New Zealand Population Review, 32(2):1-20.

Sub-Replacement Fertility, Delayed Parenthood and Regional Differentials in New Zealand

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Abstract

For most of the last 25 years, New Zealand fertility has been below the "replacement level" (2.1 births per woman), reflecting the impact of both the "quantum" and "tempo" elements of childbearing. The transition to sub-replacement level has however not resulted in complete homogeneity at sub-national levels. In 2000-02, fertility in at least 5 regional council areas was above 2.1 births per woman, and ranged between 1.6 and 2.0 births in another eight regions. While the median age at childbearing indicates a marked shift to delayed motherhood, there is greater regional diversity in reproductive patterns now, than was the case in the mid-1980s. Also, compared with the North Island, low fertility is more prevalent in the South, with 20 of the 25 South Island territorial authorities recording sub-replacement fertility in 2000-02. Given that a majority of these areas continue to experience net out-migration, this has direct implications for future growth prospects, population ageing, and social planning.

From the post WWII peak of 4.2 births per woman in 1961, New Zealand fertility fell below the "replacement level" (taken as 2.1 births per woman) in the late 1970s, and since then has varied within a narrow range (Statistics New Zealand 2006). The drop reflects the impact of both the "quantum" and "tempo" elements of childbearing (see Bengaarts and Feeney 2000; Department of Statistics 1986), which are also likely to be a key to our demographic future. Like their counterparts in other OECD countries, fewer New Zealand women are now having a child in their teens and twenties, and for the first time in our documented history, the age group 30-34 years has emerged as the most common one for

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childbearing. Nearly half of the babies born in 2005 had a mother aged in her thirties, compared with just 24 per cent a quarter of a century ago, when early marriage and early childbearing were the prevailing norm (Statistics New Zealand 2006). There is also a suggestion that a growing proportion of New Zealand women are forgoing childbearing altogether, although one must await the final data from the 2006 Census question on children ever born for more conclusive evidence.

Factors influencing these trends include changes in social values and attitudes, as well as demographic elements, such as the drop in marriage rate, the growth of de facto unions, increasing divorce rate, growing participation of women in tertiary education and in the paid work force, etc (Dharmalingham *et al* 2004; Frejka and Sardon 2004; Pool and Johnstone 1999). Additionally, advances in contraceptive technology, and access to reliable contraception, along with liberalization of abortion laws, have provided effective means for regulating fertility or restricting family size.

Notwithstanding these important developments, or the prospects of a further decline, fertility is likely to maintain its strong influence among the dynamics of population growth in the short-to-medium term, as well as its intrinsic link to various policy planning spheres, through its impact on structural changes and population ageing. While the national demographic experience is valuable for identifying policies required by the country to deal with problems arising from changing population dynamics and structures, at the regional/local level there is usually a complexity of experiences involved. These "require sensitivity on the part of policy makers and planners to the implications of emerging demographic change - for example, for labour shortages, for social services, for education and health services..., and for regional economies" (Eversley and Kollmann 1982). This also provides a strong impetus for a periodic assessment of emerging demographic trends, including ongoing shifts in reproductive behaviour, their dynamics and major determinants.

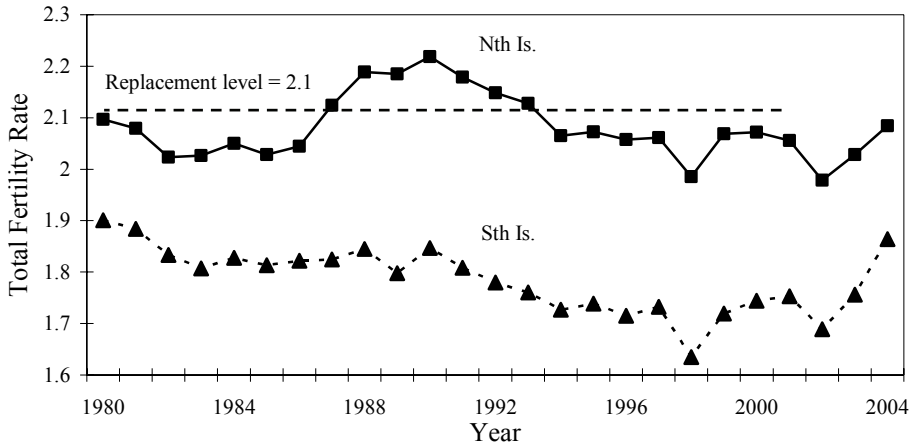
Focusing on the country's 16 designated regions and 74 territorial authorities (cities and districts), this study examines spatial variation in New Zealand fertility, over the period 1980-2002. The main questions it addresses are whether there are significant differences in fertility levels and patterns among these areas, and whether the transition to sub-replacement fertility settings has resulted in the convergence or homogeneity of sub-national experiences. The analysis uses two conventional demographic

measures viz. total fertility rate and the median age at childbearing. The total fertility rate (TFR) is the sum of age-specific fertility rates in a year (period), and gives the average number of births a woman would have during her life if she experienced the age-specific fertility rates of a given period (Shyrock and Siegel 1973). The median age at childbearing is a broad measure of the timing of childbearing, and was also estimated from the age-specific fertility rates (The median age indicates that half of all child bearers are younger, and half are older, than that age). Finally, using multiple regression analyses, an attempt is made to identify possible correlates of the observed fertility differentials (if any).

North Island vs South Island

As a first step, the fertility experience of the women in the North Island and South Island (country's two main islands) during 1980-2005 is compared in Figure 1. The two islands differ significantly in terms of their population size, growth rate and population structures. The North Island, which has historically grown at a much faster pace, is home to about 76 per cent of New Zealand's 4.14 million residents, and accounts for 80 per cent of all births in any year. The South Island's share of births is just 20 percent, which means its influence on national fertility is relatively minor.

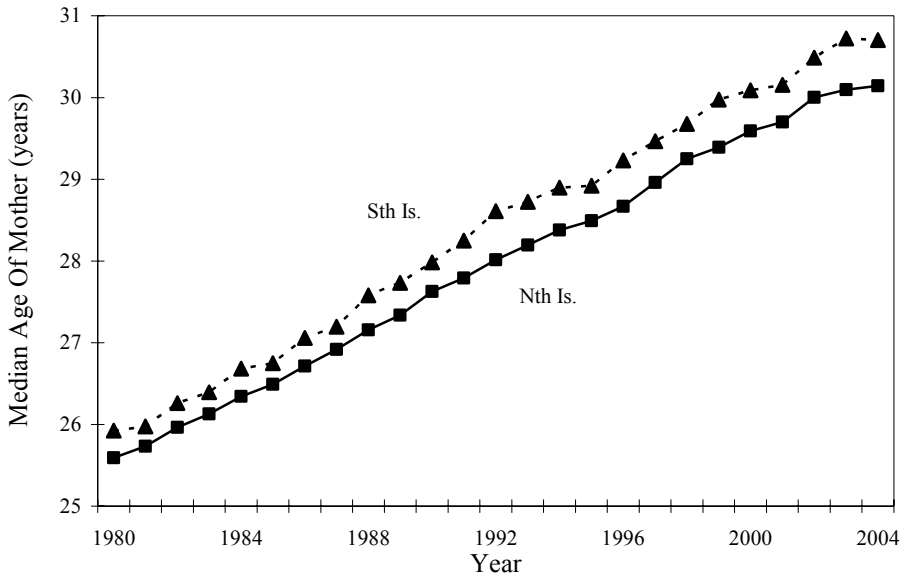
Figure 1: Total Fertility Rates, the North and South Island, 1980-2005



Over the past 25 years, below replacement fertility has been the general rule in both islands, with the South Island experiencing a record low rate of 1.64 births per woman in 1998. Notably, the brief recovery in New Zealand fertility during 1986 -1990 was primarily a North Island phenomenon: the South's rate altered little. Yet, both rates fell after 1990, and since then have moved more or less in tandem.

Overall, northern women have consistently outperformed their southern cousins. Periodic widening or narrowing aside, the gap in family size, as measured by TFR, has averaged about one-third of a child. That implies that for every 10 women, the northerners have had on average three extra children.

Figure 2: Median Age at Childbearing (years), The North and South Island, 1980-2005



Seeking an explanation about their possible correlates, one immediately notices how the trend lines for the median age at childbearing are placed relative to each other in Figure 2. The southern mothers are older -- on average by half a year, although the gap has widened in recent years. They delay their childbearing more than their northern sisters, and their rates of childbearing, especially at ages below 25 years are substantially lower. In 2004, for instance, the fertility rate for the South Island women below ages 20 years was just 19 per 1,000 -- about a third below the North Island figure

of 30 per 1,000. Differences in ethnic structures are probably a vital influence here. In 2001, the Maori and Pacific groups made up about one-quarter of the North Island population, compared with fewer than nine per cent in the South Island. Both these ethnic groups have much higher -- above replacement -- fertility than the non-Maori, non-Pacific group, and they commence their childbearing much earlier. The Maori fertility rate among women aged below 25 years is well over twice the Pakeha (European) rate. We also looked at other socio-demographic features, such as disparities in marriage patterns, in abortion rates, female participation in tertiary education and in the paid workforce, but the disparities in these variables are not significant enough to explain the observed North/South fertility differences.

Fertility and Regional Diversity

Next, we looked at New Zealand's 16 regional councils: nine of these are in the North Island and the remaining seven in the South Island. The regions vary in geographic area, population size, demographic structures, socioeconomic development, urbanization, and in terms of attractiveness to new immigrants (see Pool *et al* 2005; Statistics New Zealand 2005). According to the 2001 Census of Population and Dwellings, their resident population varied from less than 50,000 people in Gisborne, Tasman, Nelson, Marlborough and West Coast regions to roughly half a million in Canterbury and about 1.16 million in Auckland region, which houses the country's main commercial centre (Figure 3). Their growth dynamics also vary. During the intercensal period 1996-2001, at least six of these regions recorded a population fall, and a net migration outflow. The ratio of deaths to births ranged between less than 0.50 in Auckland, Waikato, Bay of Plenty Wellington and Gisborne to over 0.65 in the four South Island regions of Nelson, Marlborough, West Coast and Otago.

For fertility analysis, two separate time periods -- 1985-87 and 2000-2002 -- were selected, which are 15 years apart, and thus any major changes in the nature and magnitude of the inter-regional disparities in fertility can be discerned. In Figure 4, the total fertility rate is plotted on the X-axis and the median age at childbearing on the Y-axis. The North and South Island regions have been identified separately, with squares and cones, respectively. The indices for 1985-87 feature in the bottom half of the diagram, are lighter in colour, and suggest that by the mid-1980s, below

replacement fertility had spread to all corners of the South Island, except for the southern-most region of Southland, which had a fertility rate of 2.25 births per woman. In contrast, seven of the nine North Island regions supported fertility above the replacement level. The two exceptions were the highly urbanized regions of Auckland and Wellington, both with rates of 1.9 births per woman. Gisborne (on the east coast of the North Island) had the highest level -- two and a half births -- while Canterbury and Nelson had the lowest rate -- below 1.8 births per woman.

Figure 3: Usually Resident Population at 2001 Census, and Average Annual rate of Population Growth1996-2001 (per cent), Regional Councils, New Zealand

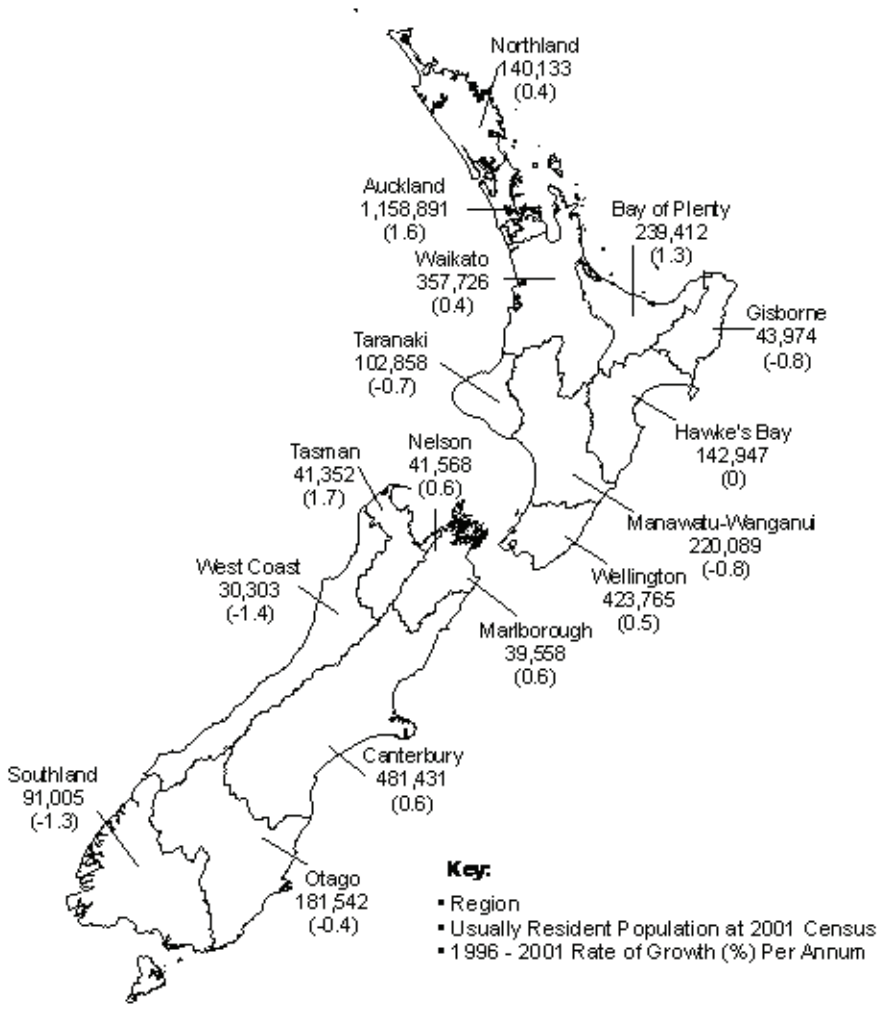
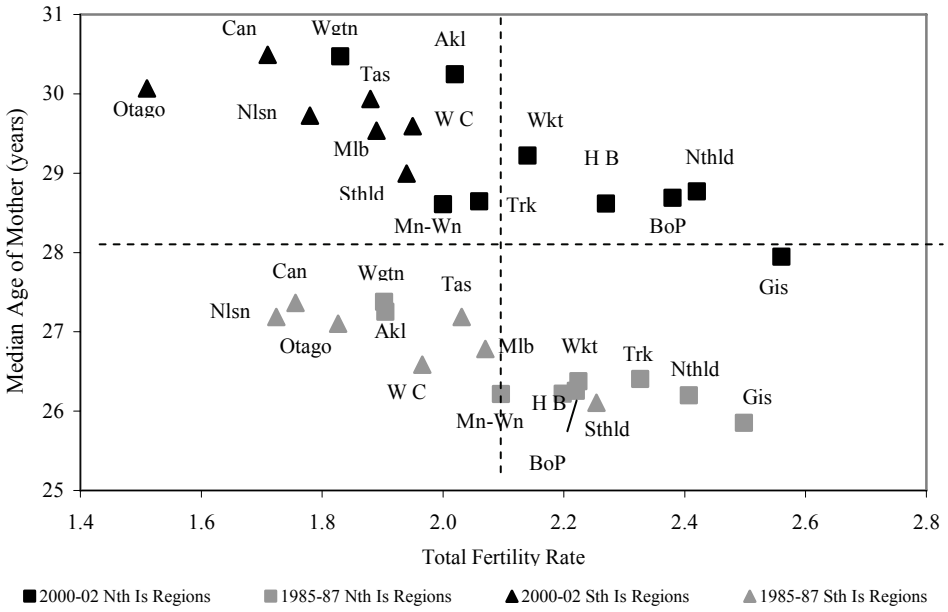


Figure 4: Total Fertility Rate, and Median age at Childbearing, Regional Councils, 1985-87 and 2000-02



Looking at the age pattern of childbearing in 1985-87 in the lower part of Figure 4, the squares (North Island regions) are placed mostly below the cones (South Island regions), which confirms our earlier observation that northern mothers are younger. Notable exceptions are the major urbanized regions, Auckland and Wellington, partly because of the concentration of career-oriented professional women there. In the mid-1980s, Canterbury mothers were the oldest (median age 27.4 years), and Gisborne mothers the youngest (25.8 years) -- a gap of one and a half years.

The indices for 2000-02 are plotted with darker colour in this chart and highlight the key changes over the 15-year period. In all, 10 out of 16 regions experienced a fertility decline during the 15 year period, and this is indicated by a shift towards left to lower TFRs. Gisborne, Bay of Plenty, Hawke's Bay, Auckland and Nelson bucked the general trend, but experienced only modest gains. The increase in fertility in Auckland probably helps explain the fact that, despite a general shift down, the national TFR remained largely unchanged during this interval. Significantly, during 2000-02, five of the nine North Island regions were still above the replacement level. They are all located in the northern North

Island, and carry a high percentage of Maori in their population (ranging between 21 and 46 per cent). Because of their population size, Auckland and Wellington were instrumental in dragging the North Island fertility to below replacement level in 2001. Overall, regional fertility experiences were more diverse in 2000-02 than fifteen years earlier. The spread, between the highest and the lowest rates, increased from three-quarter of a child to over one child per woman.

Also notable is the shift in the placement of regional dots from the lower part of the graph, to the upper half, indicating further consolidation of delayed motherhood. The median age at childbearing in Auckland, Wellington, Canterbury, West Coast and Otago increased by more than three years, compared with an increase of 2.3 years in Taranaki and Gisborne. The regional spread in median ages widened from 1.5 years in 1985-87 to 2.6 years in 2000-02. The broad conclusion thus is that the low fertility environment has not resulted in the homogeneity of regional fertility levels or patterns.

Finally, the North Islanders begin their childbearing at a younger age than their southern counterparts. But the 1996 Census data suggests that the southern women, despite having few children, and later in their reproductive life, have traditionally had more universal childbearing (i.e. lower levels of childlessness) (Statistics New Zealand, 1996 census of Population and Dwellings, unpublished data)

Territorial Authorities and Fertility

The next set of analysis relates to the administrative units, called territorial authorities: 49 of these are in the North Island, and are represented by squares in Figures 6a and 6b: lighter shades for 1985-87 and darker versions for 2000-2002. The 25 South Island TAs are plotted with cones - lighter colour cones for 1985-87 and the darker ones for 2000-02.

Looking at the 1985-87 experience in Figure 5a, TAs display a diversity of fertility experiences. Two clusters stand out. There is a cluster on the right, with TFR ranging between 2.4 and 2.6 births per woman. These are mostly smaller districts in the north, and include Whakatane, Kawerau, Far North, Taupo, Kaipara, Opotiki, Wairoa and Stratford. The second group clusters around the replacement level, and covers about 30 TAs, with nearly half of these being the South Island districts, but include Waitakere, Hamilton, Tauranga, Lower Hutt, Selwyn and Invercargill. On the extreme

left are seven cities -- North Shore, Auckland, Palmerston North, Wellington, Nelson, Christchurch and Dunedin - with a TFR below 1.8, but with delayed childbearing more advanced than among districts on the extreme right, which have median age at childbearing of only 25-26 years.

Figure 5a: Total Fertility Rate, and Median Age at Childbearing, Territorial Authorities, 1985-87

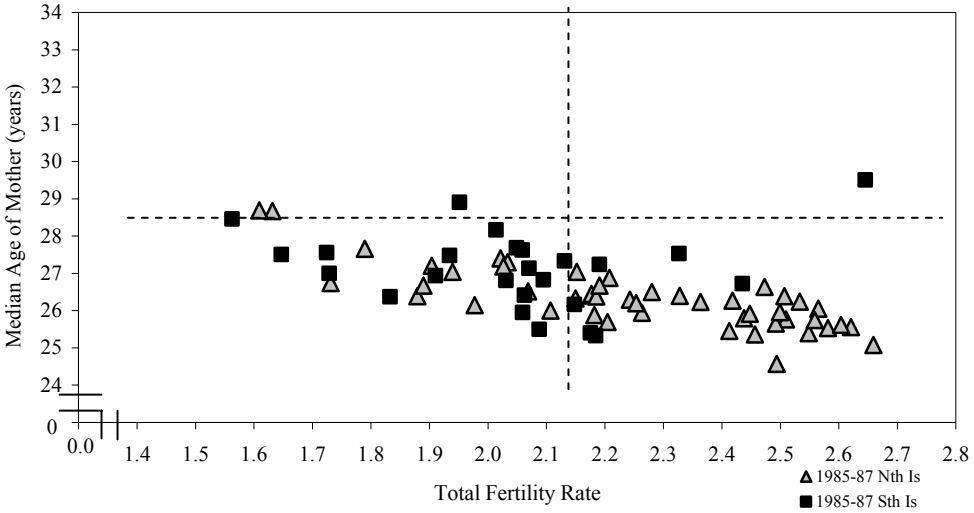
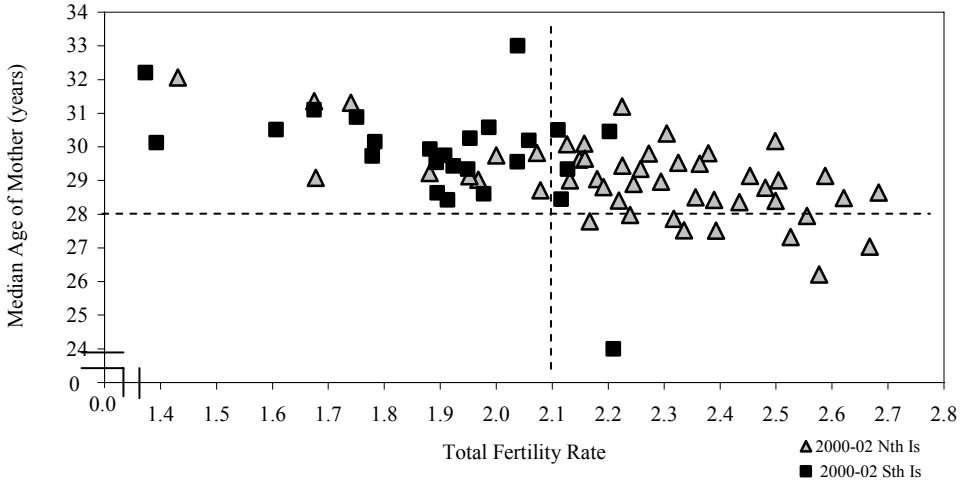


Figure 5b: Total Fertility Rate, and Median Age at Childbearing, Territorial Authorities, 2000-02



Comparing the 1985-87 and 2000-02 experiences (Figures 5a and 5b) indicates that by the beginning of the new millennium, the crowding of clustering had thinned out considerably. One new clustering had emerged, around the TFR of 1.8 - 2.0 births per woman.

Despite no apparent change in national fertility, more than half (26 out of 49) of the North Island TAs experienced an increase in their TFR between 1985-87 and 2000-02. These included Rodney, Manukau, Waitakere, Papakura, Tauranga, Rotorua, Opotiki, and Hastings. In some cases, the rises were marginal, such as in Thames-Coromandel, Gisborne, Porirua, Upper Hutt and Lower Hutt. Conversely, TFR fell by over 10 per cent in Wairoa, Central Hawkes Bay, New Plymouth, Stratford, Rangitikei and Wellington. The number of North Island Authorities with TFR above 2.4 fell from 20 (out of the 49) to 14. Six of the 25 South Island areas also recorded an increase in TFR, in four of these areas (Nelson, Waimakariri, Banks Peninsula and Clutha) the upturn was small.

As more TA's experienced a drop in fertility, the shift to the left was particularly pronounced in the South island, and this covered TAs which had TFR both above and below the replacement level in 1986. By 2001, only five South Island areas (Hurunui, Waimakariri, Chatham Islands, Clutha and Gore) exceeded the replacement level - by a margin of just 5 per cent or less.

The number of areas with a TFR below 1.9 increased from 11 to 14. Seven local authorities, viz. North Shore, Palmerston North, Wellington, Christchurch, Dunedin, McKenzie and Queenstown-Lakes had fertility below 1.7 births per woman, followed closely by Auckland City, Nelson, Westland and Selwyn.

Finally, delayed motherhood is more advanced in these low-fertility areas, the median age at childbearing being 31 years or more, compared with "high fertility" areas which have a median age of 28 years or less. Overall, delayed motherhood has made further inroads in all areas. Whereas, in 1986, virtually all areas were in the lower half of the chart in 1986 -- below the dotted line at 28 years -- a great majority supported median ages of between 28 and 31 years in 2001.

Within Territorial Authorities

Within territorial authorities, there are areas or suburbs with very low fertility rate -- between 1.2 and 1.4 births per woman. Some of these area units involve small population numbers, and the fertility estimates may not

be statistically robust. Nevertheless, in 2000-2002, of the 1,700 area units, there were at least 72, with a TFR below 1.2 and about 200 with a TFR below 1.4. Many of these are old, well established or high socioeconomic suburbs. Examples are: Kelburn, Roseneath and Vogeltown in Wellington City; Grafton, Mt Eden, Newton, Epsom and Freemans Bay in Auckland; Fendalton, Ilam, Riccarton and Bryndwar in Christchurch, and Silverpeaks, North Dunedin, High Street and Woodhaugh in Dunedin City. On the other hand, there are areas with TFR ranging between 3 and 3.5 births per woman. These include Glen Innes, Mt Wellington, Otahuhu in Auckland, Cannon Creek in Porirua, and Rakaia in Ashburton District. In Manukau City's suburb of Otara, TFR of over 3, have persisted since the early 1980s.

An Exploratory Regression Analysis

Reproductive behaviour is influenced by a wide range of social, economic and cultural conditions, and these include educational levels of women, labour force status, occupation and family income (Statistics New Zealand 2001; United Nations 1973). There is for instance a strong negative relationship between socioeconomic level and family size (Singh and Casterline 1985). Demographic literature also carries sufficient evidence on urban-rural, regional and ethnic differentials in fertility. However, the observed relationships are known to vary considerably in magnitude across countries, and over time. "A United Nations study of 22 countries found that education was negatively related to desired fertility in a manner similar to, but somewhat greater than, that found between education and actual family size" (Freedman 1987). Lower urban fertility than rural fertility has been a general rule in New Zealand as far back as the demographic records go (Jones 1971; Department of Statistics 1979). Similarly, ethnic differentials in family size have persisted in New Zealand despite a major conceptual shift, from a somewhat restrictive biological framework to a concept reflecting socio-cultural element and self-identification of ethnicity. The census data on children ever born as well as measures drawn from vital statistics indicate that both the indigenous Maori and Pacific women have significantly higher fertility than their Pakeha (European) counterparts (Statistics New Zealand 2004; Statistics New Zealand 2006), and these partly reflect underlying disparity in socioeconomic status, rather than cultural factors per se.

The remaining part of this paper reports on a multivariate analysis, undertaken to identify possible correlates of the observed variation in fertility. As it is not possible to reliably infer individual dynamics using aggregate data, the work reported here needs to be regarded as exploratory. Any patterns identified should be seen as tentative or suggestive rather than definitive.

Dependent and Independent Variables

Fertility Measure: The measure of fertility analysed was total fertility rate (TFR), defined either for the 16 regions or for the 74 Territorial Authorities (TAs). The birth statistics used in deriving TFRs were births to New Zealand mothers that were registered during the three years 2000-2002. Averaging births over three year avoids some of the random volatility that might be apparent if only one year's data was used.

Predictive Variables

Predictor (or explanatory) variables were derived from the 2001 New Zealand Census of Population and Dwellings, and were designed to capture some aspect of a factor know to affect fertility. All but one of the predictor variables were proportions of some population or subpopulation who had a certain demographic or socioeconomic characteristic. The one exception was median age of the mother at birth, which is an aspect of reproductive behaviour and arguably perhaps should not be used as a predictor of fertility. Our approach was to include it as a predictor and see how it compared to other variables possibly related to fertility.

How the explanatory variables were constructed is best described by an example. The 2001 Census variable "social marital status" was re-expressed as three proportions, for each region or TA, being the fractions of women aged 20-39 years who had a legal spouse (variable "smls"), had another partner (variable "smop") or were not partnered (variable "smnp"). For each region or TA, the three social marital status variables sum to 1, reflecting the fact that these fractional variables are related. By this type of procedure 10 census variables were converted to 31 predictor variables, giving 32 predictor variables in total with the inclusion of median age of the mother. Details are set out in Table 2. For variables such as personal income where the income range was converted to 13 categories by the census question,

and then further reduced for this analysis to three categories, the boundaries between categories were set somewhat arbitrarily.

Methodology

The predictor variables as defined in Table 1 are not mutually independent as, for example, the marital status variables "smls", "smop" and "smnp" sum to one. Therefore, to minimize multi-collinearity issues in regression modelling, it is appropriate to exclude one of these three variables from the analysis. In total, the variables smnp, qd, dep810, inc3, faminc3, fnotin, mnotin, down, and af1519 were excluded from the analysis.

Regression modelling was carried out using PROC REG of SAS, via stepwise forward selection, using a significance criterion of P=0.05 for inclusion and for retention in a model. Influence statistics for the selected regressions were examined; and, if judged necessary, some regions or TAs were excluded from the fitting procedure. For the regression for TAs the approach used led to ten of the 74 territorial authorities (see footnote to Table 2) being excluded from deriving model parameters. The main effect of this was to change the estimated model parameters by a small margin (but no parameter estimate changed sign).

Regions and Territorial Authorities vary in population size and structure, so it was considered appropriate to "weight" the regression fitting to take account of this diversity. Regressions were fitted using the square root of the number of adult females as a weighting variable.

Correlations between TFR and the Predictor Variables

Correlations between total fertility rate (TFR) and the 32 predictor variables showed a wide spread (Table 1). Consistent with the existing research findings, the analysis found strong positive relationship (r = 0.78) between fertility and the proportion of women who have no educational qualification ("qno"), or the proportion of Maori and Pacific women in a population (r = 0.72). There was a corresponding high negative relationship (r = - 0.64) between women in full-time employment ("fft") and fertility, and "women with a degree" (r= - 0.63). Low correlations (r = 0.20) -- negative or positive -- were observed for the variables "women in part-time employment", "women not partnered", or women who had an annual income of less than $10,000 (Table 1), which suggests that the impact of these factors on fertility is either weak or limited.

Table 1: Correlations of the Predictor Variables with Total Fertility Rate

Variable	Correlation *	Variable	Correlation *
Proportion of female aged 20-39 with no educational qualification (qno)	0.78	Proportion of females aged 20-39 who are in fulltime employment (fft)	-0.64
Proportion of population Maori or Pacific (emp)	0.74	Proportion of females aged 20-39 with a degree as highest qualification (qd)	-0.63
Proportion of female aged 20-39 who are Maori or Pacific (efmp)	0.72	Median age of mother (medage)	-0.56
Proportion of female aged 20-39 who are unemployed (fun)	0.65	Proportion of females aged 20-39 living in least deprived (NZDEP 1-3) area units (dep13)	-0.55
Proportion of females aged 20-39 not in the Labour Force (fnotin)	0.64	Proportion of females 20-39 with family income over $40,000 (faminc3)	-0.52
Proportion of females 20-39 with family income $0-20,000 (faminc1)	0.60	Proportion of males aged 20-39 who are employed full-time (mft)	-0.34
Proportion of females aged 20-39 living in most deprived (NZDEP 8-10) area units (dep810)	0.58	Proportion of females aged 20-39 with a vocational qualification as highest qualification (qv)	-0.31
Proportion of males aged 20-39 who are unemployed (mun)	0.54	Proportion of females 20-39 whose income is over $30,000 (inc3)	-0.31
Proportion of females 20-39 whose income is $10,001-30,000 (inc2)	0.33	Proportion of females aged 20-39 with highest qualification secondary school (qs)	-0.22
Proportion of females 20-39 living with de facto partner (smop)	0.32	Proportion of females aged 20-39 living in moderately deprived (NZDEP 4-7) area units (dep47)	-0.20
Proportion of females 20-39 with family income $20,001-40,000 (faminc2)	0.25	Proportion of females aged 20-39 living in an owner occupier home (own)	-0.18
Proportion of males aged 20-39 not in the Labour Force (mnotin)	0.23	Proportion of adult females aged 20-39 years (af2039)	-0.16
Proportion of females aged 20-39 not living in an owner occupier home (down)	0.18	Proportion of females 20-39 living with legal spouse (smls)	-0.11
Proportion of females 20-39 whose income is $0-10,000 (inc1)	0.14	Proportion of females aged 20-39 who are employed part-time (fpt)	-0.10
Proportion of adult females aged 40 years and over (af40up)	0.12	Proportion of females 20-39 not partnered (smnp)	-0.07
Proportion of adult females aged 15-19 years (af1519)	0.08	Proportion of males aged 20-39 who are employed part-time (mpt)	-0.04

*ordered from the most positive (negative) to the least positive (negative)

When interpreting regression results it is important to understand how the predictor variables are correlated with each other, as well as how correlated they are with total fertility rate. Given one dependent variable

and 32 predictor variables this means a 33 by 33 matrix of correlations. Rather than present such a matrix these correlations were converted to a map whereby variables that are positively correlated tend to be close together and variables that are negatively correlated tend to be far apart (Fig 6). The "map" was generated by extracting two dimensions from the correlation matrix, using PROC MDS of SAS.

Figure 6 offers a crude summary of the correlation structure in the variables examined, but it may assist with interpreting the results of regression modelling, as one variable may be acting as a proxy for other variables. The circular placement of the variables in this Figure is partly due to the correlation structure between related variables eg. the variables "own" (own their home) and "down" (do not own) are diametrically opposite each other because within each TA the proportions of those who own or partly their home and the proportions of those who do not sum to one; of the female income variables, "inc1" (annual income of $0-20,000) and "inc2" ($20,001-40,000) are close (correlation of 0.24) and far away from "inc3" ($over $40,000). The correlations of "inc1" and "inc2" with "inc3" are -0.73 and -0.84 respectively).

Regression Modelling Results

Some summary information on the regression models fitted for regions and territorial authorities is provided in Table 2.

Regression Model for Regions

The regression model for the regions can (reporting only the sign of the regression coefficient) be expressed as:

$$\text{tfr} = \text{intercept} + \text{efmp} - \text{mpt} - \text{dep13} + \text{medage} \quad R^2 = 0.99$$

The order of the variables on the right hand side (reading from left to right) is the order in which the variables were selected for inclusion.

The signs of the variables in this equation are the same as those of the corresponding correlations with total fertility rate, except for the variable "median age of mothers" (medage). One might speculate that perhaps once the effects of ethnic composition, male employment and deprivation are taken into account then median age of mothers is positively correlated with total fertility rate.

Figure 6: Multidimensional Scaling Representation of the correlations of the 33 TA variables

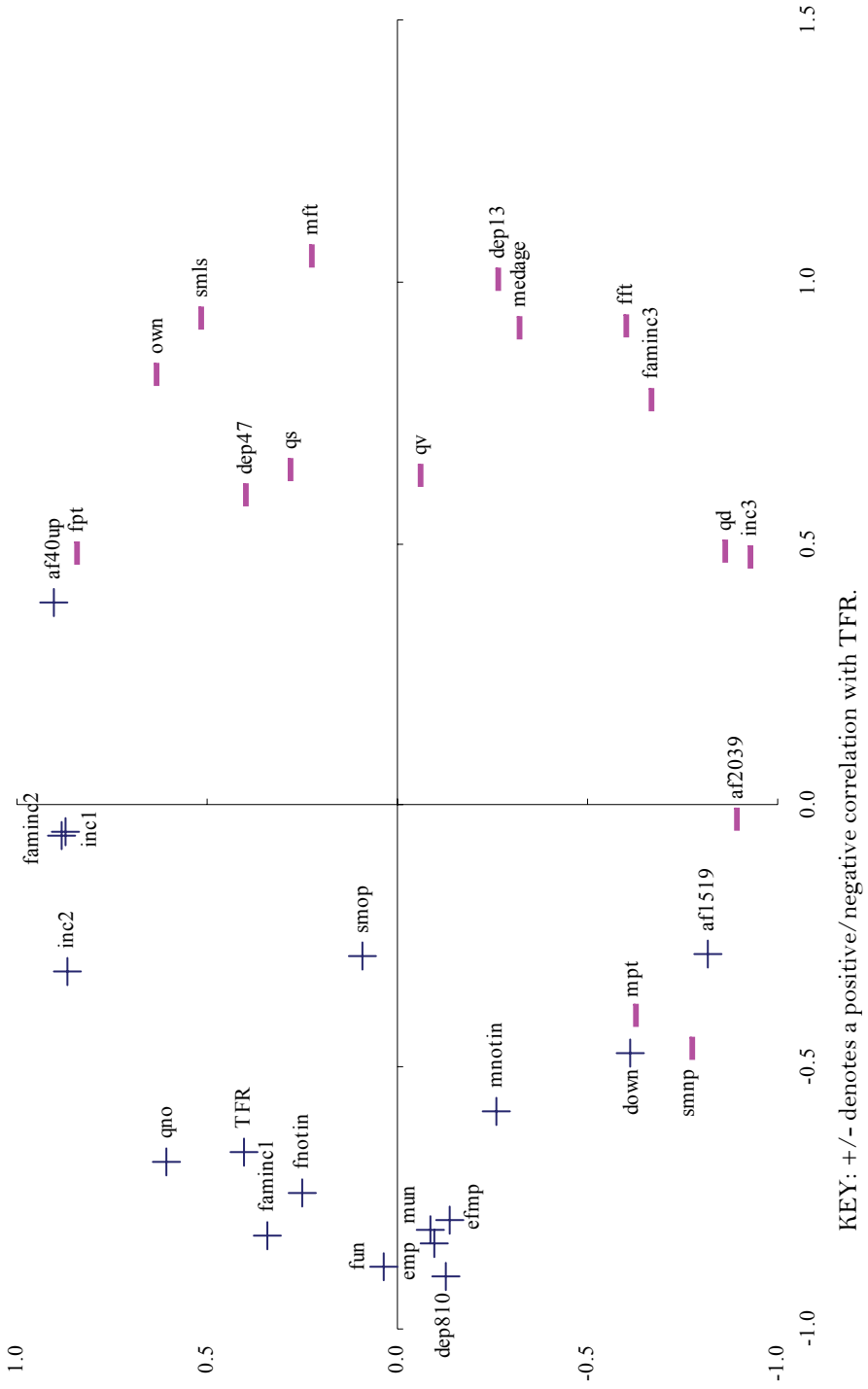


Table 2: Summary of Explanatory Variables

Variable group	Variable details	SAS var	Region	TA
	Total fertility rate	tfr	Y-var	Y-var
	Median age of mother	medage	+ X4	
Ethnicity	Fraction of pop Maori or Pacific	emp		+ X1
	Fraction of females 20-39 Maori or Pacific	efmp	+ X1	
Social marital status	Legal spouse	smls		+ X2
(Fraction of females 20-39)	Other partner	smop		
	Not partnered	(smnp)		
Highest qualification	No Qual	qno		(dropped)
(Fraction of females 20-39)	Secondary School	qs		
	Vocational Qual	qv		
	Degree	(qd)		
NZ Deprivation (AU)	8-10	(dep810)		
(Fraction of Female Pop	4-7	dep47		
Aged 20-39 Living in AUs with NZDep)	1-3	dep13	- X3	- X7
Income	$ 0-10,000	inc1		- X5
(Fraction of females 20-39)	$ 10,001-30,000	inc2		
	Over $ 30,000	(inc3)		
Family income	$ 0- 20,000	faminc1		
(Fraction of females 20-39)	$ 20,001- 40,000	faminc2		
	Over $ 40,000	(faminc3)		
Female Labour Force Participation	Employed Full-Time	fft		- X6
(Fraction of females 20-39)	Employed Part-Time	fpt		
	Unemployed	fun		+ X4
	Not in Labour Force	(fnotin)		
Male Labour Force Participation	Employed Full-Time	mft		
(Fraction of males 20-39)	Employed Part-Time	mpt	- X2	
	Unemployed	mun		
	Not in Labour Force	(mnotin)		
Household tenure	Owned or partly owned	own		
(Fraction of females 20-39)	Don't own	(down)		
Fraction in main child-bearing ages	15-19 years	(af1519)		
(Fraction of adult females)	20-39 years	af2039		- X3
	40+ years	af40up		
Number of adult females (weight*)		fadult		

(1) *set to zero for North Shore City, Manukau City, Otorohanga District, Kawerau District, Manawatu District, Kaikoura District, Selwyn District, Central Otago District, Dunedin City, and Invercargill City

(2) variables bracketed thus () were excluded from the regression analysis

Regression Model for Territorial Authorities

The regression model for the territorial authorities can be similarly expressed:

tfr = intercept + emp + smls – af2039 + fun - inc1 - fft – dep13
$R^2 = 0.94$

Apart from the variables smls and inc1, the signs of the variables in this equation are the same as those of the corresponding correlations with total fertility rate.

Comparison of the Regional and TA Models

Both models first included one of the ethnic variables ("emp" and "efmp"). This will be of no surprise to population analysts, especially those who study fertility/mortality differentials in New Zealand. Nevertheless, there are discrepancies between the average educational level of different ethnic groups and these tend to coincide with over-all socio-economic status of the group. Thus, while it is easy to jump to the conclusion that cultural values are a significant influence on fertility, it is possible that they are less significant than other correlated factors. As stated earlier, socioeconomic factors are well documented as important determinants of fertility and feature strongly in these analyses. Both models included the deprivation variable "dep13" (the fraction of the population having deprivation scores of 1-3). Two possible explanations for a negative correlation with the low deprivation sources include; very low deprivation areas are not particularly suited to families; or that people's efforts are going into career or business. The TA model also picked up annual income of $0-10,000 and female full-time employment as being negatively correlated, while the regional model picked up a negative correlation with male part-time employment. An interesting observation is the apparent interplay between time (work/life balance) and income in all these variables. Generally, males in family formation ages are financially unable to work part-time. Those males working part-time are likely to be doing so involuntarily, rather than as a lifestyle choice and thus, their partner may have added financial incentive to work full-time if they can secure full-time work.

The TA regression model does not include median age of mothers as a predictor variable, whereas the regional model does. This re-enforces the point that a factor known to affect fertility may or may not show up in regression modelling on aggregated data.

Summary

A key finding of this research study is that the transition to sub-replacement fertility setting has not resulted in complete homogeneity of fertility levels or patterns at sub-national level. Contrary to the general expectations, heterogeneity continues largely unabated. Additionally, while the median age at childbearing indicates a marked shift away from early childbearing to delayed motherhood, there is greater regional diversity in reproductive patterns now, than in the mid-1980s. Low fertility is more prevalent in the South than in the North Island, with 20 of the 25 South Island TAs recording sub-replacement fertility rates in 2000-02. Given that a majority of these areas continue to experience net out-migration, this has important implications for projecting future fertility, and for assessing its likely impact on growth momentum and population ageing, and for charting policy planning paths.

A multivariate analysis suggests that ethnic composition, social marital status, deprivation, income, and employment all have a bearing on spatial differentials in fertility. The interpretation of these variables using regression models is subject to many conceptual and methodological issues. Also, their influences may be direct or indirect, and may vary over time. We have drawn some tenuous links between fertility and affordability of a family, both financially and in time. In particular, the link between work/life balance and fertility -- whether the timing and size of family are largely conscious decisions or a natural consequence of previous lifestyle choices warrant further investigation.

Notes

An early version of this paper was read at the 2005 Biennial Conference of the Population Association of New Zealand. The views expressed in this paper are those of the authors and do not necessarily represent the views of Statistics New Zealand.

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Challenges in Estimating Populations

CHRISTINE BYCROFT*

Abstract

Estimates of population size and structure form a core output for statistical agencies. The five yearly census has always formed the basis of population estimates produced by Statistics New Zealand. Prior to 1996, population estimates were produced directly from census counts for the de facto population, and updating inter-censally using administratively sourced births, deaths and migration data. In 1996, with the introduction of the first Post-enumeration Survey (PES) to measure census coverage, Statistics New Zealand moved to population estimates based on the resident population concept, and adjusted the basic census counts for net census undercount and for residents temporarily overseas on census night. There remains a concern that the PES net census undercount adjustment may be too low due to the requirement for independence between census and the PES. In particular, the low numbers of males relative to females evident in both census and the estimated resident population has raised questions about the measurement of census undercount. As part of the development of the 2006-based population estimates, we have investigated an alternative demographic analysis approach to measuring the population, building up the population estimates over a long period of time from the components of population change - births, deaths and migration.

We explore the data quality issues associated with census-based population estimates, and with those derived from demographic analysis, using sex ratios as a point of comparison. Each approach has its own strengths and limitations arising from the different nature of the data sources. An appreciation of the data quality issues leads to a better understanding of how to combine information from both approaches and throws up some challenges for estimating an increasingly diverse and mobile population.

The New Zealand "missing men" phenomenon has received considerable attention recently in the New Zealand media (eg. New Zealand Herald 2006), as well as from Statistics New Zealand and other researchers. The main interest was sparked by a media release relating to discussion of the "man drought" in Australia, and a worse one in New Zealand (Salt 2005). Callister, Bedford and Didham (2005, 2007) explore the reasons for this imbalance in the sex ratios as evidenced in the

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1996 and 2001 censuses, particularly for ages 25-49 years, the most affected age group. They find that while patterns of migration do explain some of the differences, undercount in statistical collections may play a more important role than previously thought. Census-based sex ratios for the New Zealand population have been declining steadily since the 1970s. The question we are challenged with is: "How much of this decline is real, and how much is an artefact of inaccuracies in the statistical collection?" Comparison over time of sex ratios derived from census-based estimates and sex ratios from demographic data sources shows an increasing divergence between the two. However these demographic sources are themselves subject to their own, different, sources of error and uncertainty. We explore the data quality issues associated with census-based population estimates, and with those derived from demographic analysis, using sex ratios as a point of comparison. One of the issues we encounter is the increasing difficulty of defining the population we attempt to count and describe, given the level of international mobility we have in New Zealand.

The New Zealand Census of Population and Dwellings is the main data source for estimating the size and geographic distribution of the New Zealand population and for analysing the major demographic, social and economic characteristics of the population. A census also provides a base for post-censal population estimates and projections, which assist in planning and policy-making at the national and local levels. Whenever a census is undertaken, questions about the completeness and accuracy of the census count invariably arise. In such a large and complex exercise it is inevitable that some people will be missed and some will be included more than once. Statistics New Zealand conducts a Post-enumeration Survey (PES) immediately following the census that provides estimates of census net undercount.

The environment for census and survey taking has become more difficult over time. The New Zealand population has become more diverse in terms of ethnicity, living arrangements and lifestyles. Each census Statistics New Zealand puts in place a range of initiatives to encourage people to participate. Examples include the establishment of Kaitakaewanga and Pacific Liaison Officers in 2001 and the internet option in 2006. As well as responding to the external environment through changes to communication messages and field processes, technology changes have allowed dramatic improvements in processing and dissemination. Statistical

methodologies, particularly those relating to invalid or missing responses, have also advanced over time. Statistics NZ maintains close links with other countries running similar censuses who all share knowledge and learn from each other. Each census cycle brings an evaluation and review of previous censuses and improvements are made where possible.

As part of the development of the 2006-based "estimated resident population" series, Statistics New Zealand has undertaken a program of work aimed at understanding the apparent imbalance in the sex ratio that has generated so much popular interest, and is investigating whether improvements can be made to the methods for calculating population estimates. The goal is to achieve the best population estimates we can, where the estimates reflect the true total resident population counts, their geographic and ethnic distributions, and the age by sex distributions as accurately as possible. Population estimates have traditionally been built up from an enumerated census base. Since the 1996 census, this base has been adjusted for net census undercount as estimated by the census coverage survey, the PES. Secondly, residents temporarily overseas at the time of the census are added. Adjustments are then made for post-censal births, deaths and migration, together with component-based demographic adjustments for people aged 0-9 years, in order to arrive at the estimated resident population at the reference date of 30 June.

The estimation of census under-coverage is always a difficult exercise and is the subject of considerable research internationally. Speaking from a United States' perspective, Little (2006) says "The census undercount is a very complicated problem, involving an interplay between politics, data collection, human behaviour and complex statistical modelling". We do not attempt to address the whole range of issues in this paper. We examine the strengths and limitations of the census/PES approach to deriving population estimates. In theory, PES estimates can be improved if reasonably accurate alternative estimates of population are available at some level. An alternative population estimate can be created using demographic analysis methods. We report on investigations into the creation of an ancillary estimate of population, independent of census (as far as possible) and built up from the demographic components of population change - births, deaths and migration. The ability of migration data to support the creation of population estimates over a long time period is a key factor in this discussion.

We first describe the sex ratio issue and summarise approaches taken by other National Statistical Institutes to estimating census coverage. The discussion in the New Zealand context is framed in terms of an examination of the quality of data sources – census/PES and demographic components of population change. Data quality is assessed in terms of "fitness for purpose". We briefly discuss the impact that a change in population totals and/or sex ratios might have on different uses of population estimates.

To summarise our findings: intercensal population estimates start with a census base and use administrative data sources (mainly births, deaths and external migration) to estimate population change over time. These intercensal estimates are known to become less certain the further one moves from census, especially at the more detailed sub-national geographies and ethnic breakdowns. Reliable data sources on internal migration are scarce and movement between ethnic groups poses an additional problem. Conducting a census every five years provides a new and detailed population benchmark that is not affected by errors accumulated over time. Population estimates at the new census year reference date adjust for census net undercount to the extent possible given PES results. Some undercount may remain unaccounted for due to what is known as correlation bias.

In contrast, the components of demographic change show very high coverage of *events* (births, deaths, travel journeys) and have very good point-in-time estimates of these events. However, deriving population estimates from demographic analysis relies on accumulating estimates of population change over a long time. Any use of this "accounting" approach must recognise the significant statistical issues it raises. The travel events captured so well by the New Zealand migration system do not translate easily to a change in residency status for individuals. Bias and variability that are insignificant over the short-term are compounded over a long period and may sometimes have a large effect. The problem is exacerbated for migration data because change in population due to external migration is a very small proportion of very large gross flows. Sex ratios are vulnerable to inaccuracies because as the ratio of male to female they are sensitive to the estimation of two values, not just a single population total.

While demographic analysis suggests that more men than women are not accounted for in the population estimates, the uncertainty in estimating the sex ratio using demographic analysis is of a similar order to the difference between the sex ratio for this demographic estimate and the

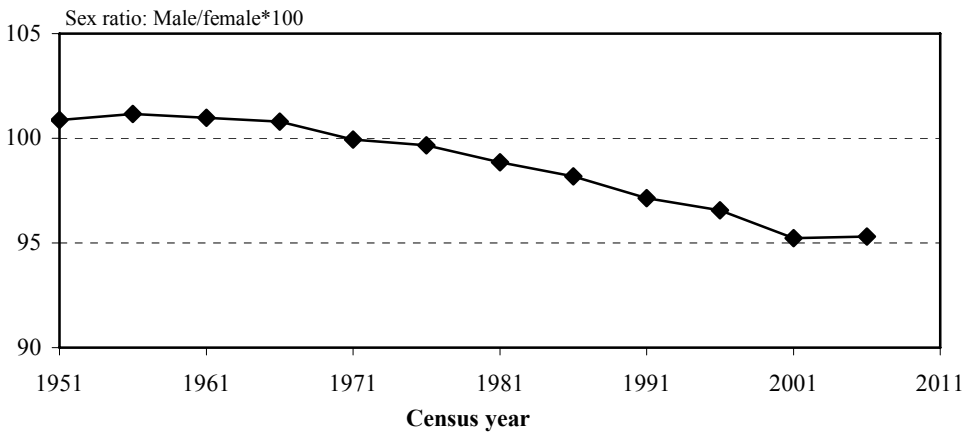
published population estimates. We do not yet have a reliable alternative estimate of the population with which to adjust for potential correlation bias in the PES, and migration, as with other sources, cannot be ruled out as the main reason for missing men. We now develop these themes more fully.

Sex Ratios in New Zealand Populations

The three graphs that follow give an overview of changes in New Zealand sex ratios over time. For a more detailed examination of sex ratios in the 20-49 year age group see Callister *et al.* 2005 and 2007. First we need to define what we mean by the New Zealand population. The population of interest in this context is the usually resident population of New Zealand.[1] The New Zealand census is taken on a de facto basis -- the scope for census is all persons present in New Zealand at census night. Census usually resident population counts exclude overseas visitors in New Zealand on census night. However census usually resident population counts also exclude New Zealand residents temporarily overseas. The ongoing population estimates series, the Estimated Resident Population (ERP), extends the census usually resident coverage to also include residents temporarily overseas on census night.

An historical perspective reveals a long-term, steady decline in the sex ratio[2] of the New Zealand population as measured by census since the Census of 1971 (Figure 1).

Figure 1: Census sex ratios from 1951 to 2006



Sex ratios by five year age groups (Figure 2) show that the age groups from 20-24 years to 40-44 years are a key driver of this overall decline. In censuses from 1976 through to 2001, the number of males has dropped relative to the number of females for these younger adult ages. Census 2006 results show the sex ratios have generally stabilised, at least for the present.

Figure 2: Census sex ratios from 1976 to 2006, by 5-year age groups

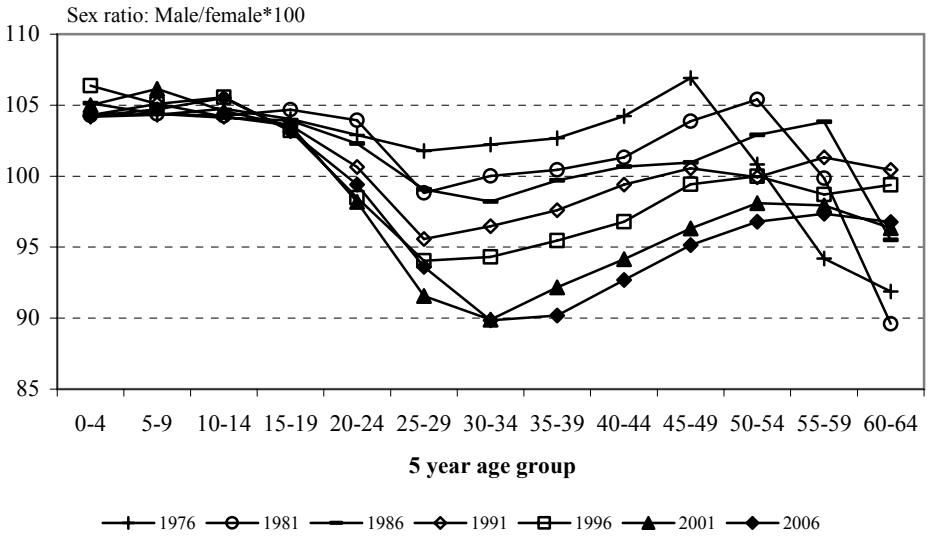
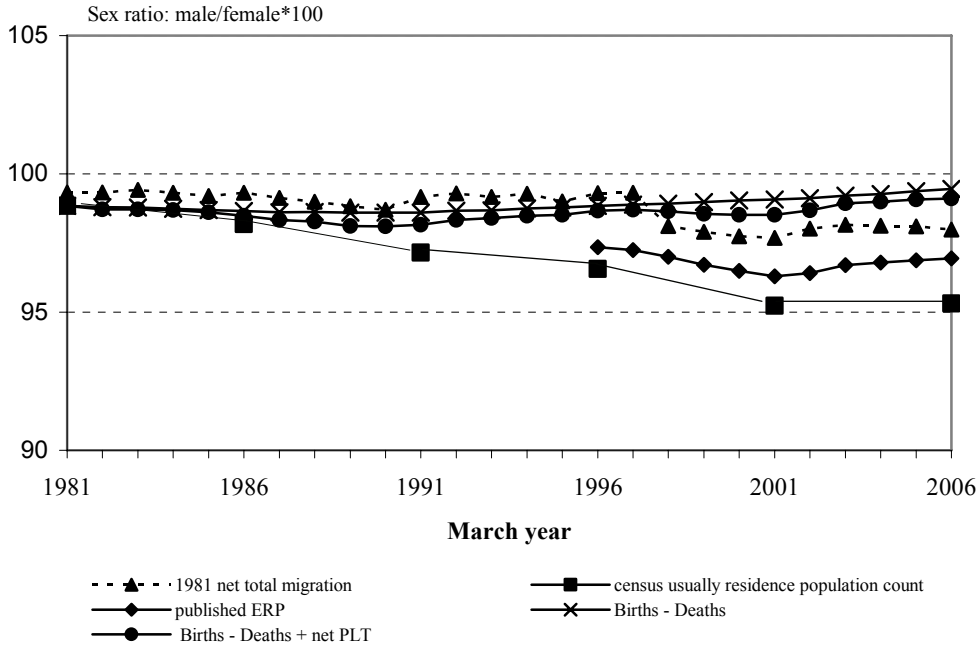


Figure 3 takes 1981 as a starting point and compares census sex ratios with other estimates. The smooth "births-deaths" series describes what is expected from a closed population, updating the census 1981 population for births and deaths only. Two series are drawn adding population change due to migration. One includes population change from migration using published figures for net permanent and long-term migration (Births – deaths + net PLT). The other (1981 net migration) uses an alternative estimate of population change due to migration calculated from net total migration adjusted for short-term travellers. This demographic series based on net total migration is also adjusted for an estimated undercount in census 1981 and starts at a slightly higher sex ratio as will be discussed in more detail below. The bottom line is the sex ratio from successive censuses' usually resident population counts. Sex ratios from the published ERP are shown from 1996. Migration data will be discussed in detail later, however we note here that while the demographic series using migration

data raise questions about the ERP sex ratios, both series are subject to sources of error and uncertainty.

Figure 3: Comparison of census-based sex ratios with demographic sex ratio series



Prior to 1996, unadjusted census data was used as the basis for population estimates (based on the de facto population concept with no adjustment for census undercount). With the first PES in 1996, the ERP series updates the census using estimates of census net undercount from the PES and estimates of residents temporarily overseas at census date. Intercensally, quarterly ERP figures are produced by moving the population forward including changes due to births, deaths and net PLT migration. After each census the ERP is re-calculated and the series revised backwards for consistency. The recently released Census 2006 figure is shown; however the ERP at 2006 is still based on Census 2001.

The steady decline of census sex ratios is not reflected in either of the demographic population series derived from changes in births, deaths and migration. While the ERP adjusts the census sex ratio upwards, a discrepancy remains. The 2001 census usually resident sex ratio is 95.2, the

2001 ERP sex ratio is 96.3 while using net total migration and net PLT migration give 98.1 and 98.5 respectively (at March 6 2001). At the overall population level around 2 per cent difference between the existing ERP methodology and the two demographic analysis methods is not a large discrepancy. A greater concern would be if the difference in males and females is proportionately larger for particular age groups.

How big is the issue? In the context of the New Zealand population of four million people, a sex ratio of 100 corresponds to two million males and two million females, whereas a sex ratio of 101 corresponds to 2,010,000 males and 1,990,000 females (rounding to the nearest thousand). Thus a sex ratio difference in the whole New Zealand population of 1.0 corresponds roughly to an additional/fewer 20,000 males relative to females. Adding about an extra 38,000 males to the 2001 ERP would bring the sex ratio up to what would be expected given the net total migration sex ratio, or 44,000 given the net PLT sex ratio. These values are useful as an indication of the size of the imbalance in the numbers of males relative to the number of females between the sources. However it is not a final estimate of the change in population that might be expected. The ERP sex ratio imbalance could be adjusted to meet a demographic analysis value in three ways: by re-classifying some females as males, adding males only, or adding both males and females. It is also possible that the migration data may be over-stating the true size of the discrepancy and a smaller ERP adjustment would be more correct.

This discussion is also an indication of the difficulty of determining the true population and true sex ratio. We are tasked with accurately estimating census under-coverage for (very approximately) one per cent of the population who could be viewed as the extreme end of "hard to count", whether they are in New Zealand or overseas, and to also accurately estimate the relative proportions of male and female in this group. How much this matters depends on the use to which data is put.

A preliminary investigation has been carried out of possible impacts on Statistics New Zealand outputs that would result from a change in the ERP of the order indicated by the demographic net total migration series, and of double that amount as a more extreme example. This assessment has shown minimal impact on most key outputs. Mortality and fertility rates are unaffected. Apart from the obvious increase to totals, there is no change in rates for key survey estimates such as the Household Labour Force Survey

unemployment rate. (Population estimates are used to adjust weighting of sample surveys. Since both numerator and denominator are weight-adjusted, no significant impact on rates would be expected.) Neither is there any significant impact on economic analysis that uses per capita or household estimates. One area that warrants further attention is analysis focussed specifically on gender differences in the working ages, such as the gender pay gap.

Census and PES Quality Issues

We first consider the census itself as a potential source of uncertainty in the balance of males and females. Sex and age are "foremost" variables in census and are given highest priority in ensuring their quality. Coding evaluation studies in 2001 and 2006 show that responses for age and sex were captured very accurately and therefore data capture in census can be ruled out as having any adverse impact on the sex ratio.

Statistical methods are used to account for people who do not respond to census. In common with Australia, UK, and the United States, New Zealand runs a census coverage survey. The PES is a household survey run immediately after census, and designed to ensure independence from census operations. For operational reasons, the PES coverage is restricted to usual residents of permanent private dwellings, and it has aimed for a sample size of around 10,000 households. The PES estimates both undercount and overcount to produce a net undercount figure. (Statistics NZ 2002, 2007).

The current method for estimating resident population is based on the census adjusted for net undercount using results from the PES. The undercount is one part of non-response to census and will be described next. First we discuss the processes census already has that account for known unit non-response. Census counts include counts for missing households, and for people missing within enumerated households, known as substitutes.[3] The combination of undercount (estimated by PES) and substitutes (counted within census) gives a more complete picture of non-response to census (Table 1). The number of substitutes has been increasing each census since 1996 and is greater than the net undercount. Substitutes improve the census counts and have known geographic information, but have missing values for all other variables. They are the main source of uncertainty in the census age-sex distribution.

Missing values of age and sex are imputed. For substitutes within enumerated households, sex and age imputation is often able to use information from the dwelling form (name, age), values of other variables (eg. income sources) and information from other members of the household (eg. age of partner). While clearly not providing precisely accurate values at the individual level, imputation using these various sources of other information is good for most purposes and is not expected to distort the overall sex ratio.

Table 1: Sources of non-response for usually resident population, 1996, 2001 and 2006 Censuses

	1996		2001		2006	
	Number (000)	Estimated total (%)	Number (000)	Estimated total (%)	Number (000)	Estimated total (%)
Census enumerated	3,517	95.6	3,631	95.0	3,895	94.8
Substitutes within enumerated households	--	--	27	0.7	38	0.9
Substitutes from missing households	--	--	80	2.1	95	2.3
Plus						
Total substitutes	102	2.8	107	2.8	133	3.2
Equals						
Total census usually resident population count	3,618	98.4	3,737	97.8	4,028	98.0
Plus						
Net undercount	60	1.6	85	2.2	81	2.0
Equals						
Estimated New Zealand residents on census night	3,678	100.0	3,822	100.0	4,109	100.0

Source: Statistics New Zealand 2007

When there is a lack of adequate information on which to base an imputation, it is preferable that imputed variables maintain the same patterns as the responding population. In 1996 and 2001 all substitute forms raised for missing households have imputed age-sex values using the general age-sex distribution since no other information is available. In 2006 a methodological change was made whereby age for substitutes in missing households was imputed from a donor household randomly selected within their immediate physical neighbourhood. The donor methodology shows young adults (20-39 years) over-represented in missing households. Sex continued to be imputed stochastically at the same overall rate as the whole population (49 per cent male).

Using PES responses that match to substitute missing households provides an independent check on the true make up of missing households. Results from 2001 PES support the view that missing households have the same overall sex ratio as the general responding population, but a higher proportion of young adults (Brown 2004). Based on this independent estimate from 2001 PES we conclude that the 2006 donor imputation provides a better age-sex distribution for missing households. The 1996 and 2001 imputations appear to have under-estimated young adults, but the overall sex ratio was reasonable. Further work is underway to more accurately determine the impact of imputation for missing households on the sex ratio.

PES Estimation

The adjustments used to create the ERP contributed in varying degrees to differences between the Census and ERP sex ratios, with the largest being the census net undercount adjustment (Table 2).

Table 2: Adjustments used to create the ERP at 30 June 2001

Adjustment	Total added to population	Excess of males over females
Census net undercount	80,900	9,400
Residents temporarily overseas on census day	54,500	6,200
Net change, 6 March to 30 June	4,100	200
Demographic adjustment 0-9 years	3,700	1,400
All adjustments	143,200	17,200

The method of estimating net undercount from PES data is known as Dual System Estimation (DSE) ("capture/recapture" in the wildlife literature) as it uses two systems, census and its related PES, to estimate net undercount. DSE relies upon an assumption of independence between the probability of response to census and the probability of response to PES. This assumption of independence is necessary to ensure unbiased estimates of census undercount (Bell 1993, Elliot and Little 2001, Brown *et al.* 2006). A lack of independence between census and PES leads to “correlation bias” in the DSE estimate. While every effort is made to ensure the integrity of the PES and separation from census, operational independence cannot be fully guaranteed. Bell (2001) describes two mechanisms that would lead to correlation bias from failure of a general independence assumption:

(1) *causal independence* - the act of being included in the census makes one more likely or less likely to be included in the PES , or

(2) *heterogeneity*- census and PES inclusion probabilities vary over persons within the DSE post-strata

The DSE estimated population is generally assumed to be smaller than the true population. Correlation bias is thus negative because it is expected that there is a tendency for people enumerated in census to be more likely to be included in the PES than those missed in the census, rather than the reverse. For example, the DSE does not estimate undercount that arises from people who are deliberately avoiding contact with government agencies. Improvements to the estimation methodology in 2006 mean that the impact of correlation bias due to heterogeneity of response probabilities has been reduced in 2006 compared with the two earlier PES. In 1996 and 2001 the DSE has not used any post-strata in calculation of overall undercount. In 2006, Generalised Regression (GREG) estimation rather than the DSE was used as in the Australian 2001 census (Bell *et al.* 2007). GREG estimation calibrates PES weights for benchmark categories according to sex, age groups, ethnic groups and region that had not been possible before. This reduces the risk from heterogeneity because the assumption of independence is needed only within these much smaller categories, not for the whole population.

The DSE depends upon very high accuracy in matching households and individuals between census and PES. Matching introduces an additional source of bias not normally encountered in sample surveys because incorrect matching decisions may bias PES undercount estimates.

The impact on sex ratios depends on the difference between the undercount of males and the undercount of females. The overall net undercount in 2001 was 2.2 per cent with a sample error of 0.3 per cent. As it is a net calculation, undercount difference between males and females of 9,400 has a much higher sample error. An approximate[4] calculation of the sample error of the difference between the net undercount estimates for males and for females (taken as males minus females) gave a 95 per cent confidence interval range of 1,000 to 18,000. While general experience in conducting surveys shows markedly higher non-response rates for males, this relative sample error of almost 100 per cent is an indication of the difficulty we have using the PES to accurately estimate the difference between male and female undercounts that determines the sex ratio.

Correlation bias is defined here as the difference between the DSE estimate of population and the true population (ie. assuming any other biases are negligible). The problem is that we do not know the true population, and must look for alternative ways of estimating it. The possibility of correlation bias is a widely recognised concern to National Statistical Offices and a variety of approaches have been taken to address the issue. The Australian Bureau of Statistics (ABS) has concentrated on improving the DSE estimator. For 2006 the ABS has developed an extension of the DSE estimator that allows weighting to take account of a variety of variables for each unit that could potentially affect Census and PES response (Bell *et al.* 2007). The ABS approach has the advantage of not relying on any external source of data. The UK 2001 One Number Census estimated correlation bias at the household level, using a combination of the census list of households and the Postcode Address File as an ancillary estimate of the true number of households. A synthetic estimate at the individual level was modelled since no other reliable person estimates exist (Brown et al 2006). For the United States 2000 Census the US Bureau of the Census carried out intensive research and revision of the estimates from the Accuracy and Coverage Evaluation (A.C.E) survey. For the A.C.E Revision II, correlation bias was corrected to the extent possible using target sex ratios obtained from demographic analysis (Bell 2001; Robinson 2002; US Bureau of the Census 2001b). The female undercount was assumed to be correct and males only added. However, published intercensal population estimates are based on unadjusted census counts due to some remaining technical concerns with the A.C.E survey, including the correction for correlation bias.

Using Demographic Analysis to Estimate Population

We now look at how alternative estimates of population might be derived in the New Zealand context from the components of population change - births, deaths and migration. This method is known as demographic analysis. In this model, the population at time t is the population at time t-1 suitably aged for the duration of the period, plus births minus deaths and plus inward migration minus outward migration.

$$P(t) = P(t-1) + \text{Births} - \text{Deaths} + \text{in-migration} - \text{out-migration}$$

Starting with a base census population for t=0 and subsequently adjusting it for births, deaths and migration over a long period depends on the quality

of the starting point data and requires an extremely high quality registration system. Inadequacies in the census base starting point flow through directly to subsequent population estimates. Any inadequacies in the records of external migration may well accumulate over the lifetime of the population, and like inaccuracies in birth and death registration may become apparent in old age (either as negative populations or as unrealistic survival).

We first discuss the starting point for demographic analysis. It would be preferable to start in the 1960s before the decline of sex ratios, however we have worked with the 1981 Census as a starting point to produce an experimental series. The choice is somewhat arbitrary, but represents a balance between the desire to reduce the unknown cumulative effect of errors in components but also to begin before the major decline in sex ratios. Whatever the causes, the declining sex ratio observed in census populations were already advanced by 1981.

We are still faced with the issue of estimating undercount at the chosen census base. Working back from the 2001 census provides a conservative estimate of 1981 census undercount, and is the approach taken at present. Estimation of the census undercount at the starting point of a component series is critical to estimation of population totals and requires further investigation. We note that the sex ratio is not sensitive to the undercount total, but is sensitive to the age-sex distribution of the undercount. The 2001 undercount distribution has been applied to the total estimated 1981 undercount. This is an assumption that cannot be tested, though its sensitivity can be assessed.

Births, deaths and migration figures are derived from administrative sources. These administrative sources record events, and are considered to be minimally affected by avoidance behaviour of the kind that is expected to influence sex ratios derived from survey data. They are also known to offer largely complete coverage of the events. Thus we would expect to be able to derive good estimates of population, independently of census. However there are different limitations in using administrative data, especially migration data. Migration data is available only at the national level not for sub-national geographies, and for the age and sex variables only, crucially not by ethnic group. The migration data poses further problems in relating travel events to the individual person, in deriving small net effects from

extremely large gross flows, in estimating aggregates from sampled data and in accurately identifying the correct subject populations.

The lack of geographic and ethnic details becomes an important issue if demographic estimates are used to adjust for correlation bias. Additional population known at the national level by age and sex must be distributed to sub-national strata. Assumptions must be made about the relative impact of correlation bias at these more detailed levels. Bell (1993, 2001) and Elliot and Little (2005) discuss various possible models. The dilemma is that different models fit equally well but distribute the population differently among strata. One must balance the desire for improvements at a national level with consideration of the potential for creating perhaps greater distortions at finer levels.

Births and Deaths

Births and deaths are derived from a legal registration process that is very closely monitored. Death data in New Zealand can be regarded as 100 per cent complete and the coverage of births data is very high. A small proportion of births (less that 1.5 per cent) is registered late and not included in official figures. Although the number is small, the cumulative effect of late birth registration over a long period of time is not insignificant. Adjustment for late birth registrations is greatly simplified if component-based estimates start from a census base in the 1970s or better 1980s. Starting from such a base enables us to ignore the more historical events (ie. they can be assumed to be captured in the base).

The dates of birth and sex variables are very reliable in both sources. Thus we can be confident that birth and death registrations provide us with high quality data for estimating natural increase in population over time. For a component series starting in 1981 the only adjustment necessary to published birth figures would be a small factor for late birth registrations.

Migration

Migration in New Zealand is characterised by high gross flows and volatile net migration (Figure 4). As well as overseas born migrants entering New Zealand a significant proportion of permanent and long-term arrivals are New Zealand citizens returning from extended absences overseas (Lidgard and Gilson 2002). The 2006 census shows 23 per cent of the resident

population were born overseas, and 19 per cent of people aged 25 to 34 years were living overseas five years ago in 2001. For the New Zealand born population, 9 per cent of those aged 25 to 34 years reported living overseas five years ago. Similarly, there are a large proportion of those born in New Zealand living overseas. The conservative OECD estimate is over half a million New Zealanders living outside New Zealand (Dumont and Lemaître 2004).

The large numbers involved and the different age-sex distributions of those migrating in to, and out of New Zealand mean that migration plays a significant role in population change over time.

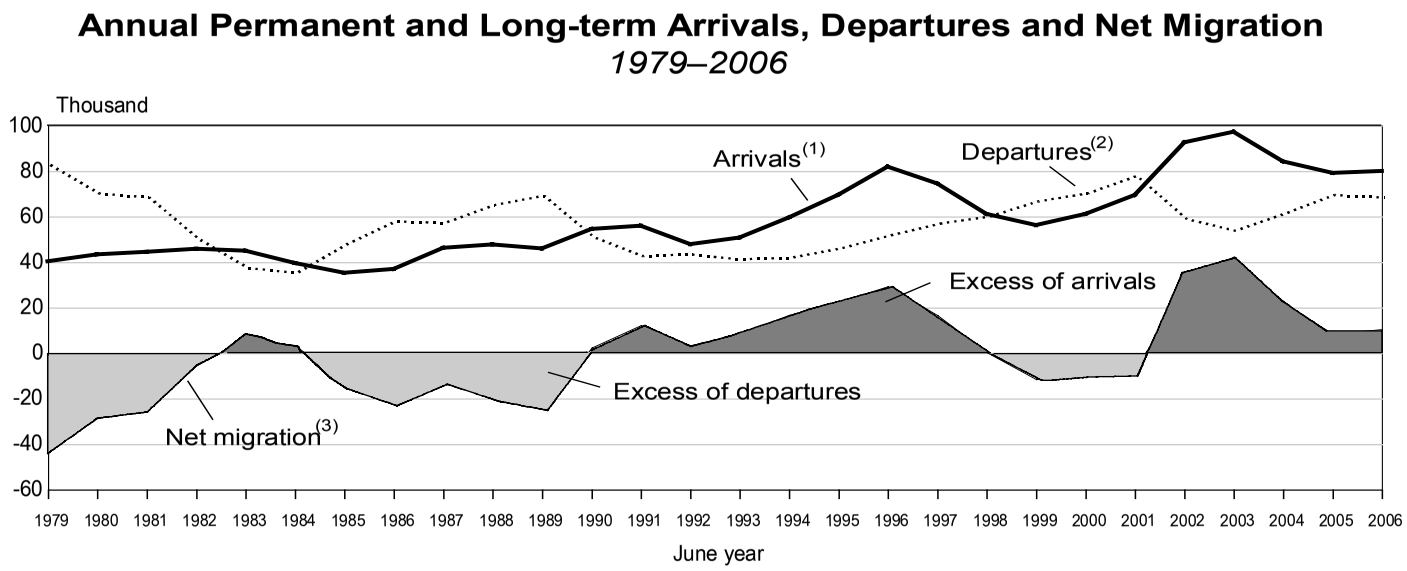
The accuracy of migration data is thus a critical aspect in producing an alternative population estimate. New Zealand is in an unusual position of having excellent coverage of journeys across its borders through the system of migration arrival and departure cards, supplemented since 1997 by electronic capture of passport data. Estimating the change in resident population due to migration depends on converting these records of *events* into a change of residency status by *individuals*. Statistics NZ published Permanent and Long Term (PLT) migration classes travellers according to their status as resident or visitor, and their intended length of stay or absence as recorded on the arrival and departure cards.[5]

However, people can be classed as permanent and long-term migrants but actually be short-term migrants, or vice-versa, if:

- they change their travel intentions,
- they incorrectly complete the arrival or departure card or
- the details they provided are incorrectly coded.

The effect of any incorrect classing is referred to as *category jumping*. PLT migration is the class most affected by category jumping because it comprises a small proportion of very large gross flows. For example in the year ended December 2006 there were 8.7 million arrivals and departures, of which 98 per cent were by short-term travellers. A small proportion of all travellers category jumping from short-term to PLT migration could have a large effect on net PLT migration. As well, intentions of permanent and long-term migrants are much more susceptible to change than someone on a short holiday.

Figure 4: Migration flows, 1979 - 2006



1 Overseas migrants intending to stay in New Zealand 12 months or more (or permanently), plus New Zealand residents returning after an absence of 12 months or more.

2 Overseas visitors departing New Zealand after a stay of 12 months or more, plus New Zealand residents departing for an intended period of 12 months or more (or permanently).

3. Excess or arrivals over departures. A minus sign denotes an excess of departures over arrivals.

Source: Demographic Trends (2006), Statistics NZ

As Bedford (2001) points out, a focus solely on PLT migration can be misleading, especially when aggregated over a reasonably lengthy period. Because of category jumping, recorded PLT migration may not accurately reflect the actual size, age structure or sex differential of changes to the resident population due to external migration. Ideally one would wish to follow movement histories by individual over time, using suitable criteria for length of stay or absence to define permanent and long-term migration. The ABS is moving towards a system that enforces statistical integrity of individual movement histories (ABS 2006). Statistics NZ migration data is limited to identification by passport number, not at the unit of individual, so cannot measure external migration directly. We have used the ability to match journeys by passport number in an alternative method of estimating external migration that attempts to overcome the drawbacks of recorded PLT.

An alternative estimate of external migration can be derived as net total migration over a period of time adjusted for short-term travellers at the start and end of the period. Short-term travellers are residents temporarily overseas (RTOs) and visitors temporarily in New Zealand (VTNs) who have not yet completed their journeys at the date of interest. The change in external migration estimated in this manner (estimated netPLT) during a period from time t-1 to time t can be expressed as

$$estimatednetPLT(t-1,t) = \sum_{months \in (t-1,t)} (arrivals_m - departures_m) + [RTOs(t) - VTNs(t)] - [RTOs(t-1) - VTNs(t-1)]$$

Where the summation for total migration is over all months from time t-1 to time t.

The difference between this estimated net PLT and recorded net PLT migration is the net effect of category jumping. Estimated net PLT does not rely on travellers' intentions, but because it is a residual calculation it does depend on the accuracy of net migration figures and on the accuracy of classing short-term travellers as residents or visitors.

Fig 3 includes the sex ratio over time derived from a demographic analysis based on net total migration and corrected at the 1981 start point for short-term travellers, and by quarter since 1998. The sex ratio at 2001 and 2006 lies between the higher value calculated using the netPLT series, and the lower value from the ERP.

The method is still in development so results must be treated as experimental, however the exercise has served to highlight several issues

which are now discussed in more detail. We consider the level of accuracy of net migration figures and the RTO and VTN estimates.

Net Migration

Net migration is the difference between total arrivals and total departures. The number of travel journeys had reached an annual total of a million arrivals and departures by 1985 and in the year to December 2006 there were 4.4 million journeys recorded in each direction. No data capture system is perfect, and even inaccuracies which are very small in proportion to the total gross flows at any particular point in time, have the potential to impact on the net value aggregated over a period if they are biased towards either arrivals or departures. If the cause of error affects males and females alike, for example flight delays, then sex ratios may be useful even though totals are biased.

A second issue is the availability of only sampled net migration estimates over some of the period. In 1975 sampling of migration cards was introduced for short-term travel and continued until August 1997.[6] Thus prior to September 1997, any use of net migration figures must make an allowance for sample error. Indicative[7] sample errors have been derived for the cumulative excess of females over males aggregated from 1981. These suggest that the cumulative effect at August 1997 of sampling error in migration results in a 95 per cent confidence interval of +/- 30,000 for the excess of females over males. After this date actual figures become available. These are wide sample errors considering that the difference in sex ratios between the ERP and demographic analysis can be explained by an excess 38,000 females over males. It means we cannot rule out either the hypothesis of no real change in the excess of females over males over the period, or the hypothesis that there is enough change due to migration to indicate that the ERP is correct. Regardless of other issues, the size of this sample error means we are unable to use Statistics NZ net total migration data for demographic analysis over the time period from 1981 as an accurate alternative estimate of the sex ratio.

Short Term Travellers

The situation was greatly improved with the introduction of a new processing system in 1997. From September 1997, the available migration

data includes day of travel for all arrivals and departures. Details (country of citizenship, passport code, date of birth, sex) are also available for every record, allowing matching of arrival and departure records to link two legs of a journey. Matched arrivals and departures provide a good measure of when people were in or out of New Zealand, and can be used to verify classing (as a PLT migrant, overseas visitor or New Zealand resident traveller). Estimates of RTOs and VTNs have been calculated by matching adjacent journey pairs. Completed short-term journeys are found by searching a 12 month window either side of the date of interest. The class of a reference leg of the return journey determines resident or visitor status. Where arrivals and departures could be matched within a year, they were counted as a VTN at a point in time if:

(1) the arrival was classed as a visitor, and
(2) the arrival was before the time of interest, and
(3) the departure was after the time of interest

Similarly, a return journey is counted as an RTOs if the class of the reference leg is a resident and the length of absence was less than 12 months. The matching was to the last known record of the person regardless of class and direction i.e. a resident arrival can be matched to a PLT departure. RTOs have been calculated using departures (first leg of journey), and arrivals (second leg) as the reference. While almost 80 per cent of RTOs were common to both the arrival- and departure-based estimates, the two measures do differ, due to matches to records of another class. Some of these differences will correctly capture category jumping, while some will be errors.

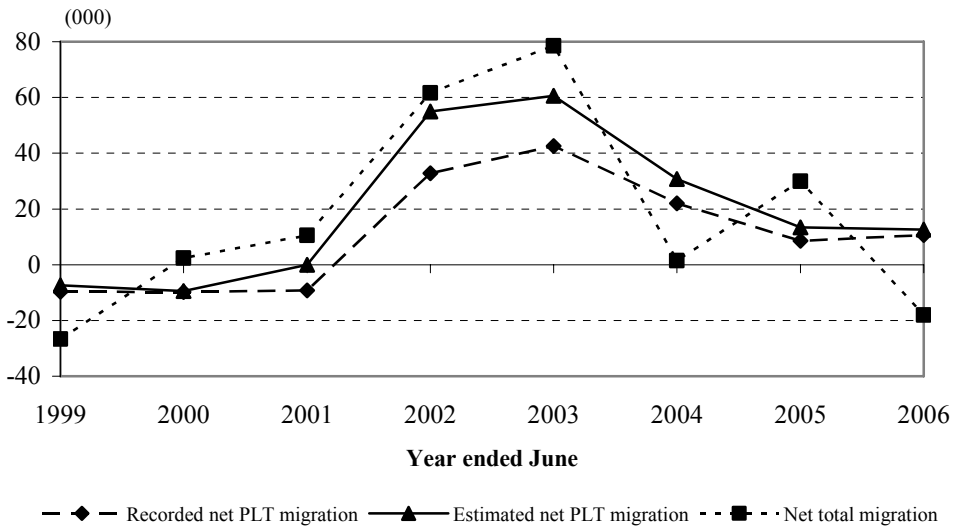
However there are still two groups not captured under these definitions but who contribute to the change in resident population: those who meet the definition of New Zealand resident but travel frequently and consider themselves as visitors (eg overseas students); and former New Zealand residents who no longer meet the resident definition, but return frequently to New Zealand and consider themselves to be New Zealand residents.

The calculation of RTOs and VTNs translates units recorded as events (the completed journey) to the statistical unit of the individual. The accuracy of RTO and VTN counts is mainly dependent on correct classification as resident or visitor at the reference leg of the journey. This

classification depends on whether the traveller views his or herself as "living in New Zealand". The increasing ease of short-term international travel results in a blurring of the concept of "usual residence" and represents a challenge to the measurement of residence status for both census and migration data.

Figure 5 shows some early results for point-in-time estimates by June year from 1999 when a full year of matched data is first available. Both estimated net PLT series show a trend that is similar in shape but often higher than recorded PLT migration. It is pleasing to see that the variability in net total migration is not reflected in the estimated net PLT series.

Figure 5: Measures of net migration by year



Results

Table 3 summarises what is known about sources of error and variability for overall sex ratios derived from each of the population estimates discussed.

Table 3: Sources of error in sex ratio

Population estimate	Variability in overall sex ratio	Probable bias
Census	negligible	Undercounts males more than females
ERP	PES sample error +/- 9,400	Correlation bias; possibly undercounts males more than females
Demographic using net PLT	none	Unknown
Demographic using net migration	Net migration sample error +/- 30,000	Unknown

We now compare results from the different methodologies for estimating the population at census day 2001- census, published ERP and the demographic estimates. Results are given for sex ratios by age groups. Figure 6 compares sex ratios for five year age groups for the estimated net PLT demographic series with census usual resident population count and the ERP. There is considerable volatility apparent at 5 year age groups when net migration is aggregated over a long period of time, mainly due to sampled estimates. We are clearly unable to achieve a stable alternative population estimate by five year age group. We would expect to do better by aggregating over broader age groups. Figure 7 shows the same series by the four PES output age groups. At the middle adult ages, census undercount of males is modified in the ERP. The demographic net migration series shows close agreement with the ERP for three of the four age groups. It is encouraging that despite the limitations in data sources, both methods arrive at very similar results. The exception is the 30-44 year age group where there is a 4.5 per cent difference. While much of the difference may be due to sample error, it suggests that this should be an area for further investigation. A similar comparison is being used in the development of the census 2006 based ERP. Thus although the alternative demographic estimates of population do not provide us with definitive answers to population size and structure, they are helpful as points of comparison when developing the ERP within the existing method.

Figure 6: Comparison of sex ratios at 2001 by 5 year age group

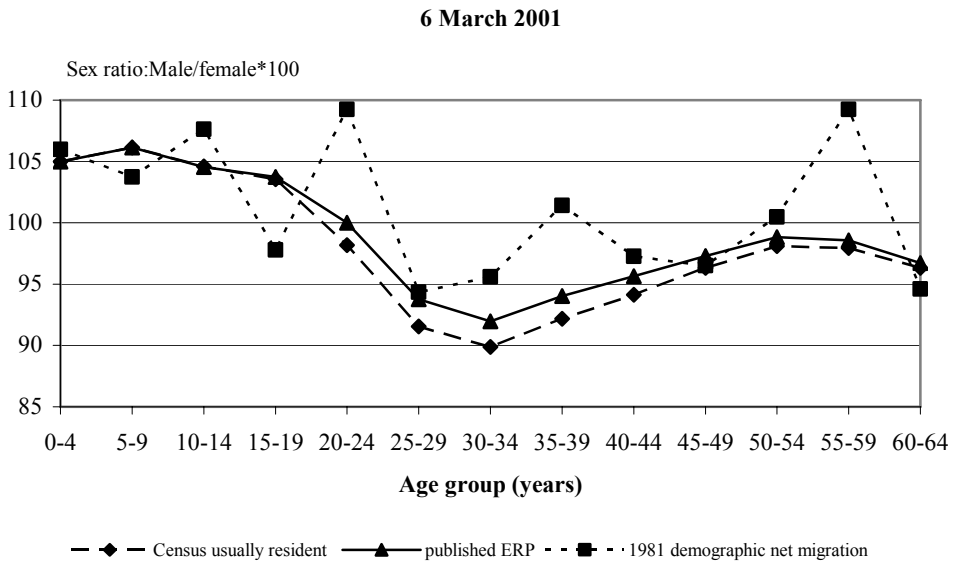
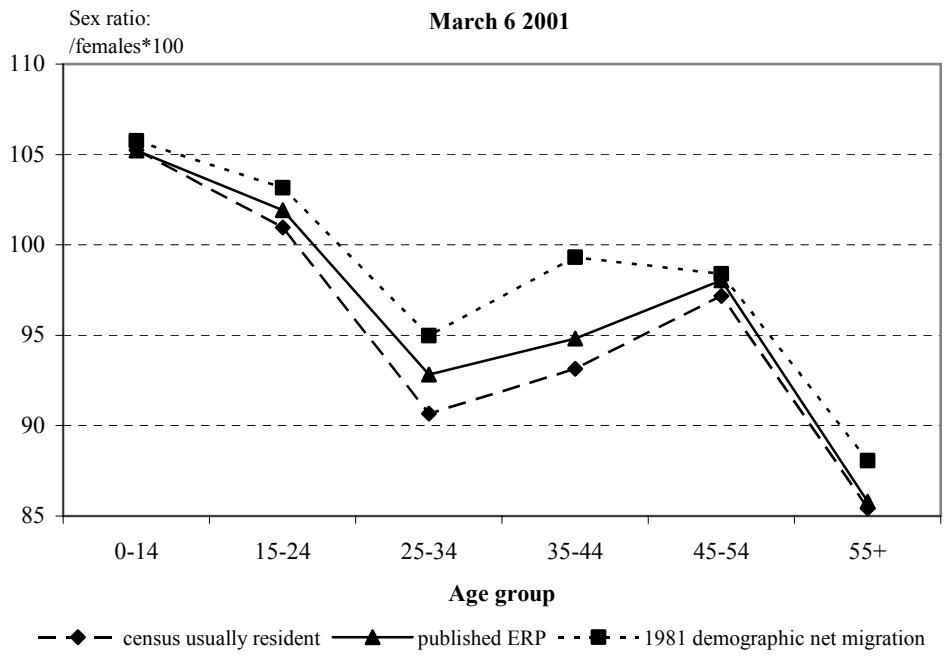


Figure 7: Comparison of sex ratios by PES age strata



Conclusion

The investigations presented here have been conducted as part of the normal process of review of methodology for the new 2006 estimated resident population base. We have given some focus to sex ratios in the hope that we might shed more light on the interesting issue of missing men, although this is just one aspect of population distribution. The methodology for the estimated resident population base includes an adjustment for census net undercount. In common with other countries such as England and Wales, Australia, and the United States, New Zealand estimates census net undercount using a census coverage survey (the PES in New Zealand). Correlation bias is a well recognised limitation of the PES estimation method, with the likely consequence that the population estimates will still miss some of the census undercount. Because men tend to show lower response rates to surveys in general it is perhaps reasonable to assume that they are more affected by correlation bias than women. An improved PES estimation methodology in 2006 does mitigate the effects of correlation bias to some extent, but is not expected to eliminate it. Understanding the actual size of any correlation bias, and correcting for it in population estimates is a difficult problem as it requires an alternative estimate of the unknown true population we wish to measure.

We have looked at using demographic analysis to provide an alternative population estimate, using a new method to measure the change in population due to external migration. Traditionally external migration figures have used net PLT, which is based on peoples' intentions. The new method has explored the use of net total migration over a period of time with corrections for incomplete short-term travellers at the start and end of the period. This adjusts for any change in travel intentions. Preliminary results for recent years suggest that the real contribution of migration to population change is not always measured well by recorded net PLT migration. The new method provides a promising avenue for further research into the nature of short-term travel as well as longer term change in resident population. However there are a number of unresolved issues in aggregating population change over a long period that mean we do not have a robust alternative estimate of population.

Demographic analysis continues to be the foundation of intercensal population estimates, is used explicitly as an adjustment for 0-9 year olds in

the census based ERP and is useful as a comparison to census-based estimates. However we have found that the uncertainties inherent in the demographic population estimate are too large to explicitly correct for correlation bias, given the data sources available at present. The existing methodology remains the best we have and will continue to be used for the 2006 estimated resident population. Investigations are continuing particularly with regard to category jumping in migration data, and understanding the reasons why people are missed from census and household surveys.

Notes

This paper is based on work done by the Population Statistics unit and Statistical Methods at Statistics New Zealand. In particular I wish to acknowledge the contributions of Bill Boddington, Pat Coope, Robert Didham, Kim Dunstan, Kirsten Nissen, Michael Ryan and Nicholas Thomson. We are also grateful to an external Technical Advisory Group for comments and discussion of an earlier working paper.

1 Usual residence is the address of the dwelling where a person considers himself or herself to usually reside It relies on self-definition, with some exceptions such as rules for students. A person from another country who has lived, or intends to live, in New Zealand for 12 months or more usually resides at his or her address in New Zealand (as in external migration).

2 Throughout this paper the term 'sex ratio' refers to the number of males per 100 females.

3 Substitute forms are raised during census processing where there is sufficient evidence that a person exists, but no form has been received. Missing households are determined by the enumerator identification of occupied, unoccupied and vacant dwellings.

4 Assuming independence. A technically more correct calculation could only shift these confidence limits by up to +/- 2,000

5 PLT arrivals consist of New Zealand residents returning after an absence of 12 months or more and overseas migrants arriving for an intended stay of 12 months or more (including permanently). Similarly, PLT departures consist of New Zealand residents departing for an intended absence of 12 months or more (including permanently) and overseas visitors departing after a stay of 12 months or more. Net PLT is the difference between PLT arrivals and PLT departures. It is available by single year of age and sex.

6 The statistics for short term (less than one year) movements are derived from systematic random samples taken each month from the arrival and departure cards. There are independent samples selected for short-term resident

departures, short-term resident arrivals and short-term visitor departures. Short-term visitor arrivals are independently sampled by each country (defined by country of last permanent residence on the arrival card). Information is coded for all permanent and long-term arrival and departures. The sampling interval was calculated to achieve a sample size of around 27,000 short-term cards each month to maintain an even workload during the year. The sample fraction has risen from 1 in 4 in the mid-1970s and now averages about 1 in 25 depending on the volume of travellers.

7 The calculations assume independence between all contributing samples and do not take into account any correlation over time in the cumulative excess series.

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Immigration Futures: New Zealand in a Global Context

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ELSIE HO

Abstract

At no other time in the past century has there been such focused and intense global interest in international migration. Never before has there been such interest, internationally, in how Australia, Canada and New Zealand manage their international migration. These countries have become models for governments elsewhere who are seeking to develop policy that has a more direct impact on the quality of the population flows into their countries.

New Zealand is unusual by OECD standards in that it has a high level of emigration of citizens at the same time that it has a very high per capita rate of immigration. New Zealand's contemporary migration flows are examined briefly and it is demonstrated that the system is not nearly as dominated by migration from countries in northeast Asia as it was a decade ago.

A more flexible approach to the attainment of permits to reside in a country is being adopted in most countries now. The prospective migrants take the opportunity to assess employment opportunities and the quality of life in a prospective new home (perhaps not their only home either), while working or studying on temporary permits and gaining the sort of local experience that is valued in the points-based immigrant selection systems. The paper concludes with a brief analysis of data relating to transition to residence in New Zealand.

New "Age" and "Era" of Migration: A Point of Departure

In 1993 Stephen Castles and Mark Miller published a book carrying the title *The Age of Migration. International Population Movements in the Modern World.* The title was catchy, but the introductory paragraphs portrayed a gloomy contemporary context within which the "Age of Migration" was situated. Castles and Miller (1993:1-2) opened their discussion by referring to three dramatic events in 1992: the Los Angeles riots in May – the US's first

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"multicultural riots"; neo-Nazi onslaughts on refugee hostels in Germany in August and September – a resurgence of extreme right organizations victimizing vulnerable newcomers who were "different"; and the disintegration of Yugoslavia, a violent period of "ethnic cleansing" that generated millions of refugees. They went on to observe:

> All of these happenings were linked to mass international population movements and to the problems of living together in one society for ethnic groups with diverse cultures and social conditions. … The events of 1992 [and they listed others in Africa, the Middle East, south-east Asia, the Caribbean] were symptomatic of major changes in international relations and in the societies of both highly developed and less developed countries. New forms of global migration and growing ethnic diversity are related to fundamental transformations in economic, social and political structures in this post-modern and post-Cold War epoch (Castles and Miller 1993:2).

Fast forward 14 years to May 2006 when the Secretary-General of the United Nations, Kofi Annan, released the organisation's "early road map for [a] new era of mobility" that is creating challenges and opportunities for societies throughout the world, and is requiring Governments everywhere to re-examine their migration polices (UN 2006:5). The context for this "new era" is portrayed in a very different way from that found in the introduction to Castles and Miller's classic study. The authors of the UN report (2006: 5) observed:

> The advantages that migration brings, both to migrants and to the societies they join, are not as well understood as they might be. Migration stirs passionate debate. It can deprive countries of its best and brightest, and it can divide families. For all the good it can bring, it can also generate social tensions; for example, issues relating to migrant integration are the focus of intense controversy. Sometimes criminals and terrorists exploit the flow of peoples. Nevertheless, the answers to many of the problems raised by migration may be found through constructive engagement and debate. This will lead to a broader recognition of the enormous benefits and opportunities that migration provides.

A Burgeoning International Literature

At no other time in the past century has there been such focused and intense global interest in international migration. Governments, multi-lateral organisations, local authorities, NGOs, the private sector and the research community are all addressing issues to do with international migration in a more focused and coherent way. International migration has been the

subject of more major reports over the past 18 months than it has ever generated before. These include:

2006:

International Migration and Development. Report of the Secretary-General. United Nations, New York

International Migration and Development: Opportunities and Challenges for Policy Makers, International Organisation for Migration (IOM), Geneva

International Labour Migration. World Bank, Washington DC

2005 Global Refugee Trends. UNHCR, Geneva

2005:

Migration in an Interconnected World: New Directions for Action. Report of the Global Commission on International Migration (GCIM), Switzerland

Communication on Migration and Development. European Union, Brussels

International Migration and the Millennium Development Goals, UNFPA, New York.

Migration and Development. House of Commons, London.

International migration is certainly topical, and the UN Secretary-General "is confident that the High-level Dialogue on International Migration and development on 14 and 15 September [2006] will be remembered as the moment when cooperation on this vital matter attained a new level". Cooperation is essential for several reasons, not the least of which is the burgeoning competition between countries for labour, especially skilled labour. One of the key stimulants to the recent proliferation of reports on migration and development is the recognition that skilled labour is in demand in the labour markets of most economies, not just those in the more developed countries. New Zealand has been in competition for many years with Australia, Canada and the United States for highly skilled labour; we are frequently the fourth preference out of this group for migrants seeking work and residence, but even to attract the people we do we have to be constantly evaluating our policy settings to ensure they send signals that encourage rather than discourage potential immigrants.

If we think the current competition is stiff then we have a major surprise awaiting us in the future. At the Immigration Futures International Forum in Prato (Italy) in May, Ronald Skeldon, author of a very interesting book entitled *Migration and Development: a Global Perspective* (1997), alerted participants to the massive demand for skilled labour in China as that economy continues to grow at more than double the rate of most economies elsewhere. China is now attracting back many of the migrants who left for tertiary education and professional training overseas in the 1980s and 1990s

– the jobs and salaries that can now be obtained at home are encouraging significant return migration, especially from Canada, Australia and New Zealand. Our immigrants of yesterday are not necessarily settlers; as will be seen later in this paper, almost a third of New Zealand's permanent and long-term departures in the year 1 April 2005-31 March 2006 were not New Zealand citizens – they were citizens of other countries that are still considered to be their homes. For an increasing number of highly skilled migrants "home" is no longer in one country – as Tracey Barnett (2006) observed in an interesting article in the *New Zealand Herald* on 14 June, they "represent the unprecedented growth of a transnational global culture".

Managing Migration in a New Era: Best Practice in the New World?

In the "new era of mobility", with its blurred boundaries between different types of movement (permanent, temporary, settler, visitor, circular, return), New Zealand, like Australia and Canada, is fortunate in having a long history of pro-active immigration policy – in most parts of the world there is no tradition of deliberately seeking migrants who might settle. As John Martin (2006), Director for Employment, Labour and Social Affairs at the OECD, argued recently, only a small number of countries grant the right of permanent residence on entry to selected migrants; the great majority grant temporary residence rights with options for a transition to more permanent residence for some groups. Temporary permits are the normal entry-way, rather than approval for permanent residence, with accumulation of work/residence rights over time being the pathway to long-term stays.

Never before has there been such interest, internationally, in how Australia, Canada and New Zealand manage their international migration. Our policy settings, have many broad similarities including: points-based selection systems for skilled migrant streams; a family sponsorship/reunion stream; provision for quotas of refugees; English language requirements (and/or French in Canada); a preference for younger migrants over older ones; and we all give credit for high academic qualifications. There are important differences in our selection systems as well, and these are not just in the specific operational details. Australia manages its selection of skilled migrants much more closely in terms of aligning qualifications and skills with specific jobs, with an increasing emphasis on using international students with Australian education and work experience, as the key pool of

potential approvals in their skilled migrant stream. In New Zealand attempts are made to match skills and experience with demand in the labour market, but there is less concern with quite deliberate alignment of jobs, qualifications and skills. Canada selects on the basis of human capital and is much less inclined to try and match migrant skills with particular jobs.

An excellent comparative analysis of current skilled migrant selection systems in New Zealand, Australia and Canada, and the newly introduced 5 tier system in the United Kingdom, can be found in Chapter 4 ("International approaches to skilled migration") in a major report evaluating Australia's skilled migration categories (Birrell *et al.* 2006). This is probably the most comprehensive contemporary analysis of skilled migrant selection systems in countries deliberately targeting such people as potential settlers. Appended to the report are case studies dealing with skilled migration in New Zealand (Bedford 2006), Canada (Hiebert 2006) and UK (Salt 2006). The report can be downloaded from the website of Australia's Department of Immigration and Multicultural Affairs (DIMA – until recently, DIMIA).

The major assumption underlying the human capital model of immigrant selection that all of the current points systems in Australia, Canada and New Zealand are based on is that people with good education qualifications, appropriate language skills, and appropriate work experience will integrate easily into domestic labour markets. However, this approach to migrant selection is being subjected to increased micro-management, especially in Australia. Recent comparative research on employment experiences of immigrants in Australia and Canada (Richardson and Lester 2004; Hawthorne 2006; Birrell *et al.* 2006) has demonstrated that the labour market outcomes in terms of types of work, incomes, and matching qualifications/skills with jobs are much better in Australia than in Canada. "Picking winners", as Lesleyanne Hawthorne (2005) has called the recent transformation of Australia's skilled migration policy, is attracting a lot of interest in other countries, including New Zealand. It is a new dimension to immigration policy that has upped the competition for the best and brightest in the intensifying battle for brains. Experience with managing immigration is itself a skill that is in demand. Australia, Canada and New Zealand have become models for governments elsewhere who are seeking to develop policy that has a more direct impact on the quality of the population flows into their countries.

In the next section the flows of people into and out of New Zealand for periods of 12 months or more are examined briefly. New Zealand's contemporary international migration system (Bedford 2005) remains heavily influenced by the movements in and out of the country by New Zealanders; own citizen movements are not tracked in many OECD countries but it is clear in the case of New Zealand that these cannot be ignored in either the outflows or the inflows. Traditional sources (especially the UK and Ireland and the island countries of the eastern Pacific) have come to dominate the net migration gains of citizens of other countries again – the system is not nearly as dominated by migration from countries in northeast Asia as it was a decade ago.

The paper concludes with some observations on an important recent trend in immigration in New Zealand and Australia: the transition to permanent residence status from temporary work or student permits. This more flexible approach to the attainment of permits to reside in a country is being adopted in most countries now – it is the "suck it and see" approach to residential migration. The prospective migrants take the opportunity to assess employment opportunities and the quality of life in a prospective new home (perhaps not their only home either), while working or studying on temporary permits and gaining the sort of local experience that is valued in the points-based immigrant selection systems.

Contemporary PLT Migration in New Zealand

New Zealand is the OECD country with the highest per capita rate of immigration, the highest per capita rate of emigration and the second largest diaspora per person (after Ireland) in the resident population. The country is unusual in having such a high level of emigration of citizens at the same time that it has such a very high per capita rate of immigration. In the year ended March 2006 there were 80,125 PLT arrivals, 24,234 or 30 per cent of whom were New Zealand citizens returning after absences overseas of 12 months or more (Statistics New Zealand 2006) (Table 1). Over the same period there were 70,386 PLT departures, 22,088 or 31 per cent of whom were citizens of countries other than New Zealand leaving after a period of residence of 12 months or more. The difference between the numbers of PLT arrivals and departures was +9,739 – the balance between a net loss of 24,064 New Zealand citizens, and a net gain of 33,803 citizens of other countries (Table 1). The broad components of New Zealand's

international population flows are remarkably symmetrical in terms of magnitude. When all of the arrivals and departures (including short-term visitors and tourists) are taken into account the net migration gain falls to 7,386 – the balance between 4.342 million arrivals and 4.320 million departures.

The main groups of people, defined by citizenship, moving to and from New Zealand for 12 months or more during the year ended March 2006 are shown in Table 1. Leaving aside the New Zealand citizens, the major group of non-citizens entering was from the UK and Ireland – just over 15,500 PLT arrivals or 28 per cent of the 55,900 non-NZ citizens who came to New Zealand during the year intending to stay 12 months or more. Citizens from northeast Asia (People's Republic of China, Hong Kong, Taiwan, Korea, Japan) comprised a much smaller group in 2005/06 -- 9,845 (18 per cent of non-NZ citizens).

This was a very different situation from that which prevailed a decade earlier in the year ended March 1996. In that year, the citizens from northeast Asia comprised 18,667 (33 per cent) of the 56,840 non-NZ citizen PLT arrivals, while the citizens of UK and Ireland numbered only 8,147 (14 per cent) (Table 2). Indeed, the position with regard to "traditional" and "non-traditional" sources of immigrants for New Zealand (see Bedford et al. (2002) for an elaboration of this classification of source countries) in 2005/06 was effectively the reverse of that in 1995/96 (Tables 1 and 2). Traditional sources accounted for 60 per cent of the non-NZ citizen PLT arrivals in 2005/06 compared with 36 percent in 1995/96. Citizens of all of the long-established sources of immigrants to New Zealand were more numerous in the PLT arrivals in the year ended March 2006 than they had been in the same year a decade ago.

While numbers of PLT arrivals in the two March years are very similar (80,125 in 2005/06 and 80,228 in 1995/96) there are some major differences in the numbers and citizen distribution of the PLT departures (70,386 in 2005/06 and 50,456 in 1995/96) (Tables 1 and 2). There is a tendency to regard PLT departures essentially as New Zealand citizens leaving the country for 12 months or more. In 1995/96 76 per cent of the PLT departures were New Zealand citizens. Of the remaining 11,931 PLT departures in that year, 8,091 or 68 per cent were citizens of countries that have been traditional sources of migrants to New Zealand for many decades – Australia, the UK and Ireland, North America and the Pacific Islands.

In the larger PLT departure flow in 2005/06, New Zealand citizens leaving, while more numerous than they had been a decade earlier, comprised a smaller share (69 per cent) of the outflow. The proportion of the remaining 22,088 PLT departures who were not travelling on New Zealand passports and who were from traditional sources had also fallen to just over half (53 per cent) (Tables 1 and 2). In fact 30 per cent of the PLT departures, who were not travelling on New Zealand passports, were citizens of countries in northeast Asia – a much higher share than they had been in the out-flow in 1995/96 (17 per cent).

Table 1: PLT arrivals, departures and net migration, 2005/06

Citizenship	Arrivals	Departures	Net gain/loss
New Zealand	24,234	48,298	(24,064)
Traditional sources			
Australia	5,070	3,175	1,895
Pacific Is	5,163	939	4,224
UK/Ireland	15,522	4,389	11,133
Nth/West Europe	4,270	1,487	2,783
Nth America	3,327	1,731	1,596
Sub-total	*33,352*	*11,721*	*21,631*
Non-traditional sources			
Sth/East Europe	1,148	379	769
NE Asia	9,845	6,720	3,125
SE Asia	3,897	1,358	2,539
Sth/Cent Asia	3,700	843	2,857
Middle East	664	126	538
Africa	2,439	486	1,953
Sth/Cent America	846	454	392
Sub-total	*22,539*	*10,366*	*12,173*
NS/not collected	0	1	(1)
Total	**80,125**	**70,386**	**9,739**
Excluding NZ citizens	55,891	22,088	33,803
% Trad. Sources 2006	59.7	53.1	64.0
% Trad. Sources 1996	35.8	67.8	27.3

[Note: last row of Table is duplicated at bottom of Table 2]
Source: unpublished tables provided by Statistics New Zealand

Table 2: PLT arrivals, departures and net migration, 1995/96

Citizenship	Arrivals	Departures	Net gain/loss
New Zealand	23,405	38,525	(15,120)
Traditional sources			
Australia	4,967	2,707	2,260
Pacific Is	3,332	1,029	2,303
UK/Ireland	8,147	2,520	5,627
Nth/West Europe	1,738	773	965
Nth America	2,180	1,062	1,118
Sub-total	*20,364*	*8,091*	*12,273*
Non-traditional sources			
Sth/East Europe	2,528	96	2,432
NE Asia	18,667	2,002	16,665
SE Asia	4,802	1,112	3,690
Sth/Cent Asia	5,142	222	4,920
Middle East	2,391	77	2314
Africa	2,639	156	2,483
Sth/Cent America	307	142	165
Sub-total	*36,476*	*3,807*	*32,669*
NS/not collected	43	33	10
Total	**80,288**	**50,456**	**29,832**
Excluding NZ citizens	56,883	11,931	44,952
% Trad. Sources 1996	35.8	67.8	27.3

Source: unpublished tables provided by Statistics New Zealand

The departure of migrants who have been living in New Zealand for 12 months or more is not necessarily a sign that they have decided to re-emigrate either back to their former homes or on to another new one, like Australia. A recent study of the subsequent mobility behaviour of all migrants who were approved for residence between 1998 and 2004, and took up residence in New Zealand, reveals that for some groups movement in and out of the country is an important feature of their lives here (Shorland 2006). This very timely study reveals a great deal about the movement behaviour of new settlers in New Zealand; it is quite clear from the results that maintaining economic and social connections in more than

one country is as important for many of our recent migrants as it is for New Zealanders who have moved overseas.

The subsequent mobility behaviour of New Zealanders, who migrated to Australia between August 1999 and July 2002, has recently been studied by Lynda Sanderson (2006a, 2006b) using a data set provided by the Department of Immigration and Multicultural Affairs in Canberra. The 112,454 New Zealanders included in the data base had made over 900,000 moves since arriving in Australia, and the majority of these moves had been to and from New Zealand. Settlers are not necessarily intending to stay put when they arrive in their new homes; circulation of people, rather than a one-way movement to a new country of residence is the norm now rather than an exception. As Kofi Annan notes in the UN's recent report on international migration:

> [T]he personal experience of being a migrant has … changed dramatically. Just a quarter of a century ago, going abroad in pursuit of opportunity, or in flight from conflict, meant a wrenching, long-term separation. Contact with home was, at best, a precious five-minute phone call every month, perhaps a visit every few years, and a cherished newspaper that arrived weeks late.
>
> Owing to the communications and transportation revolution, today's international migrants are, more than ever before, a dynamic human link between cultures, economies and societies. Penny-a-minute phone cards keep migrants in close touch with family and friends at home, and just a few seconds are needed for the global financial system to transmit their earnings to remote corners of the … world where they can buy food, clothing, shelter, pay for education or health care, and can relieve debt. The Internet and satellite technology allow a constant exchange of news and information between migrants and their home countries. Affordable airfares permit more frequent trips home, easing the way for a more fluid, back-and-forth pattern of mobility (UN 2006:7).

New Zealand's data on PLT arrivals and departures, when used in conjunction with information on approvals for residence collected by the Department of Labour, demonstrates clearly that migrants to this country are living the new paradigm of international migration. This paradigm emphasizes circulation of population rather than one-way flows of migrants from source countries to destinations (Hugo 1999), and the dual role of many countries, including New Zealand, as both the source of as well as the destination for many of its citizens as well as its immigrants.

Transition to Residence

An integral dimension of the new paradigm of international migration is the shift towards more flexible policies with regard to changes in visa/permit status by people who do not have the right to reside permanently in a country. There has been a fundamental shift in thinking by policy makers in New Zealand about international migration over the past decade. At the time of the national Population Conference in 1997, the discourse about immigration was still overwhelmingly couched in terms of permanent or long-term movement for residence (NZIS 1997; Bedford and Ho 1997). Temporary migration was considered to be a different process and topic altogether. Nine years later, there are virtually no reports being produced by the Department of Labour, or by the significant academic and private sector research providers who specialize in international migration, that do not make reference to temporary as well as permanent movements. The domain of international migration for policy makers, at least in New Zealand, has come to encompass a much wider array of movements than was common in the past.

In their annual report on migration trends, the Department of Labour (2005: 32) reported that:

> Approximately 30 per cent of [temporary] work and student permit holders gain permanent residence within five years of being issued a temporary permit. Although this proportion is relatively steady over time, the increasing number of people approved for work or student permits since 1997/98 has seen a growing number of workers and students transferring to residence. …
>
> Work permit holders are more likely to convert from a temporary permit to residence than students. This finding is expected, given the links between temporary entry policy (such as Work to Residence policy) and permanent residence. Overall, 37 per cent of people issued with a work permit in 1997/98 have subsequently gained permanent residence. The comparable figure for students is 21 per cent.

This is not the place for a detailed analysis of the transition to residence phenomenon; a more comprehensive examination of the statistics relating to workers and students can be found in Bedford and Ho (2006), and the policies that facilitate this movement are discussed in Bedford (2006) and Birrell *et al.* (2006). The important point to appreciate is that transitions to residence are being used now as a major strategy to attract longer-term

residents, especially residents who already have some knowledge of and familiarity with the job market and living conditions in the country to which they are moving. Australia has been targeting international students in particular as potential migrants and the extensive review of the skilled migrant category that was commissioned by DIMA was designed in part to assess how successful his sort of policy has been in producing desirable outcomes for the Australian labour market as well as for the new settlers (Birrell *et al.* 2006).

In New Zealand's case the Department of Labour (2005: 30) has pointed out that:

> Eighty-eight per cent of all principal applicants approved for residence in 2004/05 had previously held a work, study or visitor permit at some stage since July 1997. Principal applicants approved through the skilled/business stream were more likely than principal applicants approved through the other two residence schemes [family sponsorship and international/humanitarian] to have held a temporary permit prior to residence (92 per cent). Of this 92 percent, most (80 per cent) had previously held a work permit.

The nationalities with the highest incidence of prior visits, work or study before applying for residence were South Korea (99 per cent), Japan (98 per cent), Germany (97 per cent), South Africa (96 per cent), the USA (95 per cent) and the UK (90 per cent). Almost half of the 15,174 principal applicants approved for residence in 2004/05, who had held a permit before applying for residence, had been issued with a labour market tested work permit. A further 30 per cent had been issued to immigrant partners or spouses of New Zealand residents and citizens.

Clearly, transfers from work and study are becoming a very important route to residence in New Zealand, and it is no longer advisable to treat temporary permits as a completely separate category of migration policy. Good employment and settlement outcomes for both the migrants and the host society are critical determinants of the success of contemporary immigration policy, and the work to residence transition provides one very effective route to building the experience and capability required to achieve these outcomes. The links between temporary and permanent movement are inextricably interwoven in the lives of those approved for residence, and policy makers concerned about their settlement and labour market experiences need to be fully aware of this interconnectedness between forms

of movement which have tended to get treated separately for policy purposes.

A Concluding Comment

The pivotal space for the debate about immigration remains the nation. As the Secretary-General for the United Nations notes, "It is for Governments to decide whether more or less migration is desirable" (UN 2006:8). However, the stage within which national policy and debate is taking place has taken on new dimensions in recent years. As the UN (2006:9-10) acknowledges:

> Many, if not most, States understand that international migration cannot be managed unilaterally. Consequently, country partnerships and bilateral agreements on migration are multiplying. In addition, regional consultative processes on international migration have been established in most parts of the world. The latter have proved useful in building trust and promoting cooperation among Governments. But migration is not only a regional phenomenon. Its scale and complexity are global. Furthermore, international migration, like trade and finance, is a fundamental feature of today's world system. And like trade and finance, migration demands attention at a global level.

There is plenty of scope for innovative, challenging and rewarding work in the migration field, especially as most developed countries, including New Zealand, as well as many of the less developed ones, are in the process of reviewing and amending their immigration policies and regulations so that they can compete better and cope better in the rapidly changing world of international migration.

Acknowledgement

This is a revised version of a paper presented at the LexisNexis Immigration Law Conference in May 2006. The research on which the paper is based is being supported by the Foundation for Research, Science and Technology through the "Strangers in Town" programme that is based at the University of Waikato. We acknowledge the support of staff and students in the Migration Research Group and the Population Studies Centre with the research.

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Tūhoe on the Move: Regional Mobility

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Abstract

Academic interest in geographic mobility of indigenous peoples has increased in recent years with a corresponding growth in the literature relating to Māori mobility more specifically. With this greater acknowledgement of Māori issues has also come an awareness of the need for iwi-specific research because of the diversity within and between Māori and iwi. The present research contributes to a larger project exploring Tūhoe regional mobility. In this paper, we analyse published data and unpublished census data from 2001 that relate specifically to Tūhoe regional mobility and the relationship between mobility and language. Region of residence in 1996 and 2001 were analysed in relation to age, sex, and broad language groups. Overall, this analysis found important and diverse relationships between age, sex, language, and region of residence in New Zealand among Māori who identify as Tūhoe. For example, patterns of mobility for different age groups and sex had some similarities with other research, such as a higher proportion of "stayers" in older age groups, but differences were also found, such as higher proportions of "movers" among females in some age groups. Interestingly, we found that language between "movers" and "stayers" differed depending on the region of residence. A greater proportion of "movers" were able to converse in Māori in Auckland and the Waikato, but a slightly greater proportion of "stayers" could converse in Māori in the Hawke's Bay and Bay of Plenty. These results suggest that geographic mobility among Māori, and Tūhoe more specifically, are complex and should not be overly-simplified in more aggregate analyses.

Geographic mobility of indigenous peoples has received growing academic interest. In New Zealand, this was highlighted by the April 2005 International Association for Official Statistics (IAOS) Satellite Meeting on Measuring Small and Indigenous Populations held at

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Te Papa Tongarewa in Wellington and the publication of a major edited book by Taylor and Bell (2004). There is also a small but growing body of literature relating to Māori migration (eg. Barcham 2004; Bedford & Pool 2004; Nikora, Rua, Te Awekotuku, Guerin & McCaughey, submitted; Nikora, Guerin, Rua & Te Awekotuku 2004; Scott & Kearns 2000). The literature relating to Māori migration and geographic mobility has drawn mostly on data from Statistics New Zealand, particularly census data (eg. Bedford, Didham, Ho & Hugo 2005; Sin & Stillman 2005), but others have used in-depth interview studies to explore mobility among particular iwi and hapu (Nikora *et al.* submitted; Nikora *et al.* 2004; Scott & Kearns 2000). Māori mobility has political, social, economic, and cultural implications (Barcham 2004) which can only be fully understood using a variety of methods and, minimally, consultative interpretation of data with those who are affected.

Bedford, Didham, Ho and Hugo (2005) examined 2001 census data of Māori internal and international migration. Bedford *et al.* (2005) found that of Māori in New Zealand aged five years and older, only 38 per cent had the same residence in 1996 and 2001. In Australia, only 26 per cent of Māori aged five years and older lived in the same place in 1996 and 2001. With roughly 50 per cent of the total New Zealand population living in the same residence, this is "high mobility". Bedford *et al.* (2005) also showed that one-third of the Māori movement was intra-regional and a smaller proportion had moved between regions (New Zealand -- 13.6 per cent) or states (Australia -- 5.0 per cent). Bedford *et al.* (2005) also found that, overall, internal migration of Māori in Australia and New Zealand was within major urban areas.

Sin and Stillman (2005) explored geographic internal mobility of Māori in New Zealand between 1991 and 2001. Based on the assumptions that Māori are less mobile than other ethnic groups due to attachments to geographic locations (Walker 1990) and that less mobility could economically disadvantage Māori, they examined mobility of Māori and Europeans in the same areas. They found that, in this context, Māori were generally more mobile than Europeans and that Māori mobility increased in the late 1990s. However, when they explored mobility in roughly the iwi takiwā (tribal region), they found the opposite to be true: that is, higher mobility of Europeans compared with Māori. They also found that Māori

with higher qualifications were more mobile than similarly qualified Europeans. They suggest, based on these data, that social ties are more important than land ties to explain decreased mobility of Māori in their own iwi regions but that "land-based attachment is also an important impediment to mobility" (Sin & Stillman 2005:3).

In the Bedford, Didham, Ho and Hugo (2005) study, high mobility of Māori was emphasized, but no judgement was made as to whether this mobility was a positive or negative finding. On the other hand, Sin and Stillman (2005) began with an exploration of Māori mobility based on data showing lower mobility of Māori compared with non-Māori and that, for economic reasons, this is problematic. While analysing Māori mobility in general provides us with a better understanding of issues relating to mobility that may impact on Māori, there are differences between iwi that will likely be lost in such general analyses.

Nikora *et al.* (2004) explored, through intensive interviews, the mobility of Tūhoe out of the Bay of Plenty region (which is broadly the iwi takiwā for Tühoe) to the Waikato region (which is generally the iwi takiwā for Tainui). Overall, Nikora *et al.* (2004) found that most Tūhoe who migrated to the Waikato wanted to eventually return to their "home"; that their Tūhoe identity had increased as a result of migration; and that many developed an appreciation of other Māori iwi and traditions. Nikora *et al.* (submitted) found even more complex relationships concerning mobility when they interviewed Tūhoe still living in the iwi takiwā. Many were keen for the young people to move away for education and employment but clearly believed that they would return.

Both of these studies (Nikora *et al.*, submitted; Nikora *et al.*, 2004) reported a lack of detailed statistics about Tūhoe mobility in New Zealand, which hampered efforts to make full sense of the movements and the reasons for moving. The purpose of the present paper, therefore, is to extend the findings of the Nikora *et al.* (2004 and submitted) studies with an analysis of published and unpublished data available from the 2001 Census specific to Tūhoe (Statistics New Zealand). We first present some general data for Tūhoe such as areas of residence in New Zealand and age and sex distribution. We then present data relating to Tūhoe "movers" and "stayers" and provide an initial analysis of related characteristics such as language,

sex and age. One aspect that has not been explored previously is if and how language might interact with regional mobility.

Method

We first sourced previously published data relevant specifically to Tūhoe and provide a brief summary. We then obtained unpublished data tables from the 2001 Census from Statistics New Zealand that included usual residence in 2001 for New Zealand residents who identified as Tūhoe and usual residence "five years ago" (based on 2001 area definitions). "Movers" and "stayers" were defined regionally and therefore are reflective of mobility between regions and do not reflect intra-region or international mobility. "Movers" were identified as those people who lived in a different region "five years ago" compared to 2001 and "stayers" were those who lived in the same region in 2001 and "five years ago". Within these data we also obtained sex (male, female and total), age (in broad age groups: 0-4, 5-14, 15-24, 25-44, 45-64, and 65+), and language information. For clarity, we only present language information in terms of English Only and Māori + (which includes those who could speak Māori only, Māori and English, Māori and Other (not English) and Māori, English and Other). This question in the census form asks "In which language(s) could you have a conversation about a lot of everyday things?" All data were rounded to base three in Census data and therefore do not necessarily add up between and across cells.

Results and Discussion

Some Demographics of Tūhoe

Statistics New Zealand (2002a, b) showed that there were 25,917 Tūhoe in 1996 and 29,259 in 2001; a 13 per cent increase compared with an average increase of 4 per cent for all Māori. This is a large increase whether it is due to actual increase in numbers or propensity to report affiliation with Tūhoe. Overall, Tūhoe were reported to have the youngest population out of the ten largest iwi with 42 per cent under the age of 15 compared with 37 per cent under the age of 15 for all Māori (Statistics New Zealand 2002a). Tūhoe were also more likely than other iwi to indicate that they belonged to the Māori ethnic group (95 per cent) as opposed to the Non-Māori ethnic group (Statistics New Zealand 2002a). Of the ten largest iwi, Tūhoe also had the

largest proportion who could converse in Māori (42 per cent) compared with only 21 per cent of all Māori (Statistics New Zealand 2002a).

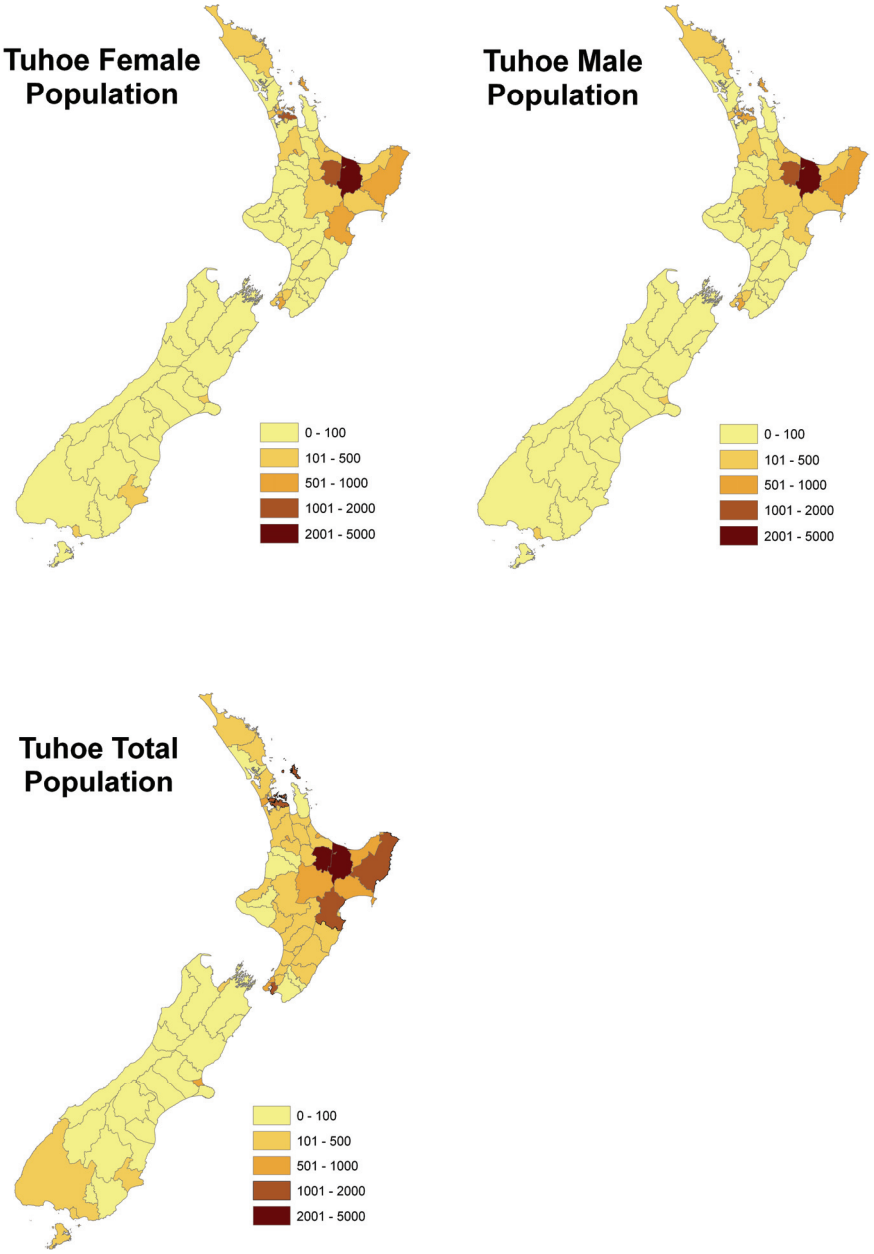
Economically, Tūhoe had the lowest median total personal income ($13,600 compared with $15,600 for all Māori) and were the least likely to own or partly own their home (27 per cent compared with 35 per cent for all Māori) among the ten largest iwi (Statistics New Zealand 2002a). Compared with other iwi in the ten largest iwi and the Māori total, Tūhoe were also the least likely to have household access to a telephone (84 per cent compared with 90 per cent of all Māori), the Internet (20 per cent compared with 29 per cent of all Māori), and to a fax machine (12 per cent compared with 18 per cent of all Māori). A larger proportion of Tūhoe did not have access to a motor vehicle (17 per cent compared with 12 per cent of all Māori) (Statistics New Zealand 2002a, b).

Statistics New Zealand (2002a, b) also found a slight increase in 2001 (81 per cent) in the proportion of Tūhoe living outside the iwi takiwā (tribal region) compared with 1996 (79 per cent). Statistics New Zealand (2003) also reported that the majority of Tūhoe (81 per cent) lived in urban areas (ie. towns or cities with 1,000 or more people) and that living in urban areas was age-related, with more than 80 per cent of those younger than 34 living in urban areas while only 69 per cent of people 65 years or older were living in urban areas.

Figure 1 shows the distribution of males, females and total Tūhoe living in New Zealand in 2001 by territorial authority (see Appendix 1 for full data table of these statistics). This figure clearly illustrates the concentration of Tūhoe in the Tūhoe takiwā and surrounding areas (Rotorua and Whakatane districts).

Table 1 shows the number of males, females, and total living in various regions in 2001 and "five years ago". The percentage of the total living in each of these regions is presented in brackets. The "five year ago" percentages exclude those who were not born "five years ago". The distribution of Tūhoe throughout New Zealand only changed slightly from "five years ago" to 2001, with a slightly greater proportion of Tūhoe living in Auckland and the Waikato in 2001 compared with "five years ago". Approximately 15 per cent of those in 2001 were not born "five years ago", which did not differ between regions. Overall, Table 1 shows that the highest proportions (35 per cent) of Tūhoe lived in the Bay of Plenty,

Figure 1: Tūhoe Female, Male and Total population distribution in New Zealand by territorial authority (2001 Census)



followed by Auckland, the "Rest of the North Island", Wellington and the Waikato. Only one per cent of Tūhoe indicated being overseas "five years ago". The vast majority of Tūhoe lived in the North Island, with only six per cent living in the South Island "five years ago" and seven per cent in 2001.

Table 1: Number (proportion) of Tūhoe living in selected regions "five years ago" and in 2001, in the 2001 Census

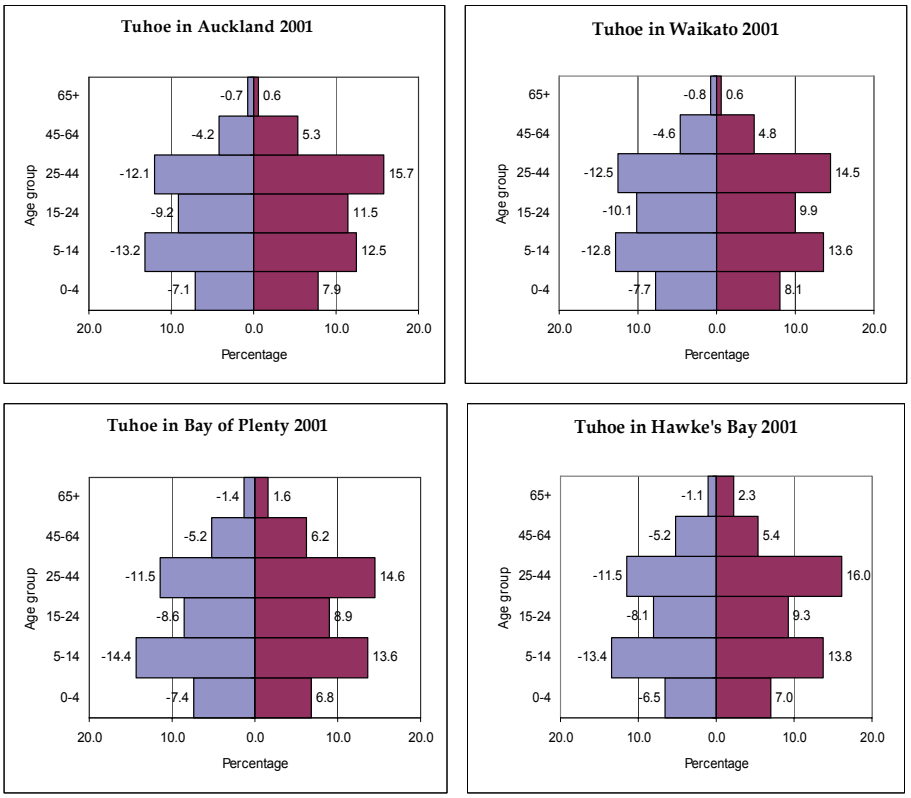
	"five years ago"			2001		
Region	Male (%)	Female (%)	Total (%)*	Male (%)	Female (%)	Total (% of total)
Auckland	1836 (15)	2100 (15)	3939 (15)	2412 (16)	2775 (17)	5187 (17)
Waikato	1032 (8)	1176 (9)	2208 (8)	1431 (10)	1527 (10)	2961 (10)
Bay of Plenty	4203 (34)	4656 (34)	8859 (34)	5220 (36)	5583 (35)	10803 (35)
Hawke's Bay	897 (7)	1032 (7)	1929 (7)	1041 (7)	1221 (8)	2262 (7)
Wellington	1272 (10)	1452 (11)	2724 (10)	1629 (11)	1692 (11)	3321 (11)
Rest of North Island	1401 (11)	1731 (13)	3135 (12)	1839 (13)	2139 (13)	3978 (13)
Total North Island	10644 (86)	12144 (88)	22791 (87)	13575 (93)	14934 (93)	28509 (93)
South Island	816 (7)	864 (6)	1680 (6)	1068 (7)	1077 (7)	2148 (7)
Overseas	150 (1)	153 (1)	300 (1)			
NEI	771 (6)	648 (5)	1416 (5)			
Not born five years ago				2268	2208	4479
Total	12378	13812	26187	14646	16020	30666

Source: Statistics New Zealand, unpublished data.
Notes: The per cent of total "five years ago" excludes those who were not born five years ago. Note that the totals in these tables include everyone who indicated belonging to the Tūhoe iwi in the 2001 census (including both Māori and no- Māori descent and Not Elsewhere Indicated). This explains the differences in total counts of Tūhoe in the data presented in this report and the numbers presented in published tables by Statistics New Zealand.

Figure 2 illustrates the age and sex distribution of Tūhoe in selected regions in New Zealand in 2001, broken into broad age groups. These data show that the highest proportion of 15-24 year old males was in the Waikato and females were in Auckland, while the lowest proportions of males were in the rest of the North Island and Hawke's Bay and females in the Bay of Plenty. Hawke's Bay had the highest proportion of females in the 25-44 age group and the South Island had the highest proportion of males. The lowest

proportions in the 25-44 age group for males were in the Bay of Plenty and Hawke's Bay and for females, in the Waikato and Bay of Plenty. The highest proportions of males and females aged over 45 lived in Bay of Plenty and Hawke's Bay. These data support concerns by Nikora, *et al.* (submitted) about the lower proportions of youth and higher proportions of elderly in the Tūhoe takiwā and the social consequences that can result from this pattern. There were, however, very little regional differences in the younger age groups (0-4 and 5-14).

Figure 2: Age-sex pyramids for Tūhoe living in selected regions in New Zealand in 2001. Proportions of males are depicted on the left and females on the right



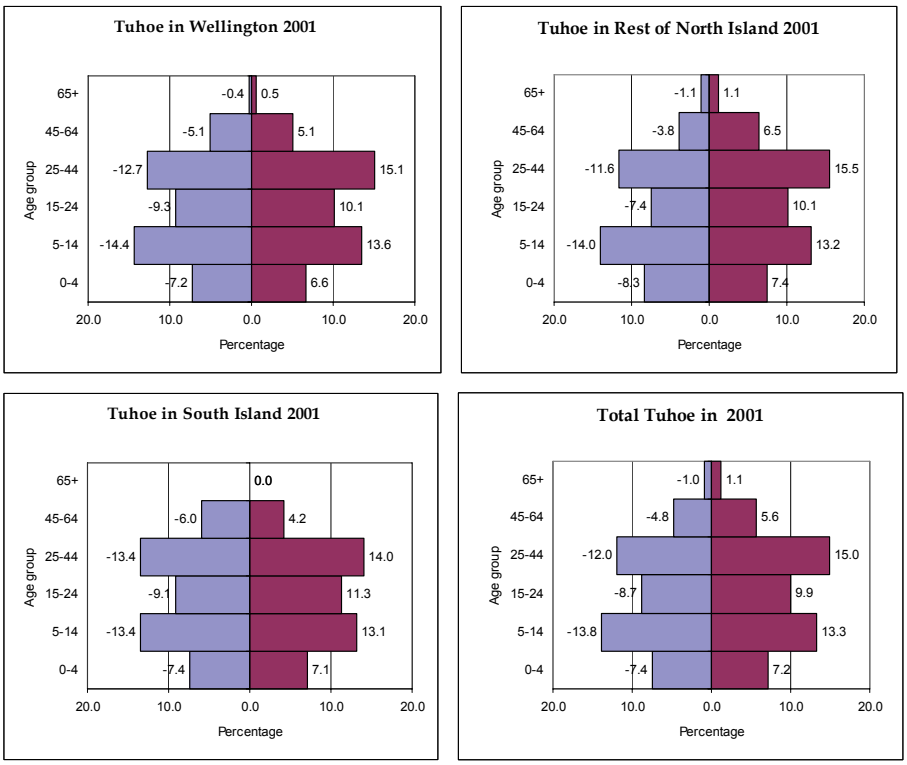


Table 2 shows the numbers (top section) and percentages (bottom section) of Tūhoe "stayers" and "movers" who were living in various regions in 2001 and their usual residence "five years ago". For example, we see that 82 per cent of Tūhoe living in the Bay of Plenty in 2001 also lived in the Bay of Plenty "five years ago" (ie. "stayers", in bold type and underlined) and that 12 per cent of Tūhoe who lived in the Waikato in 2001 lived in the Bay of Plenty "five years ago" (ie. "movers"). The Hawke's Bay and Wellington regions also had high proportions of "stayers" (78 per cent and 79 per cent, respectively). The Waikato region, however, had the highest mobility with only 68 per cent living there in 2001 compared with "five years ago". Of Tūhoe living in the Auckland and Waikato regions in 2001, 10 per cent and 12 per cent (respectively) came from the Bay of Plenty. Of Tūhoe living in Hawke's Bay in 2001, five per cent had lived in the Bay of Plenty "five years ago" and four per cent lived elsewhere in the north island. Crothers (2002) also reported a high proportion (85 per cent) of "stayers" in the Auckland region for all Māori from 1991-1996 and similar patterns of exchange between Auckland, Waikato and Bay of Plenty regions.

Table 2: Number and Percentages of Tūhoe "Stayers" (in bold type and underlined) and "Movers" aged five years and over in selected regions in New Zealand

	2001 Residence						
	Auckland	Waikato	Bay of Plenty	Hawke's Bay	Wellington	Rest of NI	South Island
Residence "five years ago"			Actual Number				
Auckland	**3219**	96	285	42	60	192	42
Waikato	126	**1689**	198	27	39	93	36
Bay of Plenty	447	303	**7575**	105	123	225	78
Hawke's Bay	51	45	108	**1515**	69	111	33
Wellington	57	45	186	39	**2253**	05	39
Rest of NI	183	111	228	87	93	**3093**	69
South Island	36	39	81	18	66	42	**1404**
Other*	297	165	612	123	159	216	138
Total	4416	2493	9273	1956	2862	4077	1839
			Percentages				
Auckland	**73**	4	3	2	2	6	2
Waikato	3	**68**	2	1	1	3	2
Bay of Plenty	10	12	**82**	5	4	7	4
Hawke's Bay	1	2	1	**78**	2	3	2
Wellington	1	2	2	2	**79**	3	2
Rest of NI	4	4	2	4	3	**71**	4
South Island	1	2	1	1	2	1	**76**
Other*	7	6	7	7	7	6	8
Total	100	100	100	100	100	100	100

Source: Statistics New Zealand, unpublished data.
*Overseas and Not Elsewhere Indicated

Table 3 depicts the inter-regional net gains and losses of Tūhoe, showing that, overall, inter-regionally, Auckland had the greatest net gain of 183 Tūhoe and that the Bay of Plenty had the greatest overall loss (195) due to inter-regional mobility. Table 3 shows that the Bay of Plenty lost 162 Tūhoe to Auckland and 105 to the Waikato from 1996 to 2001, but gained 72 in total from Hawke's Bay, Wellington, the Rest of the North Island and from the South Island. Auckland"s greatest gains were from the Bay of Plenty and the Waikato. Overall, Auckland and the Bay of Plenty had the greatest gains (183 and 120, respectively) and the Bay of Plenty and the Hawke's Bay had the greatest losses (195 and 99, respectively). This contrasts with 1991-1996 data for all Māori (Te Puni Kōkiri 2001) in which the Bay of Plenty had the highest net gain of Māori (1011 people) with the

highest net gains from the Waikato and Wellington and the greatest net loss to Auckland, but of only 57 people. This either suggests that the overall pattern changed from 1996 to 2001, or that the mobility patterns of Tūhoe are different compared with Māori more generally.

Table 3: Inter-Regional Net Gain/Loss of Tūhoe aged five years and over in selected regions in New Zealand

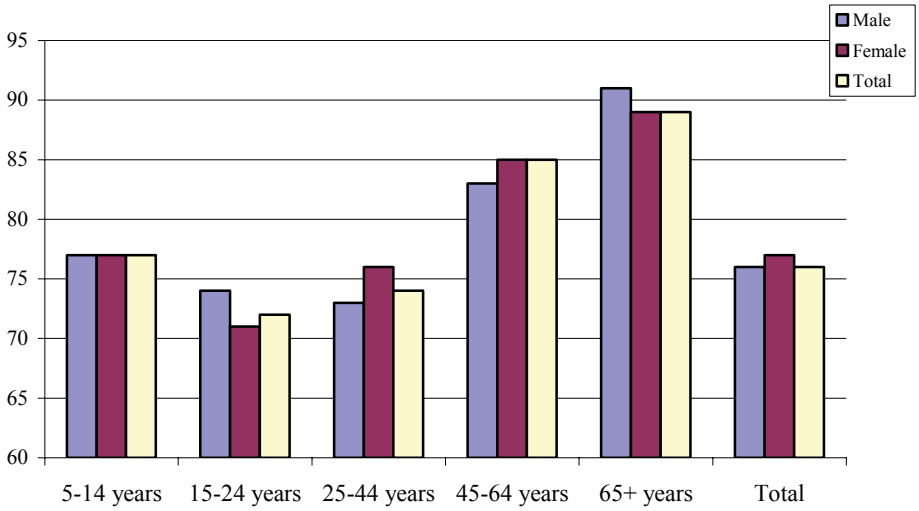
	Inter-Regional Net Gain/Loss							
	2001 Residence							
Residence "five years ago"	Auckland	Waikato	Bay of Plenty	Hawke's Bay	Wellington	Rest of NI	South Island	5yr ago Total
Auckland	0	-30	-162	-9	+3	+9	+6	3936
Waikato	+30	0	-105	+18	-6	-18	+3	2208
Bay of Plenty	+162	+105	0	-3	-63	-3	-3	8856
Hawke's Bay	+9	-18	+3	0	+30	+24	+15	1932
Wellington	-3	+6	+63	-30	0	+12	-27	2724
Rest of NI	-9	+18	+3	-24	-12	0	+27	3864
South Island	-6	-3	+3	-15	+27	-27	0	1686
Inter-regional Gain/Loss	+183	+78	-195	-63	-21	-3	+21	
2001 Total**	**4119**	**2328**	**8661**	**1833**	**2703**	**3861**	**1701**	**25206**
Total Gain/ Loss from 1996-2001	+183	+120	-195	-99	-21	-3	+15	

** Does not include Overseas and Not Elsewhere Indicated

Figure 3 illustrates the proportion of "stayers" by age and sex. The figure shows that, overall, a higher proportion of females were "stayers" compared to males, but that this pattern differed depending on the age group. Specifically, a higher proportion of females were "stayers", particularly in the 25-44 and 45-64 age groups, and there were no sex differences in the 5-14 age group. Interestingly, although other research found that young males are more mobile (and not "stayers") compared to females, these data show that for two age groups, 15-24 and 65+, a higher proportion of *males* were "stayers" compared with females. This finding may reflect mobility due to educational and employment differences shown in other data for Tūhoe (Statistics New Zealand 2003). Specifically, Tūhoe women were found to be more likely than Tūhoe males to have a formal educational qualification (61 per cent compared with 53 per cent) and a post-school qualification (24 per cent compared with 21 per cent). Other contributing factors may be the higher proportions of part-time or unemployed Tūhoe women, which would

enable greater mobility, and the occupational differences between Tūhoe women and men (Statistics New Zealand 2003). For example, while Tūhoe men within the iwi takiwā were mostly agriculture and fishery workers (26 per cent) and plant and machine operators and assemblers (24 per cent), outside the iwi takiwā they were plant and machine operators and assemblers (23 per cent) and lower proportions across a range of occupations. Interestingly, for both men and women, a higher proportion of professionals were employed inside the iwi takiwā than outside (20 per cent of women professionals were employed inside the iwi takiwā and 15 per cent outside and for men, 10 per cent and 7 per cent, respectively). The higher proportion of Tūhoe women employed in jobs such as service and sales workers, clerks and professionals may also contribute to higher mobility in the 15-24 age group and decreased mobility in the 25-64 age groups.

Figure 3: Proportion of "stayers" by age and sex



Source: Statistics New Zealand, unpublished data

Table 4 shows the number and proportion of Tūhoe "stayers" in the selected regions (Auckland, Waikato, Bay of Plenty, Hawke's Bay, Wellington, Rest of the North Island and the South Island) by broad age groups (5-14, 15-24, 25-44, 45-64, and 65+) and sex. Overall, a slightly higher proportion of females were "stayers" than males in each of the regions, and that, regionally, the Bay of Plenty had the highest proportion of "stayers" (82 per cent) and the Waikato had the lowest (68 per cent). The highest proportions

of "stayers" were among 65+ year old males in the Hawke's Bay (100 per cent) and in the total for the South Island (100 per cent). The lowest proportion of "stayers" was among females (58 per cent) and males (63 per cent) aged 15-24 in the Waikato. This pattern is consistent with qualitative data indicating movement away from the iwi takiwā to the Waikato and Auckland for education and employment opportunities in this age group (Nikora *et al.* 2004; submitted) and as indicated above.

Table 4: The number of "Stayers" (proportion) in selected regions by age group and sex

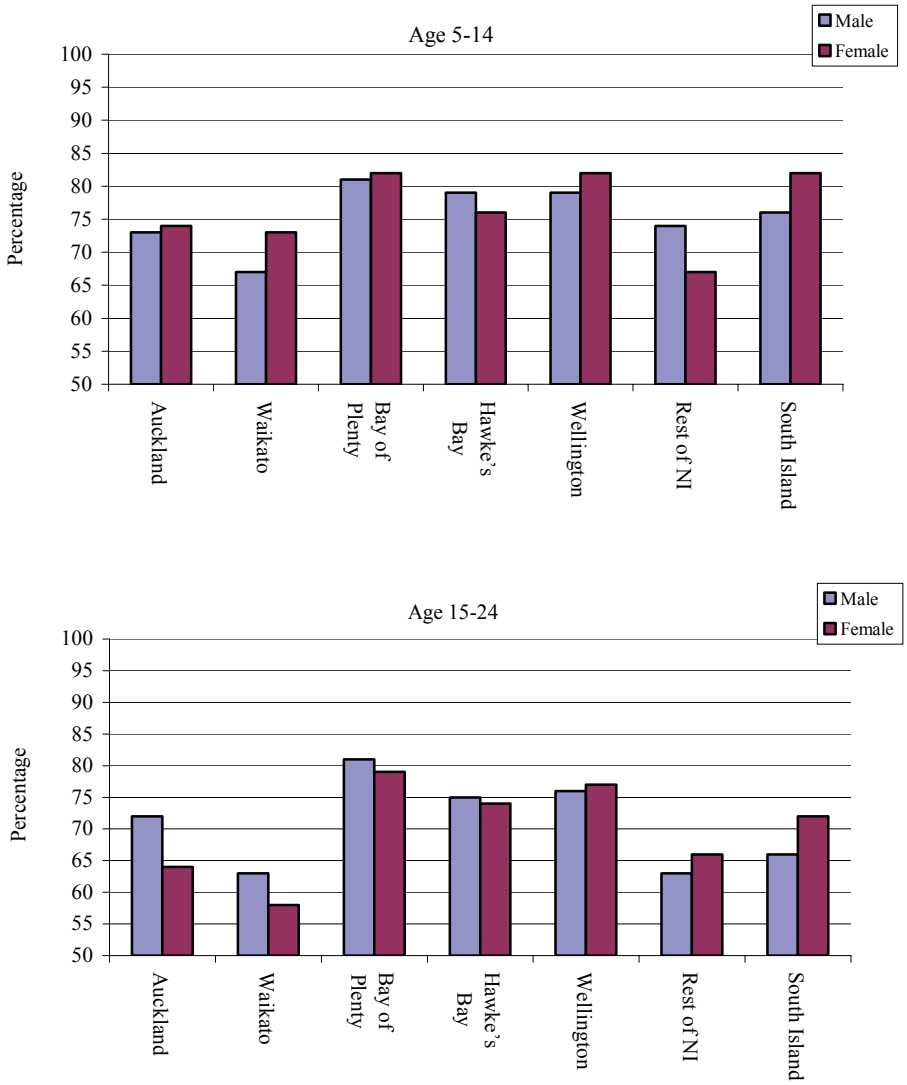
Age	Auckland	Waikato	Bay of Plenty	Hawke's Bay	Wellington	Rest of NI	South Island	Total
5-14	987 (74)	549 (70)	2457 (81)	477 (77)	747 (81)	765 (71)	453 (79)	6435 (77)
Male	504 (73)	252 (67)	1257 (81)	240 (79)	378 (79)	411 (74)	219 (76)	3216 (77)
Female	480 (74)	294 (73)	1200 (82)	237 (76)	369 (82)	354 (67)	231 (82)	3165 (77)
15-24	726 (68)	357 (60)	1512 (80)	294 (74)	492 (76)	453 (65)	303 (70)	4137 (72)
Male	345 (72)	189 (63)	750 (81)	138 (75)	234 (76)	186 (63)	129 (66)	1971 (74)
Female	381 (64)	171 (58)	762 (79)	156 (74)	258 (77)	267 (66)	174 (72)	2169 (71)
25-44	1038 (72)	534 (67)	2241 (80)	471 (75)	702 (76)	741 (69)	426 (72)	6153 (74)
Male	444 (71)	240 (65)	975 (79)	192 (74)	315 (74)	300 (65)	201 (70)	2667 (73)
Female	597 (73)	294 (69)	1266 (81)	276 (76)	387 (77)	441 (71)	225 (75)	3486 (76)
45-64	414 (84)	213 (78)	1074 (87)	207 (85)	288 (86)	321 (78)	201 (91)	2718 (85)
Male	174 (79)	96 (71)	480 (86)	96 (82)	141 (84)	120 (78)	120 (93)	1227 (83)
Female	237 (86)	114 (81)	591 (88)	108 (88)	144 (86)	198 (77)	81 (90)	1473 (85)
65+	54 (82)	36 (86)	291 (91)	69 (92)	27 (90)	81 (93)	21 (100)	579 (89)
Male	30 (83)	--	138 (94)	24 (100)	--	--	--	270 (91)
Female	27 (82)	--	153 (88)	45 (88)	--	--	--	312 (89)
Total	3219 (73)	1689 (68)	7575 (82)	1515 (78)	2253 (79)	2367 (71)	1404 (76)	20022 (65)
Male	1497 (73)	798 (66)	3600 (81)	690 (77)	1077 (78)	1059 (70)	684 (75)	9405 (64)
Female	1722 (73)	891 (69)	3975 (82)	822 (77)	1176 (80)	1305 (71)	720 (79)	10611 (66)

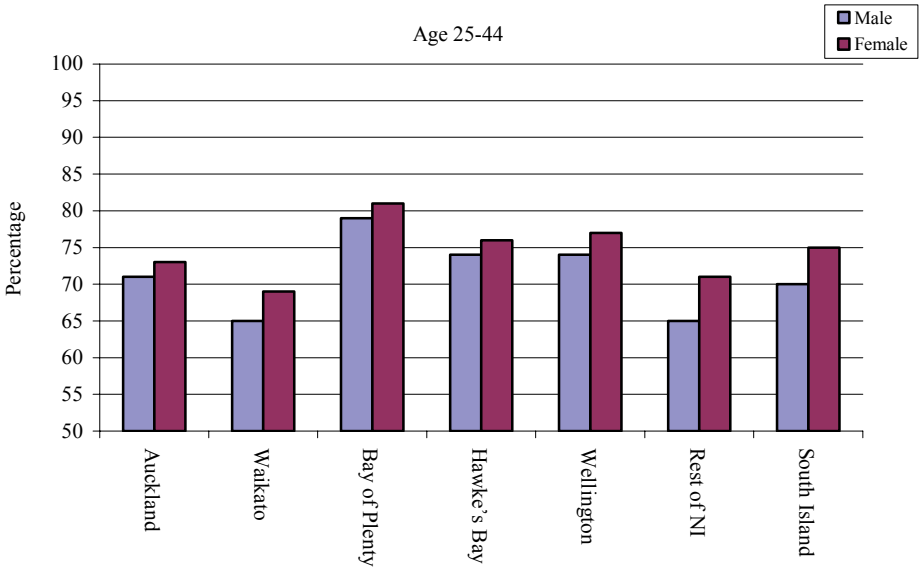
Source: Statistics New Zealand, unpublished data.
-- Numbers too small to calculate
Note: Due to base-3 rounding, data do not necessarily add up between and across cells

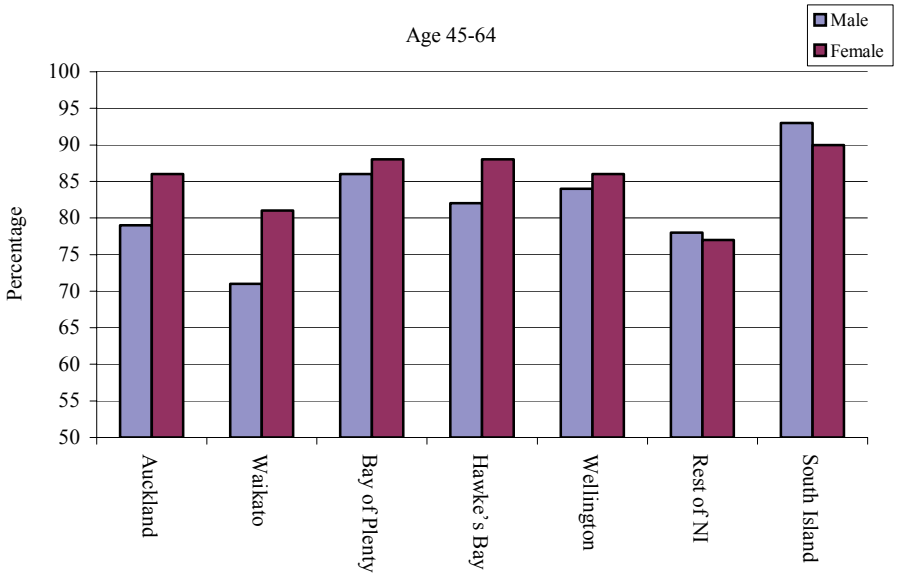
Figure 4 illustrates graphically data from Table 4 and shows the general trend of a higher proportion of female "stayers" compared to males, but also illustrates the important deviations with that trend when age and region are considered. For example, in the 5-14 age group, more males than females were "stayers" in the "Rest of the North Island" and in the Hawke's Bay. In

the 15-24 age group, more males than females were "stayers" in Auckland, Waikato, Bay of Plenty and Hawke's Bay and females were "stayers" in the Wellington, Rest of North Island and South Island regions. In the 25-44 age group, a higher proportion of females were "stayers in all regions. Interestingly, in the 45-64 age group, a higher proportion of females were "stayers" in all regions except the "Rest of NI" and the South Island.

Figure 4: The proportion of "Stayers" in selected regions by age group and sex







Source: Statistics New Zealand, unpublished data.

Language

Tūhoe have the highest proportion of te reo Māori speakers in New Zealand with 42 per cent reporting in the 2001 Census that they were able to have an everyday conversation in Māori compared with only 22 per cent of all Māori in New Zealand (Statistics New Zealand 2003). The proportion of

Māori speakers was higher within the iwi takiwā (55 per cent) than outside (39 per cent) and was higher among older Tūhoe than younger (Statistics New Zealand, 2003). Te Puni Kōkiri reported on the health of the Māori language in eight regions of New Zealand (2002) and we extracted from those reports data relevant to Tūhoe (see Table 5). Overall, the Te Puni Kōkiri report showed that 11,718, or 40 per cent, of Tūhoe could speak te reo Māori. We also looked at the number of te reo Māori speakers and the Māori language rate in Tainui (which includes part or all of the Thames-Coromandel, Hauraki, Waikato, Matamata-Piako, Hamilton City, Waipa, South Waikato, Otorohanga, Rotorua, Waitomo and Taupō districts), Tāmaki-Makau-Rau (Auckland region), Te Tairāwhiti (Gisborne and Hawke's Bay regions), and Waiariki (Tauranga, Ōpōtiki, Western Bay of Plenty, Kawerau, Rotorua, Taupō, & Whakatāne). Table 5 shows that the Māori language rate was the highest in Waiariki, which is the Māori region that most closely corresponds to the Tūhoe takiwā.

Table 5: The number of Tūhoe te reo Māori speakers and the Māori language rate for selected Māori regions

Region	Number of Tūhoe te reo Māori speakers	Māori language rate for Tūhoe
Tainui	1068	37
Tāmaki-Makau-Rau	1700	33
Te Tairāwhiti	1494	41
Waiariki	4686	46

Source: Te Puni Kōkiri 2003

Table 6 depicts "stayers" and "movers" by language, age and sex. Table 6 shows that males in the 45-64 and 65+ age groups had the highest proportions who could speak Māori +. The lowest proportions speaking "English only" were males and females in the 65+ age group. While slightly higher proportions of females indicated speaking Māori in the younger age groups, generally, slightly more males could speak Māori in the older age groups. Table 6 also shows that in the 15-24, 25-44 and 45-64 age groups, a higher proportion of "movers" could speak Māori compared with "stayers". Interestingly, although slightly higher proportions of males could converse in Māori in the 15-24 and 25-44 age groups, a much higher proportion of

females (70 per cent) could converse in Māori in the 45-64 age group amongst "movers" compared with males (57 per cent). Amongst "stayers", a higher proportion of females could converse in Māori in the younger age groups (5-14 and 15-24), but more males could converse in Māori in the older age groups (25-44, 45-64, and 65+). Overall, the proportion of those who could converse in "English only" decreased with age with much diversity between males and females, "movers" and "stayers" and age. (Note: data for the 65+ age group is not shown in the "movers" due to insufficient numbers in that group).

Table 6: The number of "Stayers" (proportion) and "Movers" (proportion) by age group and sex who could speak Māori and other languages (Māori +) or English Only

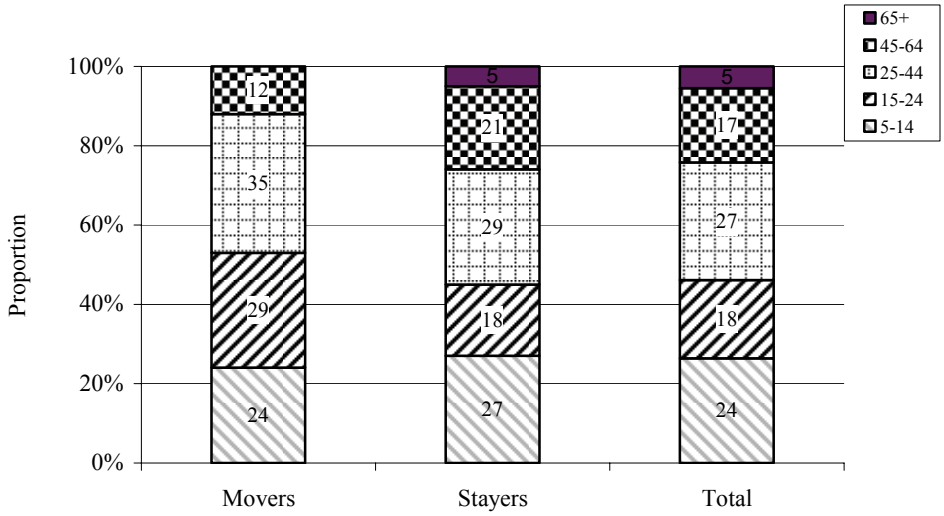
	"Movers"			"Stayers"			Total		
Age	Māori + (%)	English Only (%)	Total	Māori + (%)	English Only (%)	Total	Māori + (%)	English Only (%)	Total
5-14	**486 (34)**	**900 (63)**	1428	**2274 (35)**	**4038 (63)**	6435	**2958 (35)**	**5199 (62)**	8334
Male	231 (32)	480 (67)	720	1134 (35)	2079 (64)	3261	1479 (35)	2685 (63)	4245
Female	246 (35)	453 (64)	705	1149 (36)	1959 (62)	3165	1479 (36)	2517 (62)	4086
15-24	**597 (46)**	**681 (52)**	1305	**1563 (38)**	**2502 (60)**	4137	**2271 (40)**	**3345 (58)**	5727
Male	270 (48)	282 (51)	558	684 (35)	1248 (63)	1971	1014 (38)	1611 (60)	2679
Female	342 (46)	390 (53)	738	885 (41)	1251 (58)	2169	1257 (41)	1734 (57)	3048
25-44	**720 (44)**	**900 (55)**	1629	**2451 (40)**	**3612 (59)**	6153	**3369 (41)**	**4764 (58)**	8271
Male	327 (45)	408 (56)	723	1089 (41)	1518 (57)	2667	1548 (42)	2064 (56)	3672
Female	381 (43)	510 (57)	891	1356 (39)	2088 (60)	3486	1818 (40)	2700 (59)	4599
45-64	**252 (71)**	**114 (32)**	357	**1749 (64)**	**921 (34)**	2718	**2079 (65)**	**1080 (34)**	3210
Male	114 (57)	75 (37)	201	819 (67)	378 (31)	1227	993 (67)	465 (31)	1485
Female	132 (70)	60 (32)	189	921 (63)	540 (37)	1473	1083 (63)	615 (36)	1728
65+	--	--	--	**462 (80)**	**108 (19)**	579	**519 (80)**	**117 (18)**	648
Male	--	--	--	231 (86)	42 (16)	270	243 (82)	48 (16)	297
Female	--	--	--	249 (80)	57 (18)	312	273 (78)	66 (19)	351
Total	2061 (43)	2610 (55)	4761	8505 (42)	11175 (56)	20022	12366 (40)	16644 (54)	30666
Male	957 (43)	1206 (54)	2214	3966 (42)	5277 (56)	9405	5868 (40)	7938 (54)	14646
Female	1086 (43)	1383 (54)	2544	4539 (43)	5898 (56)	10611	6495 (40)	8706 (54)	16020

Source: Statistics New Zealand, unpublished data. -- Numbers too small to calculate.

Note: Due to base-3 rounding, data do not necessarily add up between and across cells. Per cent in this table is the proportion from the total for that group. "Other" and "Not Elsewhere Indicated" were not included in the table because the numbers were too small, but they are included in the total. Māori + includes those who could speak Māori only, Māori and English, Māori and Other (not English) and Māori , English and Other.

While Table 6 shows the proportions who could speak Māori or English-only, Figure 5 illustrates the proportion of each age group out of the total number of Māori speakers for "movers", "stayers" and the total. This figure clearly shows the age differences in ability to converse in Māori among "movers" and "stayers". Specifically, a higher proportion older people could speak Māori among "stayers" (55 per cent older than 25 years) while a higher proportion of younger people could speak Māori among "movers" (53 per cent of those 24 years old or younger).

Figure 5: The shares of "Māori +" speakers among "Stayers" and "Movers" and Total in broad age groups



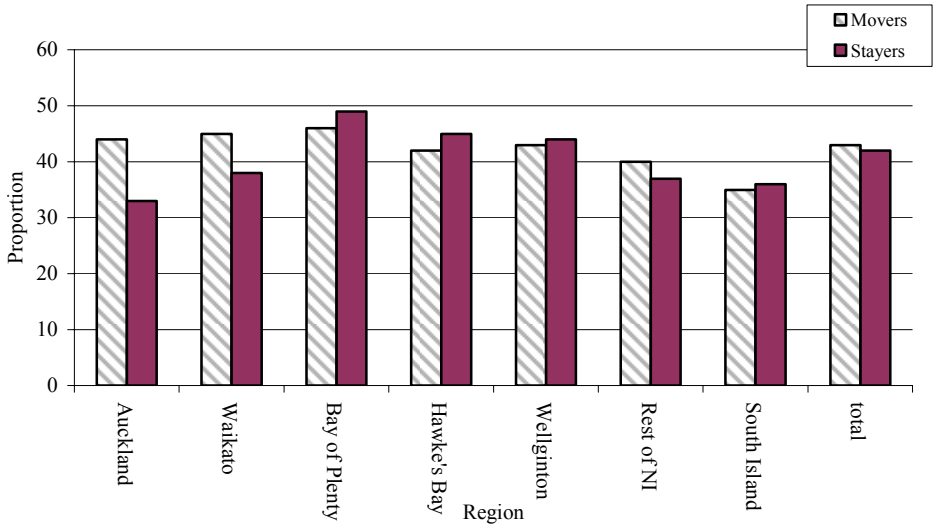
Source: Statistics New Zealand, unpublished data

Table 7 presents languages, sex and region for "movers", "stayers" and total. Table 7 shows that the highest proportion speaking Māori + were those who lived in the Bay of Plenty in 2001, followed by those who lived in Hawke's Bay and Wellington in 2001. The lowest proportions speaking Māori were those living in the Auckland Region in 2001 and females living in the South Island. Table 7 shows that the highest proportion of males who could converse in Māori were living in the Hawke's Bay, while the highest proportion of females who could converse in Māori were living in the Bay of Plenty. Overall, the lowest proportion of those speaking Māori were living

in the South Island or Auckland, but even with this, one third reported speaking Māori contrasted with 22 per cent of all Māori who could have a conversation in Māori (Statistics New Zealand 2002a).

Although the totals in Table 7 suggest no differences between language and "movers" and "stayers", regionally we see that a higher proportion of "movers" who were living in Auckland and Waikato in 2001 could speak Māori while a higher proportion of "stayers" in the Bay of Plenty indicated speaking Māori. This is further illustrated in Figure 6. Table 7 also shows that among males living in the Hawke's Bay in 2001, a higher proportion of "movers" indicated speaking Māori compared with "stayers" and compared with females. These figures are consistent with Te Puni Kōkiri (2003) findings that in the Waiariki there are multiple options for Māori to access te reo, through radio, television, and te reo courses for all age groups.

Figure 6: The proportion of "Stayers" and "Movers" speaking "Māori +"in selected regions.



Source: Statistics New Zealand, unpublished data

Table 7: The number of "Stayers" (proportion), "Movers" (proportion) and Total by region and sex who could speak Māori and other languages (Māori +) or English only

	"Movers"			"Stayers"			Total		
Region	Māori + (%)	English Only (%)	Total	Māori + %)	English Only (%)	Total	Māori + (%)	English Only (%)	Total
Auckland	**426 (44)**	**531 (54)**	975	**1065 (33)**	**2085 (65)**	3219	1722 (33)	3138 (60)	5187
Male	186 (42)	249 (56)	441	501 (33)	963 (64)	1497	801 (33)	1464 (61)	2412
Female	240 (45)	285 (53)	534	564 (33)	1119 (65)	1722	924 (33)	1680 (60)	2775
Waikato	**303 (45)**	**354 (53)**	672	**642 (38)**	**1017 (60)**	1689	1095 (37)	1686 (57)	2961
Male	162 (50)	153 (47)	327	303 (38)	477 (60)	798	546 (38)	804 (56)	1431
Female	144 (42)	186 (55)	339	336 (38)	540 (61)	891	552 (36)	885 (58)	1527
Bay of Plenty	**552 (46)**	**612 (51)**	1194	**3726 (49)**	**3747 (49)**	7575	5025 (47)	5241 (49)	10803
Male	234 (42)	297 (54)	555	1737 (48)	1812 (50)	3600	2400 (46)	2544 (49)	5220
Female	300 (47)	312 (49)	642	1992 (50)	1935 (49)	3975	2634 (47)	2700 (48)	5583
Hawke's Bay	**141 (42)**	**189 (57)**	333	**687 (45)**	**807 (53)**	1515	969 (43)	1194 (53)	2262
Male	75 (42)	72 (50)	144	300 (43)	381 (55)	690	438 (42)	552 (53)	1041
Female	72 (37)	111 (57)	195	384 (47)	429 (52)	822	525 (43)	642 (53)	1221
Wellington	**210 (43)**	**267 (55)**	483	**1002 (44)**	**1215 (54)**	2253	1407 (42)	1743 (52)	3321
Male	99 (43)	126 (55)	228	471 (44)	588 (55)	1077	678 (43)	861 (53)	1629
Female	108 (43)	141 (56)	252	531 (55)	627 (53)	1176	729 (43)	882 (52)	1692
Rest of NI	**318 (40)**	**465 (59)**	786	**882 (37)**	**1434 (61)**	2367	1407 (35)	2361 (59)	3978
Male	132 (37)	213 (60)	357	390 (37)	651 (61)	1059	627 (34)	1098 (60)	1839
Female	171 (40)	249 (58)	429	492 (38)	783 (60)	1305	780 (36)	1266 (59)	2139
South Island	**111 (35)**	**192 (60)**	318	**501 (36)**	**870 (62)**	1404	729 (34)	1272 (59)	2148
Male	69 (43)	96 (59)	162	264 (39)	405 (59)	684	378 (35)	612 (57)	1068
Female	51 (33)	99 (65)	153	240 (59)	465 (65)	720	348 (32)	660 (61)	1077
Total	2061 (43)	2610 (55)	4761	8505 (42)	11175 (56)	20022	12366 (40)	16644 (54)	30666
Male	957 (43)	1206 (54)	2214	3966 (42)	5277 (56)	9405	5868 (40)	7938 (54)	14646
Female	1086 (43)	1383 (54)	2544	4539 (43)	5898 (56)	10611	6495 (40)	8706 (54)	16020

Source: Statistics New Zealand, unpublished data.

Note: Due to base-3 rounding, data do not necessarily add up between and across cells. per cent in this table is the proportion from the total for that group. "Other" is not included in the table because the numbers were too small, but they are included in the total. Māori + includes those who could speak Māori only, Māori and English, Māori and Other (not English) and Māori, English and Other.

Conclusion

In summary, the present data showed strong growth in population for Tūhoe with a large young population and that Tūhoe were more likely to say they belonged to an iwi compared with other Māori in New Zealand. However, Tūhoe commanded fewer resources in terms of households and economics. As had been reported in qualitative research, there were fewer young people and more older people in the iwi takiwā, with young people living in urban centres: males in Waikato, females in Auckland.

In terms of mobility, the Hawke's Bay, Bay of Plenty and Wellington regions had the highest proportions of "stayers" and the Waikato, "movers". Auckland had the greatest net gain and the Bay of Plenty had the greatest overall loss due to inter-regional mobility. Overall, more females were "stayers", as earlier research showed, but within age groups and regions there was much variation to this pattern. For example, in the 5-14 age group, more males than females were "stayers" in the "Rest of the North Island", and females were more mobile in the Auckland, Waikato, Bay of Plenty and Hawke's Bay regions.

Analysis of language revealed some interesting patterns, with a higher proportion of "movers" being able to converse in Māori in Auckland and the Waikato, but a higher proportion of "stayers" conversing in Māori in the Bay of Plenty and the Hawke's Bay. Overall, there were fewer "English only" speakers in the older age groups but there was a lot of variation when the details were explored. For example, a slightly higher proportion of males could converse in Māori in the 15-24 and 25-44 age groups, but a much higher proportion of females (70 per cent) could converse in Māori in the 45-64 age group amongst "movers" compared with males (57 per cent).

Overall, although there were some consistencies between the data presented in this report and data in previous reports, there were also important differences found in the present analysis of Census data as they relate to Tūhoe. For example, some sources had previously indicated highest mobility among young males of ethnic groups (Statistics New Zealand, 2002c). The current analysis found the highest mobility was among females in the 15-24 age group. Females were also more mobile compared with males in some particular regions (particularly Auckland and Waikato). This suggests that it is worthwhile to examine data in more detail and in reference to particular iwi and regions in New Zealand.

The present data are consistent with qualitative studies showing that there are more complexities to mobility than what might be gleaned from aggregate analyses. Without qualitative studies as a comparison, we might predict patterns of mobility relating to language with either greater mobility associated with greater language ability (as this might be linked to qualifications or ability to adapt more readily to different situations), or, we could predict that language diversity could inhibit mobility, with ability to converse in Māori a reason to stay in areas with others who can speak Māori. The data presented here are consistent with qualitative studies that showed that most Tūhoe settled with other Tūhoe in most instances after moving suggesting that speaking Māori languages facilitates moving into non-traditional regions if the mover was settling with other Tūhoe (Nikora *et al.* submitted; Nikora *et al.* 2004; Scott & Kearns 2000). More detailed studies will be required to see if there are other variables that interact with mobility, such as qualifications, education, or income.

Other researchers have conducted analyses on data relevant to Māori and have interpreted those data without corresponding ethnographic or other qualitative data to verify or justify those interpretations, but without the specific details being taken into account. For example, while Sin and Stillman (2005:3) suggest that "land-based attachment is also an important impediment to mobility" for Māori, it can also be argued that mobility disrupts social and cultural ties and that land-based attachment facilitates maintenance. Other unpublished qualitative data suggest that many from another hapu near Tūhoe are happier about moving if they know that they have their traditional lands still intact and functioning -- it facilitates their mobility (Teddy, Nikora & Guerin 2007 submitted).

In conclusion, then, the present analysis, combined with reference to other research (Nikora *et al.* 2004; Nikora *et al.* submitted) for a specific tribal group (Tūhoe), has shown that generalisations should be made with caution. Similarly, policy should reflect the diversity within the Māori ethnic group and these regional and iwi variations.

Acknowledgements

The authors would like to thank staff in the Migration Research Group at the University of Waikato and Statistics New Zealand for assistance in compiling the special data tables used for this analysis. The authors would also like to thank the anonymous reviewer and Professor Bernard Guerin for helpful comments on earlier

drafts of this paper. This research was kindly supported by the Foundation for Research Science and Technology (New Zealand) through UOWX0203, *Strangers in Town: Enhancing Family and Community in a More Diverse New Zealand* Society while at the University of Waikato.

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Appendix 1:

Tūhoe iwi (Total Responses) and Sex by Territorial Authority, for the Māori Descent Census Usually Resident Population Count, 2001

Iwi	Tūhoe		
Sex	Male	Female	Total
Area			
Far North District	126	207	330
Whangarei District	135	144	276
Kaipara District	36	36	72
Rodney District	87	63	150
North Shore City	228	207	432
Waitakere City	309	384	693
Auckland City	537	639	1176
Manukau City	903	1077	1980
Papakura District	165	225	390
Franklin District	96	93	192
Thames-Coromandel District	36	42	81
Hauraki District	51	60	114
Waikato District	132	153	288
Matamata-Piako District	57	54	111
Hamilton City	456	537	993
Waipa District	84	69	150
Otorohanga District	51	24	75
South Waikato District	141	162	300
Waitomo District	36	39	72
Taupo District	303	309	609
Western Bay of Plenty District	123	162	285
Tauranga District	357	387	744
Rotorua District	1227	1365	2595
Whakatane District	2418	2508	4923
Kawerau District	474	528	1002
Opotiki District	327	336	666
Gisborne District	690	789	1482
Wairoa District	267	318	585
Hastings District	474	546	1017
Napier City	201	228	429
Central Hawke's Bay District	60	60	123
New Plymouth District	75	84	156
Stratford District	15	6	24
South Taranaki District	39	48	87
Ruapehu District	108	90	198
Wanganui District	96	96	189
Rangitikei District	54	81	135

Manawatu District	69	60	129
Palmerston North City	210	249	456
Tararua District	60	84	144
Horowhenua District	51	75	123
Kapiti Coast District	90	99	186
Porirua City	276	282	558
Upper Hutt City	195	159	354
Lower Hutt City	603	609	1212
Wellington City	276	345	621
Masterton District	99	93	192
Carterton District	6	9	15
South Wairarapa District	21	27	51
Tasman District	36	33	66
Nelson City	66	57	123
Marlborough District	45	39	84
Kaikoura District	9	3	9
Buller District	18	9	30
Grey District	12	12	21
Westland District	12	9	18
Hurunui District	6	9	12
Waimakariri District	21	21	42
Christchurch City	417	432	843
Banks Peninsula District	3	3	6
Selwyn District	42	18	60
Ashburton District	21	18	39
Timaru District	18	21	39
Mackenzie District	3	3	6
Waimate District	6	6	12
Chatham Islands District	3	6	9
Waitaki District	3	9	12
Central Otago District	6	6	12
Queenstown-Lakes District	9	3	12
Dunedin City	78	108	183
Clutha District	18	18	33
Southland District	54	54	105
Gore District	30	30	60
Invercargill City	111	126	240
Area Outside Territorial Authority	3	0	6
	13980	15300	29247

NEW ZEALAND POPULATION REVIEW

Volume 32, Number 2
Nov 2006

Editor
A Zodgekar

PANZ
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NEW ZEALAND POPULATION REVIEW VOLUME 32 • NUMBER 2 • 2006

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Production:
Bev Campbell

Email: demogsec@waikato.ac.nz

Printed at Waikato Print, University of Waikato

ISBN: 0111-199X

New Zealand Population Review

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ISSN: 0111-199X