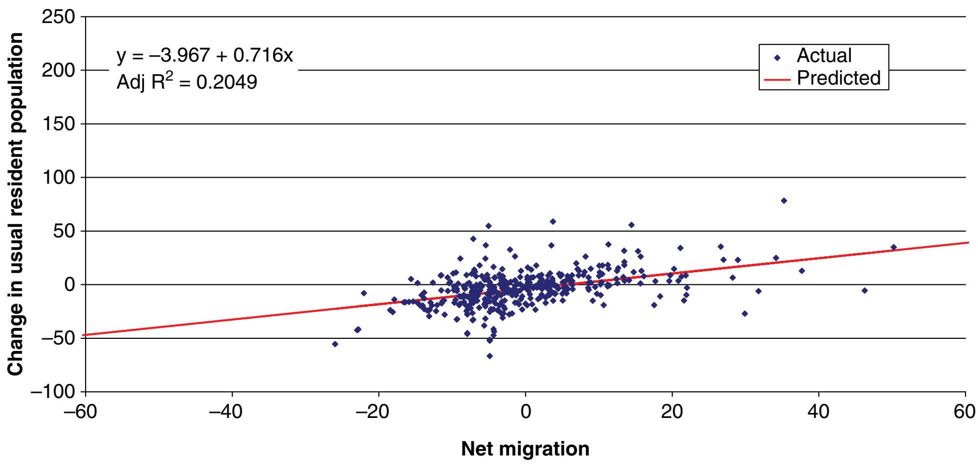

FIGURE 3. Net migration by actual and predicted percentage change in population – Areas with stable boundaries, 2001–2006.

and demographic change provides for a measure of the robustness of each IA census count.

If this residual variation were distributed randomly across the IAs we could be reasonably confident that any conclusions drawn regarding the true levels of population change were sufficiently robust for our purposes. However, in order to be sure about this we require a test for systematic bias in the error. This is provided by a regression of the error term from Figure 3 against three sets of variables: the remoteness classification of the IA (model A), the relevant jurisdiction (model B), and these two geographic classifications together (model C), as shown in Table 1.

The results from model A indicate that inner and outer regional areas experienced a higher count than predicted, while in very remote areas growth in the usual resident population was lower on average than expected based on the patterns of net migration. This result is also reflected in model B, with areas in New South Wales and (especially) Victoria indicating a higher than expected count and those in Western Australia experiencing a much lower count than expected. However, once we control for remoteness (model C), the results for New South Wales and Victoria are no longer significant, which would tend to suggest that the significant values in model B derived from the fact that the two States have large populations in both inner regional and outer regional areas. In contrast to this situation in the south-eastern States, the coefficient for IAs in Western Australia increases substantially between model B and model C, and two other jurisdictions (Tasmania and the Northern Territory) also record results that are significantly less than zero (Queensland was significant only at the 10 per cent level of significance). Because reporting of net migration is unlikely to vary systematically by jurisdiction once remoteness has been controlled for, the undercount in these areas is most likely something to do with these jurisdictions specifically, rather than reflecting simply a greater level of remoteness. The indications of undercount in Western Australia, the Northern Territory, Queensland and Tasmania are all consistent with ABS final estimates based on the PES (ABS 2008b).

TABLE 1. Coefficient estimates: difference between predicted and actual usual resident Indigenous population change

	Model A	Model B	Model C
Major city	n.s.		base
Inner regional area	4.503		7.114
Outer regional area	2.831*		6.672
Remote area	n.s.		n.s.
Very remote area	−3.710		n.s.
New South Wales		4.135	n.s.
Victoria		8.263	n.s.
Queensland		n.s.	−3.878*
South Australia		n.s.	n.s.
Western Australia		−7.724	−11.578
Tasmania		n.s.	−9.952
Northern Territory		n.s.	−7.339
Australian Capital Territory		n.s.	n.s.
Adjusted R-Squared	0.0359	0.0843	0.1072

Notes: n.s. denotes variables that are not significant at the 10% level of significance
*denotes those variables that are significant at the 5% level only.

The geography of undercount and overcount

The regression analysis achieves two aims. Firstly, it confirms that for IAs in certain jurisdictions and for particular categories of remoteness it is not possible simply to compare census counts in 2001 and 2006 and expect that this will provide a reliable measure of population change. By extension, this caution applies to change in census characteristics in these areas as well. While this much was already known at the State and Territory level from the PES, our analysis goes further by establishing a detailed geography of the problem. Thus, a second achievement is that of establishing a statistical relationship between change in usual residence counts and net migration, since this provides a means by which we can now classify IAs according to the probable reliability of their change in census counts. With this device we can search for regularities and reflect on what we can say with confidence about the changing structure of Indigenous population distribution.

The methodology for this classification is built on the discrepancy established between the actual change in census counts observed in each IA subtracted from the expected change based on the relationship presented in Fig. 3. These discrepancies can be either negative (undercount) or positive ('overcount'). They can also vary by degree. In order to identify extreme cases we isolate results that are greater than one standard deviation from the mean (zero). Thus, IAs with a discrepancy between expected change in counts and observed outcomes of greater than 25 per cent are highlighted.

Of particular note here are those IAs with negative values since these are locations where the census count in 2006 is considered to be deficient and, in effect, unreliable for policy analysis without some upward adjustment. As for IAs with positive values, these may simply reflect an improved count in 2006 compared to 2001, but in many cases it may also imply change in census coverage. Either way, the cause is of less interest than the effect, which is to enhance population increase beyond the level expected. In such areas, we have no option but to accept the 2006 count as a new true level.

Figure 4 shows the spatial distribution of negative and positive discrepancies with extreme negative cases highlighted. The resulting pattern is very striking and it is worth interpreting this map in conjunction with Figure 1, which shows the pattern of recorded change in population counts. Thus, while Figure 1 indicates that a decline in Indigenous population counts was widespread throughout almost the entire western half of the continent, Figure 4 suggests that this coincided with equally widespread undercounting in 2006.

Extreme cases of undercounting involving 35 IAs are heavily concentrated in Western Australia, mostly in remote parts of the State but also in some regional areas. Elsewhere, the Anangu Pitjantjatjara Lands stand out, as do Maningrida outstations, Nhulunbuy and associated outstations, and the Coomalie/Belyuen/Cox Peninsula/Cox-Finniss area west of Darwin. In Queensland, the Cloncurry and Burdekin IAs are prominent, with Swan Hill in Victoria providing the only example in the south-east.

It should be noted that some IAs that also have large negative discrepancies do not show up well in Figure 4 because of their small physical area. These include several in Western Australia such as the remote towns of Wyndham, Halls Creek, Port Hedland, and Warmun, as well as smaller Indigenous localities including

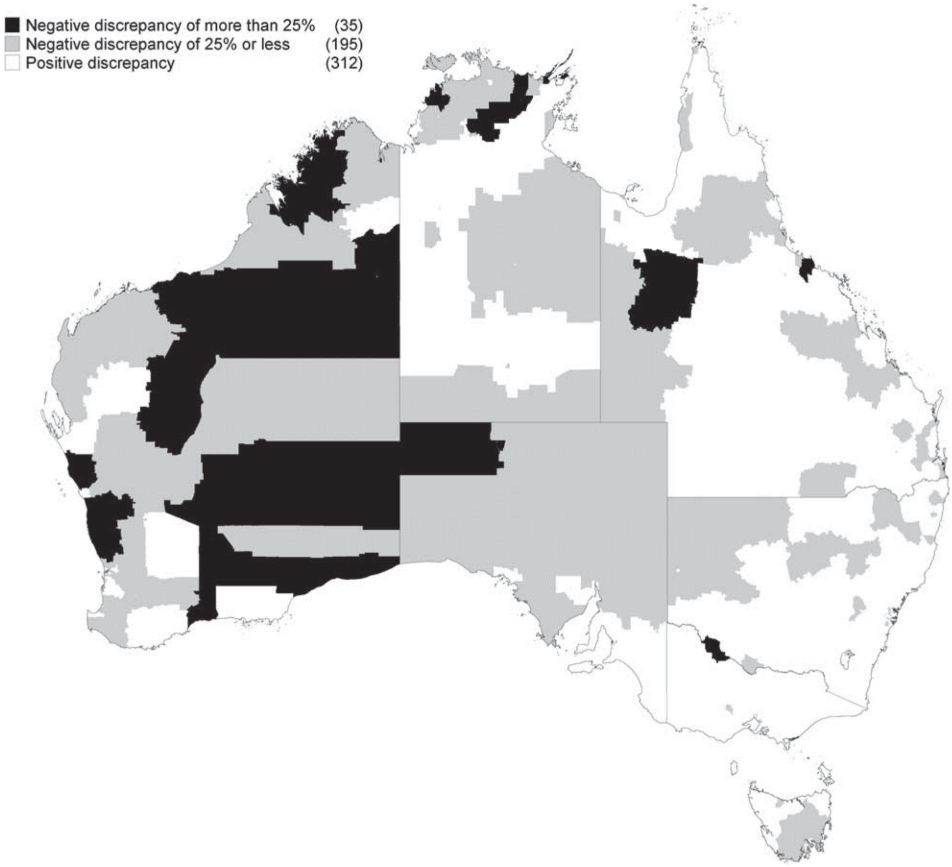

FIGURE 4. Distribution of 2006 Census undercount and 'overcount' by Indigenous Area.

Bardi, Beagle Bay, Oombulgurri, Mulan, and Mindibungu. In Queensland it includes the Cape York communities of Wujal Wujal and New Mapoon, while Ali Curung in the Northern Territory should also be added. In addition, there are a few IAs that encompass city suburbs including two in Darwin (Darwin/Inner Suburbs and Marrara/Winnellie/Berrimah), two in Perth (Perth/Vincent and Victoria Park), and one in Cairns (Cairns—City).

As for overcount, this is spatially concentrated in eastern Australia across 312 IAs mostly in southern Queensland, the eastern half of New South Wales and most of Victoria. This is found in all metropolitan areas, and in both large and small regional towns. Some overcount also occurs in remote areas of the Northern Territory and in Cape York Peninsula but here is it likely to reflect variable quality in enumeration from one census (2001) to the next (2006), an outcome noted by Sanders (2007), for example, in relation to Alice Springs town camps.

Locations of population change

Population geographers in Australia and other OECD countries have long argued that the use of administrative units for the spatial analysis of census data is sub-optimal in representing meaningful social and economic settings (Coombes & Raybould 2001; Hugo 2007). The point has also been made that for policy-related research it is important to use spatial units that are relevant to the particular issue (and population) under investigation (Hugo 2007, p. 336). Sophisticated attempts to achieve this in Australia have included proposed redesigns of the ABS Australian Standard Geographical Classification (ASGC) to allow greater discrimination of areas below the level of administrative units (ABS 2007a; Hugo 2007, pp. 343–6) as well as the idea of 'social catchments', defined as 'the territory occupied by a group of households and individuals who are in some form of regular interaction and which the inhabitants identify as "their" community or region' (Hugo 2007, p. 337).

This latter idea is interesting in the context of Indigenous affairs policy because just such an attempt was made by the Commonwealth government in the late 1980s in deciding on the original 60 Regional Council boundaries of the Aboriginal and Torres Strait Islander Commission (ATSIC). These sought to provide a reasonable representation of Indigenous population distribution and followed extensive consultations with Indigenous groups regarding spatial commonalities of cultural, social and economic factors in relation to specific areas (Commonwealth of Australia 1993, p. 3). With some manipulation to match the ASGC, these original boundaries have underpinned the subsequent evolution of the AIGC which has also attempted to incorporate sensitivity to social catchments, for example by configuring boundaries to allow the identification of outstation groups associated with particular towns or by isolating town camps and populations in towns with relatively large Indigenous populations (Taylor 1992, 1993; ABS 2007b, pp. 72–5). In effect, there is an attempt in ABS statistical geography to reflect the spatial constructs that have informed the delivery of Indigenous policy since the 1970s with different needs and opportunities identified by policy makers for Indigenous populations in major cities, regional centres, remote towns, town camps, Indigenous towns and dispersed outstations (Taylor 2006).

While this typology of place provides for more meaningful assessment of the range of circumstances facing Indigenous populations, in order to be activated for analytical purposes it requires construction from components of small area census geography. As for population change in such locations we can now assess the quality of data by allocating IA discrepancy measures to each of these categories. This is not as straightforward as it might seem, because IA populations may be distributed across more than one locational category. However, we can use Indigenous population counts from the ABS Urban Centres and Rural Localities (UCL) classification to determine the category of residence that applies to the majority population in each IA. In many cases (e.g. in many city areas) this is not necessary, but it is deployed for determining the classification of IA populations elsewhere. On this basis we identify seven locational categories that coincide with place-based COAG Indigenous reform initiatives (COAG 2009) (see Table 2).

Comparison of 2001 and 2006 census Indigenous counts for these categories suggests that the Indigenous population in remote dispersed settlements (mostly incorporating outstation populations) decreased by –4.5 per cent, while growth in remote towns was very modest (see Table 3). Significantly, rates of growth in these two locational categories were well below the underlying rate of natural increase of around 2.0 per cent (ABS 2004) and more than half of the IAs (46 out of 80) experienced a population decline. Indigenous town and town camp populations

TABLE 2. Definitional criteria for Indigenous Area locational categories

IA locational category	Definition
City areas	IAs within urban centres of greater than 100,000 population
Large regional towns	IAs in regional Australia where the Indigenous population is predominantly resident in urban centres of between 10,000 and 100,000
Balance of regional areas	IAs in regional Australia where the Indigenous population is predominantly resident in urban centres of less than 10,000, in rural localities or in rural balance
Remote towns	IAs in remote Australia where the Indigenous population is predominantly resident in urban centres that have predominantly non-Indigenous populations
Indigenous towns	IAs in remote Australia where the Indigenous population is predominantly resident in urban centres and localities that have predominantly Indigenous populations
Town camps	IAs that are made up of non-contiguous town camp localities in particular remote towns
Remote dispersed settlements	IAs in remote Australia where the Indigenous population is predominantly resident in the balance of small dispersed settlements

increased at somewhat higher rates but they were still below the national Indigenous average. In contrast, city areas as well as towns and localities in regional Australia generally recorded population increases that were well above national average growth and up to three times higher than the overall rate of natural increase.

However, if we consider these outcomes in light of our predictive model of population change we find considerable reason to be cautious about some of the conclusions, at least in terms of the strength of the trends observed (see Table 4). The first column of results gives the percentage of IAs with an estimated undercount, whereas the second column gives the percentage of IAs with a large undercount (or one with a 25 per cent discrepancy or more).

IAs classified as remote towns, town camps and remote dispersed settlements were the most prone to undercounting in 2006, with high proportions of these reporting negative discrepancies. Many of the remote towns implicated here were in Western Australia, and included Port Hedland, Wyndham, Halls Creek, Fitzroy Crossing, Derby, Broome, Kalgoorlie, Coolgardie, and Leonora, while elsewhere Mt. Isa, Coober Pedy and Alice Springs were also notable. In contrast, regional towns and localities in regional Australia were more likely to have experienced an overcount in 2006. Prominent examples of this were Mackay, Tamworth, Taree and Coffs Harbour, where Indigenous population growth was between one-third and two-thirds higher than expected on the basis of net migration. The remaining two locational types, namely city suburbs and Indigenous towns, provide an interesting comparison. Close to half the IAs in these two locational types were estimated to have an undercount. However, whereas 12.7 per cent of IAs in Indigenous towns had a large undercount, there was only one city area that fit that definition.

On the basis of these collective observations we are now in a position to make two general statements in regard to the place-based structure of Indigenous population change. Firstly, we cannot be confident about the size and direction of intercensal

TABLE 3. Change in Indigenous census usual residence counts by locational category of Indigenous Areas, 2001–2006

IA locational category[1]	2001 count	2006 count	Change (%)	No of IAs with population increase	No. of IAs with population decline
City areas	133,963	154,674	15.5	117	24
Large regional towns	89,615	106,762	19.1	89	5
Balance of regional areas	76,111	86,892	14.2	110	24
Remote towns	31,538	31,920	1.2	18	18
Indigenous towns	47,135	50,655	7.5	55	24
Town camps	1,912	2,086	9.1	2	1
Remote dispersed settlements	21,386	20,423	−4.5	16	28
All Indigenous Areas	401,660	453,412	12.9	407	124

Note: Counts for IA locational categories exclude usual residence inadequately described, usual residence not stated and offshore IAs. As a consequence, columns do not sum. It should be noted that this was more of an issue in 2001 and hence population increases by category are likely to be overstated. In 2006 the ABS Data Processing Centre had a much improved national place name data base specifically for Indigenous communities which would have assisted in improving the allocation of usual place of residence in uncertain cases (Morphy 2007a: 105).

TABLE 4. Estimated census undercount and 'overcount' by IA locational type.

A locational category[a]	Number of IAs	% of IAs with estimated undercount	% of IAs with large estimated undercount (25% or more)	% of IAs with large estimated overcount (25% or more)
City areas	141	43.3	0.7	3.5
Large regional towns	94	34.0	3.2	9.6
Balance of regional areas	156	33.9	2.2	6.0
Remote towns	36	58.3	13.9	8.3
Indigenous towns	79	49.4	12.7	3.8
Town camps	3	66.7	0.0	0.0
Remote dispersed settlements	44	68.2	29.5	6.8
All Indigenous Areas	531	43.3	6.6	5.8

a. Excludes usual residence not stated

change in Indigenous population counts in many Indigenous towns, remote towns and remote dispersed settlements, except to say that the majority of IAs in such locations are statistically likely to have recorded a substantial undercount in 2006. Our modelling suggests that the modest overall increase in population counts recorded for the categories of Indigenous towns, remote towns and remote dispersed settlements should have been higher in 2006, with up to two-thirds of IAs associated with these sorts of locations recording substantially lower counts in 2006 than expected on the basis of net migration. In order to make sense of intercensal population change in these sorts of locations it is necessary to adjust 2001 and 2006 population counts for the relevant IAs by using estimates of resident population for associated SLAs on a pro rata basis.

Secondly, we are confident that the population levels reported in 2006 for the vast majority of city suburbs, as well as the many towns, localities, and rural areas of regional Australia (where most of the Indigenous population resides) represent a real increase in levels. However, many of the rates of population increase implied for these locations are substantially higher than demographic processes alone can account for. Accordingly, any attempt to measure changes in population levels for these places should be based on a reverse survival to 2001 of the relevant 2006 SLA population estimates along the lines developed by Taylor and Bell (1998), with 2001 populations adjusted pro rata.

Key findings and related issues

The significance of spatial context in influencing demographic, social and economic processes is increasingly recognised in social policy (Hugo 2007, p. 350). Put simply, where people live has important implications for outcomes and therefore needs. For Indigenous population analysis this basic metric is substantially compromised by the volatility of census counts at small area level due to a combination of poor enumeration and social construction of Indigenous identity amongst often highly mobile populations (Morphy 2007b; Prout 2009). Identifying where Indigenous people live and how this changes over time is made difficult by poor census enumeration, and because most Australian data sources for the analysis of population characteristics have tended to be structured around administrative units. The challenge for applied policy research is to manipulate existing data in such a way as to situate populations according to their appropriate milieu. As a first step towards achieving this we have established a preliminary classification of locations with a view to assessing the utility of census counts for policy analysis. From this exercise, we are able to draw several conclusions that have consequences for data users and for further analysis.

In many parts of Australia, notably in Western Australia and in many remote towns, Indigenous towns, and remote dispersed settlements, undercounting of the Indigenous population in 2006 has reduced the census to the role of a large sample survey, with the key output being population rates rather than population levels. Rates established net of non-response (on the assumption that the latter are evenly distributed for each population characteristic) can then be applied to population estimates to establish 'true' levels for key social indicators of policy interest, such as labour force status or housing occupancy.

The converse of this situation of partial counting is common in most regional towns and city suburbs. Here, rapidly expanding Indigenous populations appear to be captured incrementally by each successive census, and the trend is one of continued growth beyond expectation based on demographic components of change. Whatever the cause of this growing census capture, it is a fact that the potential pool of self-identified Indigenous population in major cities and country areas is continually expanding, not least due to increasing births of Indigenous children to non-Indigenous women. In the previous intercensal period (1996–2001) such births were estimated at 27 per cent of all Indigenous births nationally and up to 40 per cent or higher in many parts of south-eastern Australia (Kinfu & Taylor 2005). This is in line with predicted outcomes calculated by Gray (1998) and the effect is to constantly augment the base of the Indigenous age structure in areas of high inter-marriage (such as urban and regional Australia) leading to high and sustained population momentum. Reflecting this demographic effect, recent projections of the Indigenous population reveal that future growth will be highest in metropolitan areas (Biddle & Taylor 2009; ABS 2009).

The geography of the 2006 census Indigenous count and its broad spatial polarity of 'undercount' and 'overcount' is highly instructive from a policy perspective. It points to a need to reassess the nature of population bases used as input in determining the quantum of fiscal resourcing for Indigenous policies and programs. This reassessment should consider implications for both the historic adequacy of population-based funding and programs and for future demand for these.

Firstly, there is the issue of historic adequacy. While the extension of the PES sample to include remote Indigenous communities for the first time in 2006 has finally uncovered the 'true' extent of undercounting, the revelation of very high rates in Western Australia, the Northern Territory, and to a lesser extent in Queensland leaves a substantial question lingering in relation to historic levels of funding for remote Indigenous communities and the means by which these have been established to date. Put simply, if we now know that thousands of Indigenous people are not enumerated, and that they are unlikely to have been adequately accounted for in previous post-censal estimates, then can we conclude that fiscal settings based on such estimates have been commensurately undervalued over the past 35 years?

If we can, then does this imply that services and programs provided to remote communities on the basis of official population estimates have been chronically inadequate? Is this one of the reasons why we encounter chronic infrastructure backlogs in many remote communities (Ah Kit 2004) as well as a manifest mismatch between settlement size and basic service provision (Taylor & Stanley 2005; Taylor 2010)? More broadly, at the jurisdictional level, what does this imply for the strength of disability weightings due to remote Indigenous population shares that have historically been applied by the Commonwealth Grants Commission in estimating fiscal redistributions?

While our findings relate to the adequacy of change in recent census counts, they nonetheless show that this is understated in particular types of locations. This reinforces the view that through time the operation of federal–State financial arrangements has long been possessed of a structural bias against remote regions and Indigenous communities (Dillon & Westbury 2007, pp. 185–9). The sheer scale of what is now revealed about Indigenous undercount could trigger an argument regarding a possible case for some form of restitution via future Grants Commission adjustments. However, even if such a case were to be accepted, under current arrangements the Grants Commission does not take into account capital shortfalls, and there are no guarantees in any case that such adjustment monies would be expended in remote locations (Dillon & Westbury 2007, p. 186).

As for the issue of future demand, it is now almost predictable that Indigenous populations counted in many regional towns and major city locations will tend to be higher than expected at future census rounds. This is the sense of 'overcount' that we have attributed to rising census capture of a self-identified population. Previous research has shown that despite the contribution of non-demographic factors to the large increase in Indigenous census counts over the past 35 years, this has not been reflected in a commensurate compositional shift in the population, with many social indicators remaining relatively stable over time (Altman *et al.* 2008; Hunter 2004). To the extent that this lack of relationship might continue, it seems reasonable to expect that future levels of census-identified needs will be inflated accordingly, leading to a constant sense of catch-up. What our modelling reveals is the structural geography of this potential problem with an indication that many regional towns in particular are likely to face escalating needs. One way to anticipate this situation, rather than react to it after the event, might be through the judicious development of customised population projections.

On a final note, while adjustments to census counts via the PES and other means can restore population estimates to more reasonable levels, there remain the problems of high standard errors around estimates and limited information on the characteristics of persons missed. To this extent the PES provides only a partial solution to census analytical difficulties. This is especially the case in remote areas where there is an urgent need for an improvement in the census counts themselves. Available research would suggest (Morphy 2007a) that this requires changed field procedures and more extensive and ongoing community engagement.

Acknowledgements

This research was funded by the Ministerial Council for Aboriginal and Torres Strait Islander Affairs.

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