

## Changing Sex Ratios in New Zealand: Real Change or a Statistical Problem?

PAUL CALLISTER\*  
ROBERT DIDHAM†  
RICHARD BEDFORD‡

### Abstract

In New Zealand, in all age groups under 20, and in key working age groups, historically there have been more men than women. Life table data suggest that, without migration, the number of males should remain greater than the number of females until around the age of 60 years. However, census data indicate that the number of New Zealand women residents relative to men in the broad 20-49 age group has been increasing since the 1980s. Given that birth ratios for New Zealand residents favour boys in common with international experience, the imbalance of women over men in the 20-49 age group has to come from four possible sources: 1) differential mortality; 2) more New Zealand born men leaving New Zealand; 3) a higher number of female immigrants; or 4) that statistical collections are undercounting men, and this undercounting has become progressively greater over the past 20 years. In this paper we focus on undercount and, through this investigation, raise some doubts about the validity of either a serious 'man drought' or a major 'surplus of women' in the population.

Historically in New Zealand there have been more men than women in all age groups under 20. This reflects a naturally occurring ratio by which the number of boys born is higher relative to girls. Aside from WWI, the 1918 influenza pandemic, and World War II, there have been more men than women in the prime working and couple-forming age groups (20-49) in official data collected up to the 1980s. However, census data from the early 1980s show that among prime working-age groups this ratio has reversed, with an apparent increasing imbalance

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\* Institute of Policy Studies, Victoria University of Wellington: Email: [paul.callister@vuw.ac.nz](mailto:paul.callister@vuw.ac.nz).

† Robert Didham, Statistics New Zealand. Email: [robert.didham@stats.govt.nz](mailto:robert.didham@stats.govt.nz).

‡ Richard Bedford, Population Studies Centre, University of Waikato. Email: [rdb@waikato.ac.nz](mailto:rdb@waikato.ac.nz).

between the numbers of women and men in the age group 20–49 years (Callister, Bedford and Didham 2005). Based on these data, New Zealand appears to stand out amongst industrialised countries in terms of the size and direction of this imbalance.

While changes in New Zealand's census-based sex ratios have been discussed informally by demographers, this growing imbalance between men and women in the primary working ages was not recognised by the wider community. In addition, little attention had been given to the reasons why the ratio between men and women at these ages had been changing. However, during 2005 the imbalance was widely reported in the media in New Zealand and overseas, in part through early attention given to some of our own initial research findings and when Australian demographer Bernard Salt declared there was “man drought” in New Zealand and, to a lesser degree, in Australia (Collins 2005, Laugesen and Courtney 2005; Leys 2005; Salt 2005).

In common with international experience, birth ratios for New Zealand residents favour boys and this imbalance in favour of males in the population tends to persist through the age groups until the sixties. Explaining census-based ratios favouring women over men in the 20–49 age group therefore requires consideration of the following: 1) differential mortality; 2) emigration from New Zealand of more men than women; 3) a higher number of female immigrants; or 4) a trend towards larger undercounts of men in censuses and other key statistical series.

In this paper, we focus mainly on the latter issue of a gender-biased undercount in the official statistics. However, before investigating the presence and effect of such an undercount, we summarise our findings on other possible explanations for changing sex ratios. In the discussions of mortality and international migration and their impacts on sex ratios, we use a ratio of women to men.

### **Possible Drivers of Changes in Sex Ratios**

Our initial investigations considered Permanent and Long Term (PLT) migration flows and mortality trends. In terms of mortality, using life tables prepared by Statistics New Zealand for 1970–72, 1980–82, 1990–92 and 2000–2002 we found that sex differences in mortality cannot be completely discounted in explanations for the increasing surplus of women over men in the age group 20–49 years (Callister, Bedford and Didham 2005). This initial

investigation suggested that differential mortality had been contributing in a small way to the growing disparity in numbers of males and females aged 20-29 years especially between the early 1980s and the early 2000s. This can be linked in part to variations in death rates due to motor accidents.

When our research project commenced outward migration seemed potentially to offer the best explanation as to where New Zealand's "missing men" were. We are also aware that data on the characteristics of migration flows are subject to cumulative sample errors over time in a way that limits firm conclusions on changes in sex ratios due to migration.

In an article that was widely reported in the New Zealand media, Salt (2005:1) suggested:

We Australians can't help it if more than 300,000 of your countrymen preferred living in Australia at the time of the 2001 census up from 90,000 in 1976. We didn't entice them; they came of their own volition. Perhaps they were spellbound by our magnetic personality.

Salt suggested that more men than women were migrating to Australia and, based on Australian census data, noted:

During the 1990s Australia too began tithing its 30-something men in particular to other, bigger, economies. This brawn-and-brain drain is leaving Australia with more women than men in the 30- and 40-something age group (p.2).

Certainly our study did confirm that out migration of men rather than feminisation of immigration contributes more to the widening gender imbalance. But with regards to outward migration, given that Australia is the main country of residence for expatriate New Zealanders, we expected to see evidence of there being more New Zealand men than women aged 20-49 in Australia (the mirror image of New Zealand sex ratios). However, the data on the New Zealand-born population living in Australia at the time of the 2001 census there did not show this. Sex ratios amongst the New Zealand-born population resident in Australia in 2001 were remarkably even (Callister, Bedford and Didham 2006).

In the United Kingdom, the second most important destination for expatriate New Zealanders, census data for 2000 did not provide the answer as to the location of the "missing men" – indeed there were more women than men who had been born in New Zealand living in the UK according to census data (Callister, Bedford and Didham 2006). In addition, when we looked for Australia's "missing men" in the UK, the main overseas

destination for Australians, we did not find an excess of men in the key age groups we are interested in. In fact, we found the opposite. This of course, assumes that there is not a greater undercount of New Zealand men than women in the Australian census, or a greater undercount of New Zealand and Australian men in the UK census. It may also be that some of the “missing men” are in other locations throughout the world.

We also initially assumed that much of the change brought about by migration would be due to New Zealand citizens leaving and potentially not coming back to New Zealand or, at least, staying away for a long period. However, while the movement of New Zealand citizens appears to be very important, the actual flows are complex. There is evidence of two contradictory trends contributing to the widening gap in numbers of males and females aged between 20 and 49 years. In the early 1990s, a small surplus of women in the overall net gains between 1991 and 1996 augmented a little the growing female surplus in the resident population. In the late 1990s, net migration losses rather than net gains were found for the population aged 20-49 years, and a significantly greater net loss of males contributed to the growing male deficit in the resident population between 1996 and 2001 (Callister, Bedford and Didham 2006).

While both migration and census data indicate that sex ratios in favour of women are the highest amongst the Asian group, Asians are still a relatively small part of the overall New Zealand population. Therefore, while an inflow of Asian women in excess of Asian men is an important new trend, the reasons for changes in overall sex ratios in New Zealand need to primarily consider what is taking place with the much larger European group, as well as within Maori, Pacific Peoples and the group “Other”. It is therefore, incorrect to characterise these inflows of Asian women as “women flocking” to New Zealand (Collins 2005).

It is difficult to know what drives overall migration flows and in particular, the movement in and out of New Zealand of New Zealand citizens. However, it is our view that the available migration research does not lend strong support to the idea that it was the recession of the late 1980s/early 1990s that directly drove offshore, large numbers of New Zealand men. Yet it is possible that income-earning differentials, particularly in relation to Australia, and which were exacerbated by the recession, were increasingly prompting New Zealanders to seek opportunities overseas.

It is especially difficult to find explanations as to what could be driving “gendered” migration flows, particularly into New Zealand. Historically migrant flows to countries such as New Zealand, Australia, the US and Canada have been dominated by males, so immigrant communities have often been characterized by uneven sex ratios. A change from predominantly male flows to larger international flows of women could reflect, amongst other things, changes in industrial demand. For example in some high income countries there is increasing demand for service workers, including low skilled care workers. It is mainly women who fill these jobs and sources of such workers include the Philippines and Thailand. In line with this thesis (and also the thesis that New Zealand men are marrying Asian brides), the ratio of overseas born women to men from these countries in New Zealand strongly favours women.

As in other industrialised countries, sex ratios in New Zealand are particularly extreme amongst those with tertiary qualifications. Much of this reflects unequal growth in participation in tertiary education, with women greatly outnumbering men in all age groups. However, migration may also be exacerbating this trend. Previous New Zealand research, and international studies, suggest the “best and brightest” are over-represented in the migration flows (Smith 1997; Carrington and Detragiache 1998). But we also know that there is a “brain exchange” rather than a “brain drain” taking place in New Zealand (Glass and Choy 2001). Census data indicate that the ratio of well-educated women to men is more extreme amongst those New Zealand residents born overseas than for those born in New Zealand. This may indicate that there is some gender component to this “swap” as well; we may, to some degree, be “swapping” well-educated New Zealand males for well-educated female immigrants.

All these areas need further investigation. It is also very important to assess whether one of our key data source for such investigations, the five yearly New Zealand Census of Population and Dwellings, is accurately counting the number of women and men in New Zealand. The issue of potential undercounting of males in the New Zealand census is examined in the next section.

### **Undercounts in the New Zealand Census**

Census data indicate that since the early 1980s for prime working and childbearing age groups, the number of women relative to men in New

Zealand has been increasing. Table 1 shows the ratio of women to men. In terms of actual numbers, census data show that in 1986 there were just over 700 more men than women in the 20-49 age group. This had reversed in the 1991 census, with 13,000 more women than men. This excess of women rose to over 35,000 in 1996 and to just over 53,000 in 2001.

**Table 1: Ratio of women to men in the 20-49 age groups, 1966-2001**

	1966	1971	1976	1981	1986	1991	1996	2001
20-24	0.96	0.97	0.97	0.96	0.98	0.99	1.02	1.02
25-29	0.97	0.98	0.98	1.01	1.01	1.05	1.06	1.09
30-34	0.95	0.98	0.98	1.00	1.02	1.04	1.06	1.11
35-39	0.93	0.96	0.97	1.00	1.00	1.02	1.05	1.08
40-44	0.97	0.94	0.96	0.99	0.99	1.01	1.03	1.06
45-49	1.02	0.97	0.94	0.96	0.99	0.99	1.01	1.04

Source: Analysis completed by authors using New Zealand census data from 1996 to 2001.

Yet, it is known that there are some problems with census data. In a study focusing primarily on South African sex ratios, Phillips *et al.* (2003) note that in virtually every country in the world, implausibly high ratios of women to men can be found in the younger working ages. They suggest that geographically mobile young men of those ages are undercounted relative to women of the same age.

Statistics New Zealand has carried out post enumeration surveys (PESs) following the 1996 and 2001 censuses. These surveys indicate that the undercount increased between 1996 and 2001, and separate unpublished Statistics New Zealand studies of census errors-of-closure show that undercount have been increasingly a problem since at least 1945. They also show that men are undercounted more than women, that people in their late teens/early twenties have the highest level of undercount and, in part, connected with age structures of their populations, Maori and Pacific Peoples have higher undercount levels.

Overall, the 1996 PES indicated an undercount of 60,000 people whereas the 2001 study indicated this had increased to 85,000. However, given that these were small surveys with relatively high sampling errors, these figures should be regarded as indicative only. The requirement for

independence between census and the PES – where people are randomly missed by census or the PES – may not always be met and can therefore contribute to non-sampling error. Lack of independence can occur when a person missed in the census is more likely to be missed in the PES, for example if they are deliberately avoiding contact with government agencies. As a result, the PES estimates of under coverage are likely to be lower than the true undercount.

**Table 2: Undercounts in recent New Zealand censuses (percentage undercount)**

Groups	1996	Sample Error	2001	Sample Error
Total	1.6	0.2	2.2	0.4
Male	1.9	0.3	2.6	0.4
Female	1.3	0.2	1.9	0.3
0-14	1.7	0.4	2.7	0.5
15-29	2.5	0.5	3.1	0.6
30-44	1.5	0.3	2.3	0.5
45+	1.0	0.3	1.4	0.3
Maori	3.7	0.7	4.4	1.0
Pacific Peoples	3.9	1.1	5.2	1.6
Asian	-		2.4	0.8
European	1.3	0.2	1.7	0.3

Source: PES Survey, <http://www.stats.govt.nz/analytical-reports/post-enumeration-survey-2001/default.htm>

Statistics New Zealand also produces population estimates twice a year. The estimated resident populations (ERP) are obtained by updating the census usually resident population count at the census (held in March) for births, deaths and net migration of residents during the period of the latest census to the date of the estimate. The base population is also adjusted for the number of residents *estimated* to be undercounted by the census, as measured by the post-enumeration surveys, and for the *estimated* number of New Zealand residents temporarily overseas. Table 3 uses December, and then June (for 2005) population estimates whereas the census is undertaken in March.

Table 3 compares 2001 Census sex ratios and June 2001 estimated resident population ratios and has the ratios for 2004 and 2005. The excess

number of women in each age group for the census in 2001, the ERP in June ERP data for 2004 and 2005 are also shown.

Comparing the two sources for 2001 data, in the 20-24 age group the census significantly undercounts men, with an apparent small excess of women turning into a significant excess of men. In the other age groups, however, the differences are not that great. While the population estimates strongly reduce the “man drought” effect as a result of adjustments for undercount, residents temporarily overseas and natural increase between census date and the estimates date, there still remains an estimated 35,500 more women than men in the broad 20-49 age group.

**Table 3: Comparisons of sex ratios using census data and estimated resident population data**

	Ratio of women to men				“Excess” of women		
	Census	ERP June		ERP June	Census	ERP	
	2001	2001	2004	2005*	2001	2004	2005*
20-24	1.02	1.00	0.96	0.96	2,199	-5,930	-6,100
25-29	1.09	1.06	1.03	1.03	10,884	4,310	3,820
30-34	1.11	1.09	1.09	1.09	14,886	12,580	12,570
35-39	1.08	1.06	1.08	1.08	12,105	11,180	11,310
40-44	1.06	1.05	1.06	1.06	8,616	9,040	9,280
45-49	1.04	1.03	1.03	1.03	4,728	4,590	4,620
Total					53,418	35,770	35,500

Source: Census data and Estimated Resident Population data, Statistics New Zealand

\* Provisional

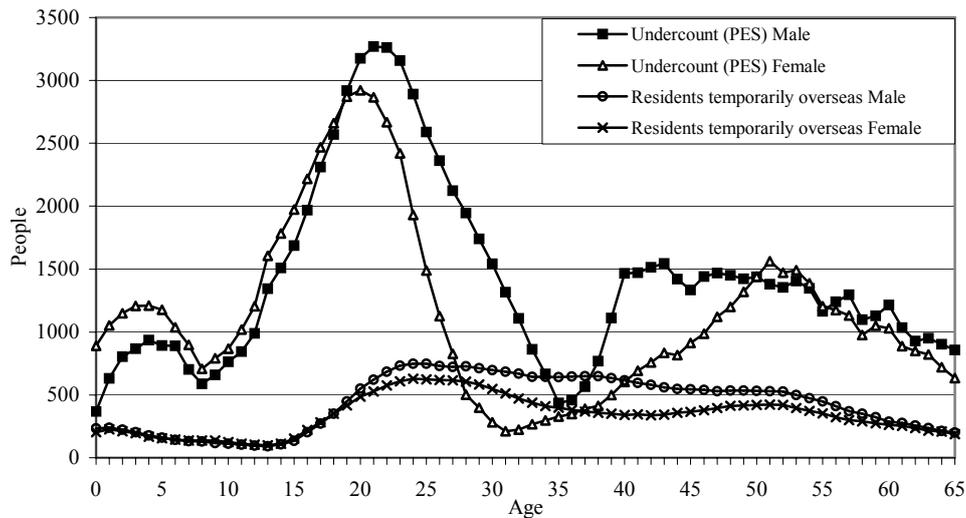
Our research raised many further questions, two important ones being 1) why is undercount getting worse, particularly for men, and 2) is the Post-enumeration Survey still under-reporting men relative to women?

Figure 1 shows an approximation of the age and sex profiles of the official net undercount in the census. As noted above, this must be premised on two key cautions – the data are based on a small sample and, second, the PES report splits the population into four broad age groups, so the single year of age distribution should be treated as purely illustrative of what we know about the age profile. The pattern for residents temporarily overseas is based on actual migration data. What is apparent is that males are

significantly more likely not to be enumerated for all ages from around 20 years to 50 years with relatively little difference between males and females at other ages.

A key consideration was whether migration contributed to the apparent "man drought". One way of approaching this issue is to consider what we might expect the sex ratio to be in the absence of migration. What would the sex ratio be if we were dealing with a closed population? Life table survivorship information provides a useful approach to investigating this possibility.

**Figure 1: Age and sex profile of undercount and residents temporarily overseas, 2001**



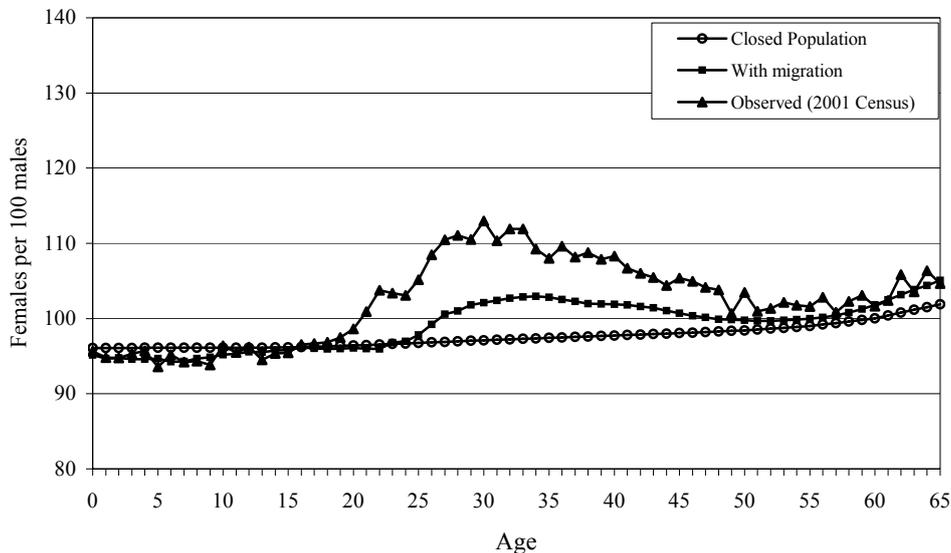
Source: Based on 2001 PES results, <http://www.stats.govt.nz/analytical-reports/post-enumeration-survey-2001/default.htm>

The sex ratio at birth is attenuated over time by differential mortality, so that by the age of around 60 years the sex ratio is around unity. This is then adjusted (Figure 2) for the effect of PLT migration and compared with the 2001 census enumerated population. Again we see that migration has some effect but the effect of differential under-enumeration in the census is significant. Also noteworthy is that while there appears to be a surplus of women among the younger adults, this surplus vanishes in the fifties.

To measure whether or not this has increasingly become a problem in census data, the enumerated population for each age and sex was compared

with the age of the group at the previous census for each census from 1901 to 2001. For each census up to 1976 the differences could easily be explained by historical events. From 1981 onwards the apparent gain of females is not so easily explained.

**Figure 2: Effect of migration and undercount on sex ratio**



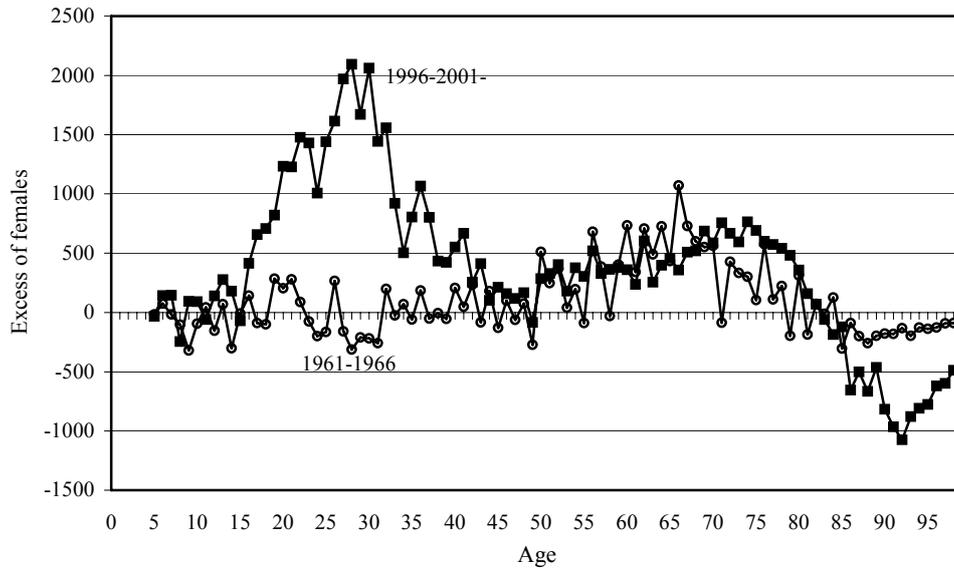
Source: Life tables, migration data and census 2001. Life tables can be found at: <http://www.stats.govt.nz/analytical-reports/nz-life-tables-2000-002/default.htm>

Figure 3 compares the 1961-1966 intercensal period with that for 1996-2001. For the age group we are interested in, 20-49 year, there was a gain of females in each individual age. This same pattern also occurred for each period from 1971 onwards and has increased at each census since 1981. The significance of this is that the change of sex ratio cannot be explained by population ageing and there is a temptation to consider that it is due only to migration since the net gain of females happens in the key migration ages. However, migration data alone cannot account for the magnitude of the female gain.

The net effect of this can be seen in Figure 4, which plots the sex ratios recorded in census data 1981-2001 relative to the 1981 census and adjusted for demographic components of change. Note that this graph plots males per 100 females in contrast to other graphs in this paper which plot females per

100 males. The 1981 data are problematic because of issues with undercount, but they provide a useful starting point for looking at the most recent period. Adding in births and deaths by date of occurrence (Sex Ratio BD) we see the expected gradual rise in sex ratio over time, in complete contrast to the census trend (Sex Ratio A). Even factoring in the effect of migration (both total net migration and net PLT migration) does not radically change the expectations.

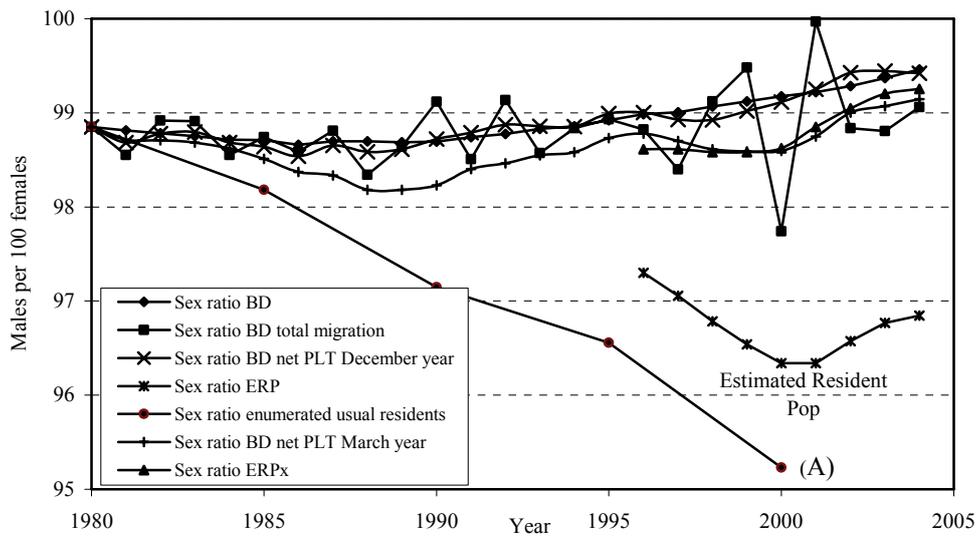
**Figure 3: Apparent intercensal gain of females 1961-1966 and 1996-2001**



Source: Censuses of Population and dwellings, 1961, 1966, 1996, 2001

The immediate consequence of this discovery leads to consideration of the sex ratio calculated from population estimates. Population estimates are heavily dependent on the census population counts. It was found that this sex ratio (Figure 4, Sex ratio ERP) was lower than we would have expected (sex ratio ERP<sub>x</sub>) based on components of change. Statistics New Zealand is currently addressing this issue as part of a review of population estimation methodology.

**Figure 4: Comparison of census sex ratios 1981-2001 with 1981 adjusted for births, deaths and PLT migration**



## Conclusion

This paper has reported on some findings from an exploratory inquiry into a phenomenon that has been present in the New Zealand census data for almost two decades, but which has recently become the subject of much discussion amongst researchers and the wider public. An evocative label, such as “man drought” or surplus is bound to stimulate public interest – climate metaphors are popular at a time of growing concern about global warming - and there is no doubt that the New Zealand media made a great deal of the growing disparity in numbers of men and women in the adult population when it was couched in such terms. However, the various pieces of information we have brought together have raised some doubt about the validity of a man drought or surplus of women of crisis proportions. The way this investigation unfolded demonstrates that while it is important to ensure that statistics attract the public’s interest, the information needs to be presented in a way that clarifies issues and informs debates. To this end we will be continuing our analysis of New Zealand’s migration and census data with a view to establishing why the sex ratios for the population aged between 20 and 49 years continue to widen.

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Disclaimer: The opinions expressed in this paper are those of the authors, and do not necessarily, nor are intended to, reflect those of the organisations to which the authors are affiliated.

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