

FUNCTIONAL LABOUR MARKETS REVEALED BY TRAVEL TO WORK DATA 1991 AND 2001

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Abstract

Regional labour market analysis is ideally based on functional rather than administrative areas. Travel-to-work data obtained from the 1991 and 2001 Census are used to define a set of functional labour markets for New Zealand. Comparison of the labour market catchments in 1991 and 2001 is undertaken to test the effectiveness of the statistical procedures and to examine the extent to which travel to work patterns have changed. The labour catchments are compiled from data amalgamated to Census area units. For the 2001 labour catchments, boundaries are calculated using both 1991 and 2001 area units. Maintaining constant spatial unit boundaries for 1991 and 2001 provides a test of the algorithm used to compile catchments. The 2001 catchments based on 2001 area units provides a basis for examining changes in travel to work patterns 1991-2001. A reduction in the number of labour market catchments from 140 to 106 or 104 occurs, depending on the area units used, but changes tend to preserve the broad structure of catchment boundaries identified in 1991. The overall stability in the identified catchments suggests that they provide a robust basis for regional analysis. Interpretation of the reduction in the number of areas is difficult because of data deficiencies associated with the 2001 Census. Allowing for the reduced reliability of the 2001 Census it appears that catchment boundaries are responding to expected changes in commuting patterns.

Introduction

In December 2001, the Department of Labour published the first national set of labour market areas (here called catchments) (Newell and Papps, 2001). That first analysis is based on travel to work patterns identified from 1991 Census data. This report updates that analysis using 2001 Census data. The original study was motivated by the recognition that administrative areas, the main existing basis for regional analysis, potentially cut across labour market areas and distort analysis of employment and unemployment patterns. In other countries, travel to work catchments are frequently the preferred spatial framework for studying local labour markets (Owen and Green, 1989; Crampton, 1999; Casado-Díaz, 2000). The decision to generate labour market catchments using 2001 data reflected the perceived utility of the original investigation and the opportunity to evaluate the stability of travel to work boundaries over time.

The system of travel to work areas based on 1991 Census data separated New Zealand into 140 comparatively self-contained catchments (Newell and Papps, 2001). This was based on an adaptation of the 'best practice' in travel to work analysis developed in the UK (Coombes et al., 1986; Coombes, 2000) modified to suit New Zealand's smaller and lower density population compared with the UK. Comparison between

the 1991 and 2001 catchments is undertaken in two ways. The labour catchments are compiled from data amalgamated to Census area units. For the 2001 labour catchments, boundaries are calculated using 1991 area units and 2001 area units. Maintaining constant area unit boundaries for 1991 and 2001 provides a test of the algorithm used to compile catchments. The 2001 catchments based on 2001 area units provides a fuller examination of any changes in travel to work patterns 1991-2001 than where the 1991 area units are maintained. A reduction in the number of labour market catchments from 140 to 106 or 104 is identified, depending on the area units used, but changes tend to preserve the broad structure of catchment boundaries identified in 1991.

Interpretation of the catchment changes is complicated by differences in data coding and data quality between the 1991 to 2001 Census. The sources and impact of the changes in data quality are explained in connection with the generation of the 2001 catchments. The 2001 Census data used to generate catchments are modified in an effort to minimise the impact of differences in the completeness of data capture. Even with the amendments made, it is probable that some of the reduction in the number of catchments reflects data quality rather than real changes in travel to work behaviour. Given this judgement, the overall conclusion is that there is considerable stability in labour market catchment areas in 1991 and 2001. Further robustness to the boundaries is shown by the consistently high self-containment they provide for labour market groups identified by gender, ethnicity, hours worked, income, occupation and age. Prior to presenting this analysis further justification for the use of travel to work patterns is provided followed by an outline of the method adopted for defining labour market catchments.

Travel to work areas

From a geographical perspective, labour markets can be delineated by the distance employees travel to work (Ball, 1980; Coombes and Openshaw, 1982). From any centre of population, journey-to-work time and cost constrain the spatial area over which residents commute to work. Travel to work patterns may thus be used to identify labour market catchment areas. The New Zealand Census collects information about place of residence and work to enable such areas to be identified. Even so there is no tradition of using functional labour market areas to monitor sub-national employment change, although the prospective benefits of doing so have been recognised (Morrison, 1989). For example, the interpretation of migration data based on administrative boundaries is restricted by the uncertainty over how much of this movement involves a change of employment (Maré and Choy, 2001). In comparison, migration across travel to work catchments is less ambiguously related to changes in employment (Green, 1994).

The case for generating a new set of boundaries to study labour markets is based on their advantage over the use of administrative boundaries and their capacity to provide a basis for comparative analysis over time.

The hierarchy of administrative areas provides the most frequently used sub-national boundaries for labour market analysis. This is to be expected from the wide recognition of administrative boundaries and relationship with public agency

responsibilities. The attempt to propagate a further set of boundaries requires evidence of a clear need. Four issues contribute to this case.

First, few if any set of areas in a national administrative hierarchy provide fully comparable units for spatial analysis (Coombes, 2000). For example, the four main New Zealand urban regions as defined by regional council boundaries vary in total population from 1.16 million (Auckland) to 181,540 (Otago). The Auckland and Wellington regions each encompass four cities with separate administrative jurisdictions. In contrast, the two South Island regions with urban concentrations are distinguished by their geographical extensiveness. Going down the urban hierarchy identifies a group of 15 cities with a larger population range than regional councils and much variation in their proximity to other population centres. The absence of comparably defined areas is a constraint when seeking to analyse urbanisation processes. Many patterns and processes are shaped by the distribution of urban and rural areas. Consequently, to provide meaningful and comparable units for analysis, a set of areas need to be defined in relation to these settlement features. This problem is amplified further when seeking to make cross-national comparisons. Many statistics (such as inter-regional migration rates) are sensitive to the size of region selected. The comparatively small population size of New Zealand regions makes it difficult, for example, to interpret the relative importance of regional labour market adjustments that occur in response to employment shocks (Choy et al., 2002). New Zealand apparently has a comparatively high migration response but this may be because the regional units being compared typically contain a small population. What counts as inter-regional migration in New Zealand may be counted as intra-regional migration in a large country with more populous regions than New Zealand.

Second, the use of consistently and appropriately defined area boundaries is especially important for comparing local unemployment rates. Unemployment reflects a shortfall in labour demand relative to labour supply. The respective location of workers and employment opportunities is, therefore, a critical determinant of local unemployment rates. Low-income workers are both the most likely to be unemployed and to have the most restricted residential options among employment groups. As a result, the extent to which a particular administrative boundary embraces or excludes a low-income housing area potentially has a significant impact upon reported unemployment rates. In this context it is particularly important to ensure that unemployment rates are expressed for a comparable set of areas. A further extension of this arises where welfare assistance depends on the 'job testing' of applicants. Claims about the inability to find suitable employment require evaluation against the geographical area that it is reasonable to expect employment search to be confined to.

Third, the use of travel to work catchments minimises the opportunity to selectively present spatial statistics. Much employment policy intervention seeks to ensure that workforce characteristics reflect the attributes of the population from which the workforce is potentially drawn. This is typically motivated by a wish to raise the employment of specific social groups such as disabled persons, ethnic minorities, new migrants and long-term unemployed. When monitoring progress against these goals for sub-national populations, results can be sensitive to the area boundaries that are used. Ethnic groups, for example, tend to cluster in particular residential areas. Judging their representation in a locality's workforce depends on the distribution of these clusters relative to the area boundaries defining the locality. Where

administrative boundaries are the only option for assessing representativeness, judgements may be affected by the administrative boundary selected. It is preferable that the evaluation is based on the most appropriate area. In this context, appropriateness means the local labour market catchment area that best represents the workforce relative to places of employment. Travel to work areas provide this representation on the basis of an objectively defined area.

Four, promulgating travel to work catchments can establish a standard for spatial data analysis in a context where the dependence of data users on administrative boundaries is reducing (Coombes, 2000). GIS-based software is increasing the ease of aggregating data to non-standard areas and encouraging data users to demand greater flexibility in the release of official statistics. This may be a challenge to statistical agencies that in the past have determined the appropriate areas for which data should be released. This decision has usually involved selecting the lowest tier of the administrative hierarchy providing sufficient statistical reliability and confidentiality protection. Responding to the expectations of increased data flexibility gives a risk of statistics being misused and of reduced comparability between individual investigations. Identifying standards with respect to the types of area appropriate for analysis is a way statistical agencies can respond to user expectations while maintaining a role in controlling the use of official statistics.

Of course, any system of boundaries is likely to have some limitations. A potential shortcoming of travel to work catchments is the lack of continuity between boundaries over time. Reform of administrative systems causing a change in boundaries potentially occurs less frequently than changes in journey to work patterns. This arises partly because of the impact of investment in housing and transport infrastructure and the changing cost of personal mobility. As well, travel to work areas are sensitive to the economic conditions that exist when input data are collected.

Job search may be expected to occur over a wider geographical area in times of comparative labour surplus than in times of comparative labour shortage. At times of low labour demand, the catchment may be distorted by not including the potential journeys of those out of work. The extent of this depends on the distribution of unemployment among occupational groups and variation in mobility between occupational groups. An assumption may be that unemployment is concentrated among low income workers and who have lower mobility than high income workers. Later analysis (see section Sub Group Labour Markets in 2001) suggests that this may not be the case in New Zealand but further investigation of the impact of unemployment on travel to work is needed to confirm this.

Related to the potential instability generated by unemployment, the acceptability of generating boundaries on the average behaviour of the working population is a further potential weakness. Boundaries may vary, for example, according to whether male or female journey to work is measured. Use of travel to work patterns requires evidence of the comparative stability in the areas and high self-containment between social groups. Prior to exploring how well the New Zealand boundaries perform against these criteria further explanation of the method by which they are generated is provided.

Defining travel to work areas

A well-defined local labour market catchment area should possess two characteristics. First, labour catchments that have a high degree of self-containment with minimal travel to work across the generated boundaries. Second, catchments should be internally integrated with a high degree of intra-area movement (Goodman, 1970; Ball, 1980; Coombes and Openshaw, 1982). To achieve these attributes, the method developed by Coombes et al. (1986) was adopted for the analysis based on 1991 data (Newell and Papps, 2001) and for the present study. Full description of the method can be found in the earlier study, here a summary of the key aspects of the approach are described with discussion of the issues arising in seeking comparability between the 1991 and 2001 catchments. At the outset, it is appropriate to identify aspects of New Zealand's employment geography that need to be considered in defining labour catchments.

There is no rule to determine how to allocate employment between catchments. It is a matter of judgement to determine how to balance the search for self-containment with the practical need to minimise the number of separate areas. New Zealand's low population density and coastal geography makes this trade off a crucial influence on catchment geography. If the minimum population threshold is raised too high it groups some comparatively self-contained small communities with larger populations, sometimes creating misleading and discontinuous aggregations. An example is Stewart Island, which is amalgamated with Invercargill or not depending on the threshold population coefficient used in the algorithm. The preference in the previous study (Newell and Papps 2001) was to recognise that isolated, small communities are a feature of New Zealand's labour market. This concern partly reflected the importance of rural and provincial land use activities and their associated communities to the New Zealand economy. The quality of the raw travel to work was a further consideration in that the use of Census data enables small catchments to be produced more reliability than in a country such as the UK where travel to work data are derived from a 10 percent sample of the Census population. On the other hand, the wish to identify small labour market catchments alongside the preference for national coverage means some detail may be lost in larger urban catchments.

Census area units are the starting point for the analysis. These units typically have a population of 1,000 to 3,000 persons but across the country as a whole they are highly variable in population and geographic size. Most area units remain unchanged between each Census but some boundaries alter and new areas may be added. The travel to work data are coded to those statistical units in use at the time of each Census collection. To facilitate comparability of the 1991 and 2001 analysis, a common set of area unit boundaries was needed. To achieve this consistency, where necessary 2001 data were reallocated to 1991 area units by breaking down 2001 data to the individual meshblocks from which area units are defined. In the process of making this adjustment, the reduced proportion of Census responses providing a workplace address coded to a meshblock or area unit in 2001 compared with 1991 presented a need for further adjustment as discussed below.

Catchments are defined by reaching one of three criteria. Most catchments emerge by meeting the minimum thresholds of 70 percent self-containment and 2,000 employed at local workplaces. These criteria interact such that a lower workplace population

would be acceptable where self containment levels were correspondingly higher than the threshold and vice versa.

A computerised algorithm processes the source data in four stages.

1. Area units are ranked according to the proportion of local residents working in the area unit (referred to as supply side or residential self containment) and those in the upper 20 percent or with a high rate of in-commuting are selected as starting points ('foci') to aggregate area units around. In-commuting is measured by the "job ratio" meaning the ratio of jobs at local workplaces to locally resident workers.
2. Foci that have high levels of commuting between them are linked together.
3. All the non-foci area units are assigned incrementally to the foci that they are most strongly attached to. This process commences with the areas that have the strongest commuting links to the foci and ends with the area with the weakest links to other areas.
4. The 'proto travel to work catchments' are ranked according to the size and self containment criteria. Starting with those proto catchments furthest away from meeting the criteria of 70 percent self containment and 2000 minimum population, area units are reallocated to the emerging labour market area that has satisfied the size criteria or not as yet been rejected. This process continues until all remaining catchments meet the set criteria.

Applied to New Zealand, the modified Coombes algorithm produces labour markets with comparatively high levels of self-containment (typically at least 85 percent) and small workforces. In 1991, the average labour market size was 9,000-10,000 employed persons but roughly half had fewer than the proscribed minimum 2,000. The number of separate labour markets identified is more sensitive to the self-containment criteria than the population criteria (Newell and Papps, 2001). Most areas exceed the minimum self-containment level of 70 percent but modifying this value produces significant variation in the number of local labour markets.

Issues in compiling 2001 catchment areas

Comparability of the 1991 and 2001 analysis requires that the same spatial reference frame is used and that the data variables (usual residence, workplace location and labour market attributes) are coded in the same way. To achieve this requirement, replication of the 1991 analysis using 2001 Census data required some additional analytical steps because of differences in the proportion of Census returns that provide both a specific residential and workplace address. This has the effect of reducing the reliability of the 2001 boundaries compared with 1991, although as the majority of areas remained unchanged the analysis is felt to retain its comparability.

Area units were used in the 1991 analysis. As explained, given some adjustment in area unit boundaries between 1991 and 2001, the more recent analysis required regrouping of some data from the meshblock level to enable a comparable set of base areas to be identified. Data on residence is coded to the meshblock level in each Census for all respondents. In contrast, only a proportion of respondents identifying themselves as employed provided sufficient information or were interpreted sufficiently to code their workplace location to a meshblock (although typically there

is sufficient information to code them to a larger area unit). A problem arises where the gap involves respondents residing in meshblocks that need to be reallocated to a different area unit. If an entry was not coded to the meshblock level it sometimes could not be unambiguously assigned to 1991 area units and was left out of the initial dataset. On this basis, only about 84 percent of those identifying themselves as employed in 2001 could be coded to a 1991 workplace area unit compared with 92 percent in 1991.

In view of the change in population size arising from data gaps, an adjustment was required to ensure that the 2001 analysis represented the same proportionality to the total working population as the 1991 analysis. To achieve this comparability, 2001 data were scaled to the same level of completeness as the 1991 data assuming that missing workplace addresses exhibited the same distribution of locations as the coded addresses. When this scaling up was applied, the algorithm produced a 23 percent reduction in the number of local labour markets identified in 2001 compared with 1991 (from 140 to 90).

A further difference between the 1991 and 2001 Census data is the proportion of long distance commutes such as a journey to work from Tauranga to Auckland. Such commutes were more frequent in the 2001 than in the 1991 data and present a problem for the analysis. One issue is that it seems likely that many of these observations are illusory, a result of miscoding of the workplace location. Moreover, the idea of a travel to work area is to capture the area within which the working population habitually seeks employment and where local employers recruit most of their labour. In this sense, idiosyncratic travel patterns arising through unusual circumstances or existing as a temporary transition to relocation might be ignored. It is also possible that respondents in 'field' roles may identify a head office work location rather than the area they work within as their workplace address. The manner in which the workplace coding by Statistics New Zealand relates workplaces to the business survey frame may also mean that some workplaces may be allocated to out of region workplace addresses. On the other hand, an increase in long-distance commuting on a weekly if not daily basis may be an aspect of changing work patterns. For example, flexible employment practices such as extended shift hours to facilitate shorter working weeks or a combination of home-based and workplace activity made possible through information technology. Dual income households, contract-based employment and high incomes also make an increase in long distance commuting possible.

Although the proportion of these problematic trips is small they have a large influence on some catchment boundaries (Table 1). For this reason, a screen was devised made up of region-to-region travel to work combinations that were considered unusual on the basis of geography and 1991 travel to work data. Those observations were then filtered from the 2001 travel to work matrix and the data scaled back to the same level of capture as 1991 data. This step conserved 16 labour markets additional to the 90 identified in the initial processing of 2001 data.

Table 1
Proportion of journeys to work eligible for omission due to distance travelled

Region of trip destination	Proportion (%) of trips eligible for screening due to long distance	
	1991	2001
Northland	0.5	2.04
Auckland	0.29	0.88
Waikato	0.32	0.92
Bay Of Plenty	0.74	2.9
Gisborne	0.63	2.75
Hawke's Bay	0.5	2.38
Taranaki	0.68	1.68
Manawatu-Wanganui	0.29	1.61
Wellington	0.37	1.88
Marlborough	0.67	5.78
Nelson	1.03	4.43
Tasman	0.33	3.42
West Coast	0.72	3.62
Canterbury	0.31	1.23
Otago	0.35	1.7
Southland	0.21	2.16
All regions	0.41	1.59

The long distance observations that were screened out represented 1.6 percent of all trips in 2001. By contrast, only 0.4 percent of 1991 travel to work observations would have been screened out under this protocol. Marlborough is the most affected region with 5.8 percent of observations screened out for 2001 whereas, had the procedure been applied in 1991, 0.7 percent of trips would have been screened out. Given the possibility of travel between Marlborough and Wellington on a weekly or shorter basis, it is possible that the 2001 Census results are reflecting real changes in commuting behaviour for some journey to work combinations. On the other hand, the reduced rate of coding of workplace addresses to meshblock areas may be indicative of increased data inaccuracy in the 2001 Census results. Investigation of the occupations held by those reporting long distance commuting would be a useful check on the 2001 data. Prior to such investigation, the screening procedure seemed justified. The final number of local labour market catchments identified for 2001 then became 106 versus the 140 in 1991.

2001 labour market catchments on 1991 area unit boundaries

A principal purpose of the present study is to examine how well preserved the 1991 boundaries are in 2001. As noted, for comparability, this requires that the 2001 data are applied to 1991 area unit boundaries. A separate analysis was also envisaged based on 2001 meshblock data. In practice it was decided that because of the comparatively high proportion of 2001 responses without a meshblock workplace address and concerns about precision of the 2001 data it was not feasible to construct catchments from this micro level. Furthermore, the small domain release policy

limitations on Census tabulations would have made it difficult to construct a set of statistics below the area unit level. Instead the 2001 areas were compiled using 2001 area unit level data with results showing some significant differences from the areas based on 1991 area units. These alternative areas are reviewed in a separate section below.

Bearing in mind the tendency for area unit boundaries to be maintained between Censuses, the discussion of findings focuses most on the boundaries generated from 1991 area units. As noted above, this shows a fall in the number of local labour markets from 140 to 106. Before reviewing the change, salient features of the 1991 boundaries to be noted are as follows (for further details see Newell and Papps, 2001).

- The labour markets vary in employment size from 273,603 (Central Auckland) to 36 areas with fewer than 1,000 employees.
- The geographical area of labour catchments varied between 6 square kilometres (Waiouru) and over 11,200 square kilometres (Te Anau).
- The main urban centres have extensive labour markets. The Auckland metropolitan region, for example, was divided into two catchments split around Onehunga-Panmure south of the central city. The Christchurch labour market stretches inland to Arthur's Pass but excluded part of the Banks Peninsula.
- For the most part, labour market areas are geographically contiguous. Exceptions partly reflect physical geography and transport infrastructure, such as Featherston's inclusion in the Wellington labour market while the sparsely populated area surrounding Featherston forms part of a separate southern Wairarapa labour market.
- Considerable difference existed between labour market catchments and territorial local authorities. Usually this involved a local authority area being comprised of multiple labour markets but discordance also existed, including the labour market catchments of all 15 cities.

Catchment changes 1991-2001

The 106 labour markets identified in 2001 are shown in Figures 1 and 2. A region-by-region mapping of the catchments that also identifies local territorial authority boundaries is given in Appendix One. Appendix two provides a key to the area unit codes linked to each travel to work catchment.

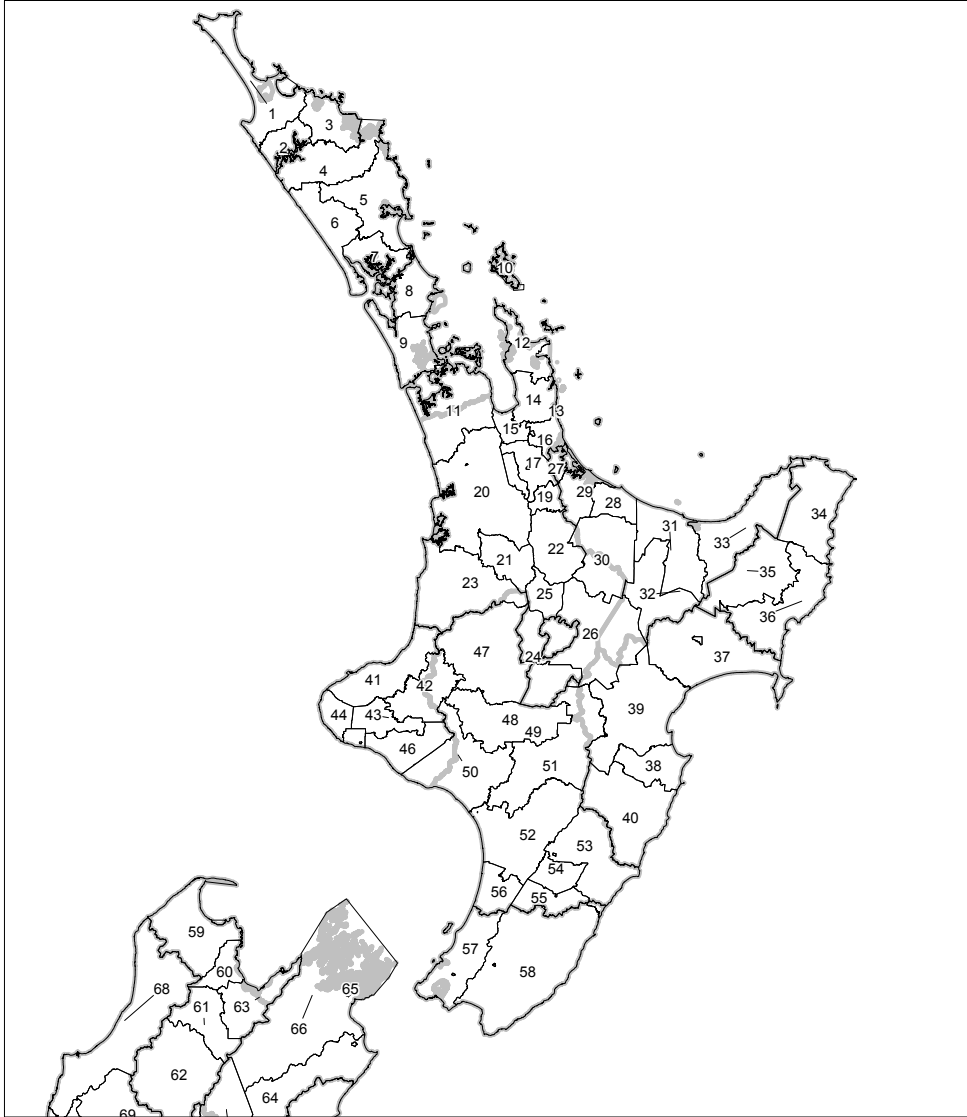


Figure 1

2001 Labour Market Catchment Areas in the North Island based on 1991 Area Units
(Labels refer to the local labour market catchment areas listed in Table 2)

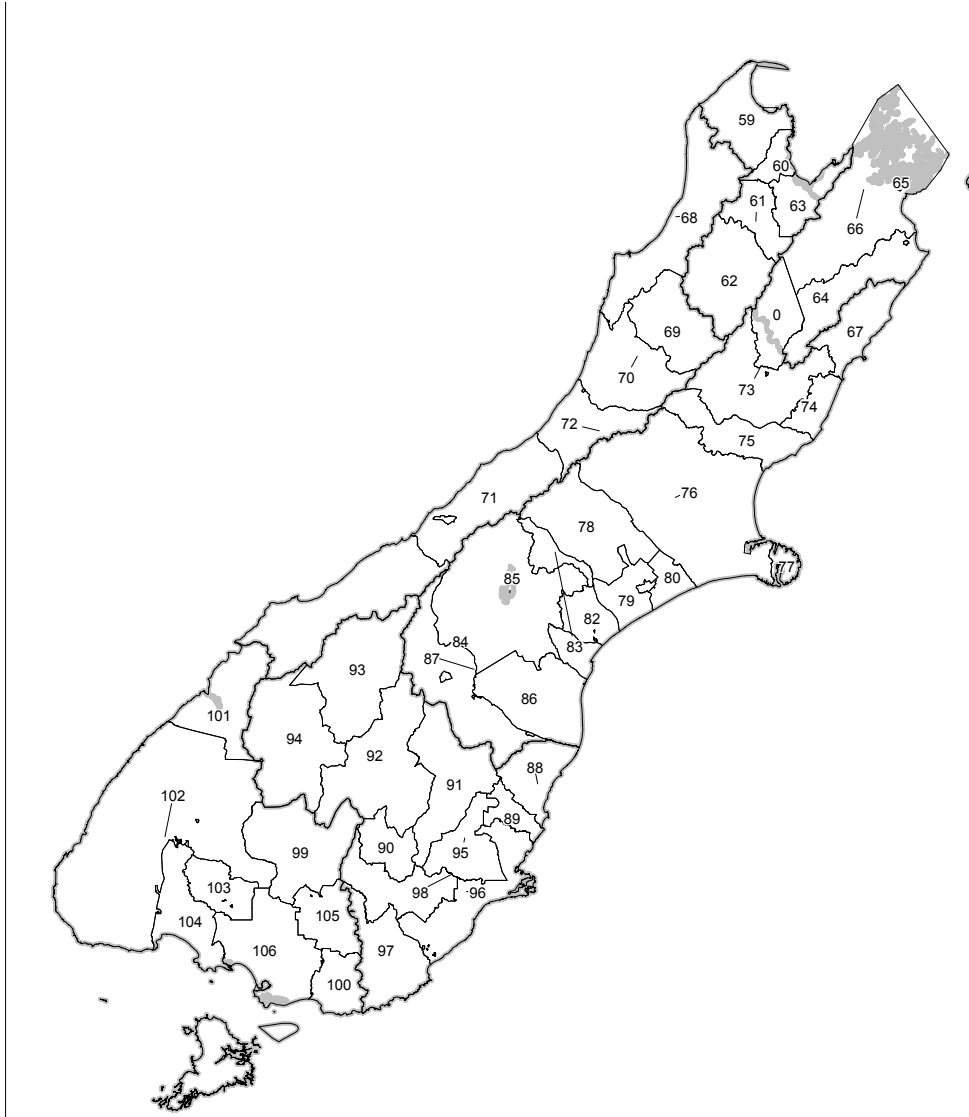


Figure 2
2001 Labour Market Catchment Areas in the South Island based on 1991 Area Units
(Labels refer to the local labour market catchment areas listed in Table 2)

Table 2
Labels for 2001 Labour Market Catchments on 1991 Area Units shown in Figures 1 and 2

1 Kaitaia	37 Wairoa	73 Amuri
2 Hokianga North	38 Hastings Zone	74 Parnassus
3 Kerikeri	39 Napier Zone	75 Hurunui
4 Kaikohe	40 Central Hawke's Bay District	76 Christchurch
5 Whangarei	41 New Plymouth District	77 Okains Bay
6 Dargaville	42 Douglas	78 Mt Somers
7 Rehia-Oneriri	43 Stratford	79 Hinds
8 Warkworth	44 Kahui	80 Chertsey
9 Central Auckland Zone	45 Kapuni	81 Ashburton
10 Great Barrier Island	46 Hawera	82 Orari
11 Southern Auckland Zone	47 Taumarunui	83 Timaru
12 Whitianga	48 Tangiwai	84 Twizel Community
13 Whangamata	49 Waiouru	85 Mackenzie
14 Thames	50 Wanganui	86 Waihao
15 Hauraki Plains	51 Pohonui-Porewa	87 Aviemore
16 Waihi	52 Palmerston North	88 Oamaru
17 Ngarua	53 Dannevirke	89 Waihemo
18 Morrinsville	54 Pahiatua	90 Teviot
19 Matamata	55 Nireaha-Tiraumea	91 Maniototo
20 Hamilton Zone	56 Levin	92 Alexandra
21 Maihihi	57 Wellington Zone	93 Wanaka
22 South Waikato District	58 Masterton	94 Queenstown
23 Waitomo District	59 Golden Bay	95 Silverpeaks
24 Turangi	60 Motueka	96 Dunedin
25 Marotiri	61 Golden Downs	97 Clutha
26 Taupo	62 Lake Rotoroa	98 Tuapeka
27 Katikati Community	63 Nelson	99 Waikaia
28 Te Puke Community	64 Ward	100 Toetoes
29 Tauranga	65 Picton	101 Te Anau
30 Rotorua District	66 Blenheim	102 Mararoa River
31 Whakatane	67 Kaikoura District	103 Wairio
32 Matahina-Minginui	68 Westport	104 Te Waewae
33 Opotiki District	69 Inangahua	105 Gore
34 East Cape	70 Greymouth	106 Invercargill
35 Tairāhema-Rakauroa	71 Franz Josef	
36 Gisborne	72 Hokitika	

The consolidation of catchments has been largely a North Island phenomenon. In the North Island, the number of areas dropped by 36 percent from 91 to 58 whereas the South Island had a net loss of one catchment to 47 (see Figures 3 and 4 in Newell and Papps 2001). Higher population densities in the North Island than the South Island produce greater opportunity for changes in travel-to-work patterns. As shown below, even where the number of areas remains similar large changes in the geography of travel-to-work may take place.

The mean self-containment of labour market catchments was less in 2001 than 1991 alongside a growth in the average employment size of catchments (Table 3). The

same pattern holds for area units, the statistical divisions from which the catchments are constructed. The expansion of the proportion of the population of working age in paid work, as well as increases in population for the underlying building blocks, is likely to be the main explanation for the growth of catchment populations.

Table 3
Comparison of catchment and area unit attributes 1991 and 2001 (based on 1991 area unit boundaries)

Area attributes	Labour market catchments		Area units	
	Mean	Standard deviation	Mean	Standard deviation
<i>1991 catchments</i>				
Residential self-containment	87.0%	7.9%	30.9%	24.8%
Employment self-containment	89.4%	6.3%	46.2%	26.8%
Employed population	9,131	28,157	782	537
Number of jobs	9,131	28,225	781	1,991
<i>2001 catchments</i>				
Residential self-containment	84.5%	7.9%	26.4%	20.3%
Employment self-containment	81.3%	9.8%	38.6%	23.7%
Employed population	11,384	36,509	842	630
Number of jobs	11,384	36,211	842	2044

Around a third of the labour markets identified with 1991 area unit boundary data remained unchanged in 2001. Expressed as a share of total employment in 2001, 10.5 percent of employment is located in unchanged labour catchments. Given the extent of change suggested by these figures it is important to further explore the influences affecting apparent boundary movements.

Slightly over half (23 of 44) of the unchanged labour market areas are found in the South Island. A further 22 areas experience minor changes either through expansion or contraction. There are then a range of catchment changes from the merger of adjoining areas to more complex fragmentation and rebuilding. The distinction between merger and fragmentation is blurred where the original labour market area receives all of one formerly separate area and part of another. It is also possible for an area to absorb one neighbouring area while losing part of its original area to a new or previously existing catchment.

The most frequent form of change involves the merger of two or more former separate and adjoining labour markets. These mergers preserve the external boundaries that delineate the enlarged labour market but result in the collapse of 59 formerly separate areas to less than half this number of areas in 2001. In a smaller number of cases (15), a labour market area becomes part of two or more enlarged labour markets in 2001.

Merger of labour market areas is primarily driven by changes in apparent self containment. This can result from urban area extension and decentralisation around neighbouring centres. Around Auckland, for example, three labour markets (Pukekohe, Waiheke Island and Waiuku) have become absorbed into the two

dominant areas of Central and Southern Auckland. The net change in the number of areas is reduced by the emergence of Great Barrier Island as a separate labour market. At the same time, immediately to the north of Central Auckland, the Warkworth labour market has expanded through absorbing part of the former Central Auckland labour market and parts of its other neighbouring market.

The Hamilton and south Waikato region has seen a loss of 12 labour markets and concentration in a significantly enlarged Hamilton catchment and two new areas (South Waikato and Waitomo) formerly comprising six separate travel to work areas. In contrast, the Wellington catchment has experienced little change although it has absorbed the formerly separate Otaki labour market. The previously extensive Christchurch labour market appears to have expanded through enveloping the low population density parts of four areas (including part of Hokitika and Wanaka which it is postulated reflect data quality issues rather than real change) that survive with changed boundaries. Palmerston North now covers territory formerly divided into three relatively self-contained markets. Within Otago and Southland, adjustments involving expansion of the Dunedin and Invercargill labour markets have contributed to a loss of two separate catchments. Other mergers arise where emerging provincial centres play a role as employment centres for surrounding rural areas. Thus Masterton and Stratford have each absorbed two smaller catchments. In contrast with the changes around growing urban centres, rural labour market catchments are more likely to have remained unchanged or grouped as a unit with adjoining catchments (Table 4).

Table 4
Summary of Apparent Changes to Labour Market Catchment Groupings by Urban / Rural Type¹ between 1991 and 2001

	Main urban	Secondary Urban	Minor Urban	Rural	Sub Total
Same	3	1	16	24	44
Same	4	2	3	1	10
Almost Merged	7	5	16	31	59
Whole ²					
Expanded	4	1	2	0	7
Shrunk	1	0	2	2	5
Split	0	4	8	3	15
Sub Total	19	13	47	61	140

Alongside the changing geography of employment around urban areas, changes in the composition of the workforce may also be influencing catchment modification. From late 1991, when New Zealand had its highest unemployment rate in over 50 years, a period of employment growth followed. Total employment grew by 18.4% from 1.48 million in June 1990 to 1.76 million in June 2000. Over the same period the working age population increased by 15.1% from 2.51 million to 2.89 million. These trends allowed unemployment to fall given only a modest change in the labour force participation rate (from 63.9% to 64.8%). Alongside employment growth was a redistribution of employment between males and females. In 1987, 71.2% of males of working age participated in full time work: in 1990 the rate was 63.7% and by 1999 it was 60.2% (figures cited in Morrison, 2001). Female participation rates increased during the 1990s but significantly so for part time participation only.

Clearly given compositional changes in the workforce, evolution should be expected in catchment areas. Indeed, the changes in employment perhaps suggest the potential for travel to work patterns to have changed more than they appear to have done. One constraining influence is that much employment growth is concentrated in urban areas where travel-to-work catchments are comparatively large. Another influence is that gender differences in the mobility of employed persons may be reducing (see section below Sub group labour markets in 2001).

Differences in data coding and data quality between the 1991 and 2001 Census are another source of change arising outside of actual changes in travel to work. The effect of increased "noise" in the data, due to coding or data entry mistakes, would be expected to have its greatest effect on catchment areas with small working populations. A small number of coding gaps or errors can shift the allocation of area units to catchments more readily for small populations than large populations. The sensitivity of the result to changes in self containment is illustrated by the fact that of the 25 1991 labour market catchments which experienced a decrease in workplace self containment of more than 18%, 80% (20) were merged with other catchment areas

¹ The urban rural classification of each unit reflects the percentage of each catchment's population living in each 1991 urban / rural types

² This is where two or more 1991 catchment areas are grouped into one in 2001

between 1991 and 2001, versus only 34% for other catchments. Similarly, 58% of the 12 1991 labour markets with workplace employment numbers of less than 500 were merged with others in 2001 compared with only 40% other labour market catchment areas. The high incidence of change among small catchments at least illustrates their sensitivity to changes in data quality.

Finally, comparing 1991 and 2001 it should be noted that even labour catchments with unchanged boundaries have typically undergone significant growth and reduced self-containment since 1991 (Table 5). Employment self-containment reduced by over 10 percent in almost a quarter of cases and by from 5 to 10 percent in a similar proportion of areas. This reduction is usually associated with a significant growth in the area's employment, although there are catchments that experience high employment growth with little change in their self-containment. Despite a predominance of catchments with reduced self-containment the overall levels remain high, including more than half having an employment self-containment level of 0.85 or more.

Table 5
A profile of unchanged labour catchment areas 1991-2001

Labour market*	Employment 2001	Change (%) in employment 1991-2001	Work self-containment 2001	Change (%) in work self-containment 1991-2001
1.Kaitaia	5140	31.4	0.94	-2.9
20.Whangamata	1233	63.7	0.78	-10.8
22.Hauraki Plains	1211	17.7	0.74	-16.1
29.Matamata	4438	10.2	0.85	-5.0
35.Maihihi	3128	18.5	0.82	-5.2
44.Katikati	2516	43.6	0.81	-0.7
45.Te Puke	5492	24.0	0.77	-9.8
46.Tauranga	40132	54.6	0.93	-2.9
51.Murupara	991	13.5	0.85	-4.3
53.Opotiki	2640	29.4	0.90	-6.2
54.East Cape	1135	20.9	0.92	-3.2
55.Tarndale-Rakauroa	849	12.7	0.75	-16.3
56.Gisborne	13817	13.9	0.97	-0.2
61.Central Hawke's Bay	5977	20.2	0.89	-6.1
63.Douglas	539	5.1	0.82	-13.1
67.Kapuni	782	-4.5	0.79	-6.7
74.Tangiwai	1584	15.8	0.90	0.5
75.Waiouru	1059	-27.5	0.89	2.0
82.Dannevirke	4598	3.8	0.89	-5.0
83.Pahiatua	1848	-4.8	0.82	-5.0
84.Nireaha-Tiraumea	768	9.4	0.84	-10.8
92.Golden Bay	2335	55.7	0.90	-6.6

93.Motueka	5836	38.2	0.85	-4.5
94.Golden Downs	527	32.1	0.79	0.5
95.Murchison	710	47.9	0.85	-9.6
96.Nelson	27952	33.7	0.97	0.4
97.Ward	496	24.3	0.81	3.4
100.Kaikoura	1588	46.6	0.93	-5.1
101.Westport	3020	10.4	0.94	-4.4
102.Reefton	764	11.2	0.90	-1.1
107.Parnassus	592	2.2	0.93	-3.6
108.Hurunui	1217	24.4	0.79	-16.2
110.Okains Bay	920	50.3	0.80	-16.7
111.Mt Somers	1854	34.6	0.80	-14.9
112.Hinds	1932	44.1	0.71	-20.5
119.Aviemore	573	-7.3	0.85	2.4
120.Oamaru	7250	9.3	0.96	0.1
122.Teviot	864	-3.7	0.90	4.6
123.Maniototo	846	-0.7	0.94	-0.3
124.Alexandra	5059	15.5	0.90	-5.1
130.Tuapeka	1489	7.0	0.85	-5.4
133.Toetoes	914	8.8	0.81	-16.3
137.Te Waewae	967	15.5	0.81	-11.3

* Number is the reference number for 1991 labour market areas (see Newell and Papps 2001, Table 2)

2001 labour market catchments on 2001 area unit boundaries

A parallel set of catchments was constructed based on 2001 area unit boundaries rather than the 1991 area unit boundaries as used above. Whereas there is some change in area unit boundaries between Censuses, meshblock boundaries are preserved to a greater extent. This provides a further way of determining the robustness of labour market catchments, in this case testing how sensitive boundaries are to changes in the underlying spatial units from which they are constructed. It may indicate a need to construct catchments from meshblock data, the lowest level of Census data so as to fully capture the impact of changes in the distribution of population on travel to work patterns.

The generation of boundaries based on 2001 area units followed the same procedure as that based on 1991 area units except in determination and treatment of missing data. For the 1991 area unit-based boundaries, the shortfall in reporting of workplace addresses was adjusted to ensure that the same proportion of actual workplace counts were represented in each analysis (controlling for scale effects that were an artifact of the data rather than real). The analysis on 2001 area unit boundaries corrected for all missing data to generate catchments based on their full population. Consequently a higher proportion of the journeys to work included in the 2001 area unit analysis are estimated journeys based on the behaviour of Census respondents that provided both a residential and workplace address coded to a meshblock. This scaling up may magnify anomalies in the data for sparsely populated areas if the persons providing complete data are not representative of all journey to work patterns. Local

investigations of commuting patterns would be a useful extension of the present study given the likelihood of needing to undertake some data adjustment in future years as well as for 2001.

Using the 2001 area unit boundaries, the number of labour market catchments is 104 compared with 106 when 2001 Census data are applied to the 1991 area unit boundaries (Figure 3 and 4).

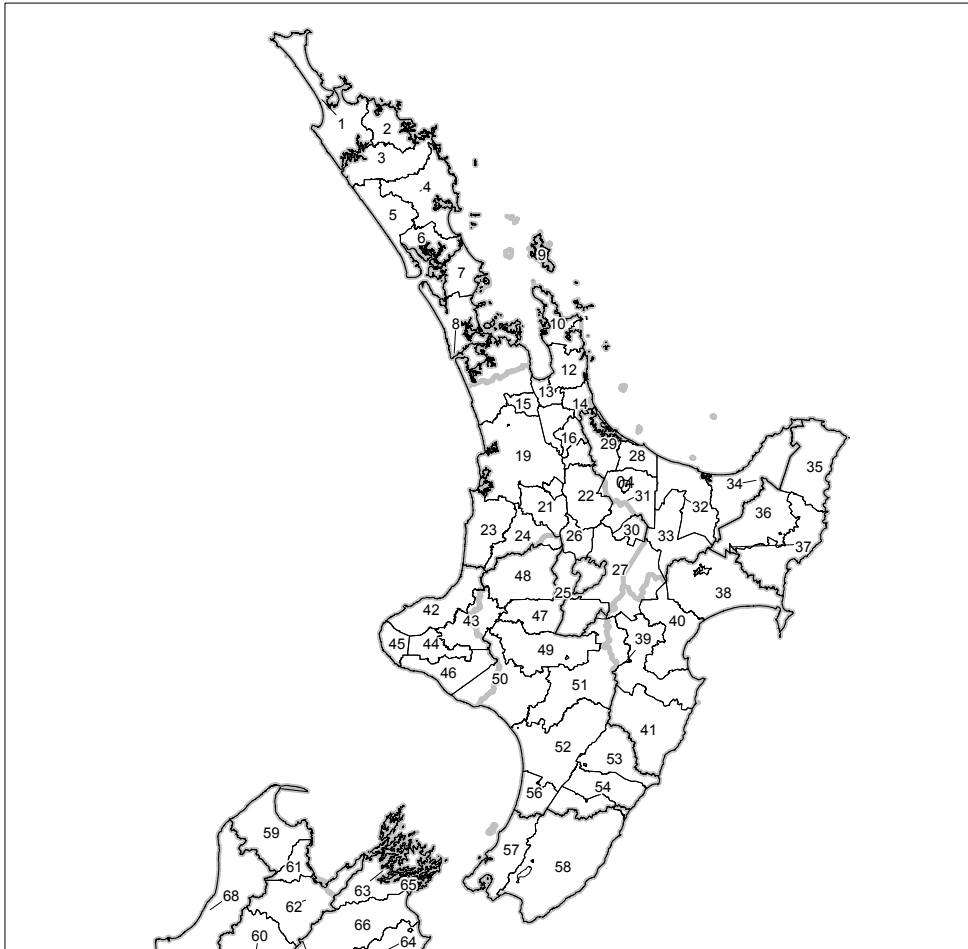


Figure 3
2001 Labour Market Catchment Areas in the North Island based on 2001 Area Units
(Labels refer to the local labour market catchment areas listed in Table 6)

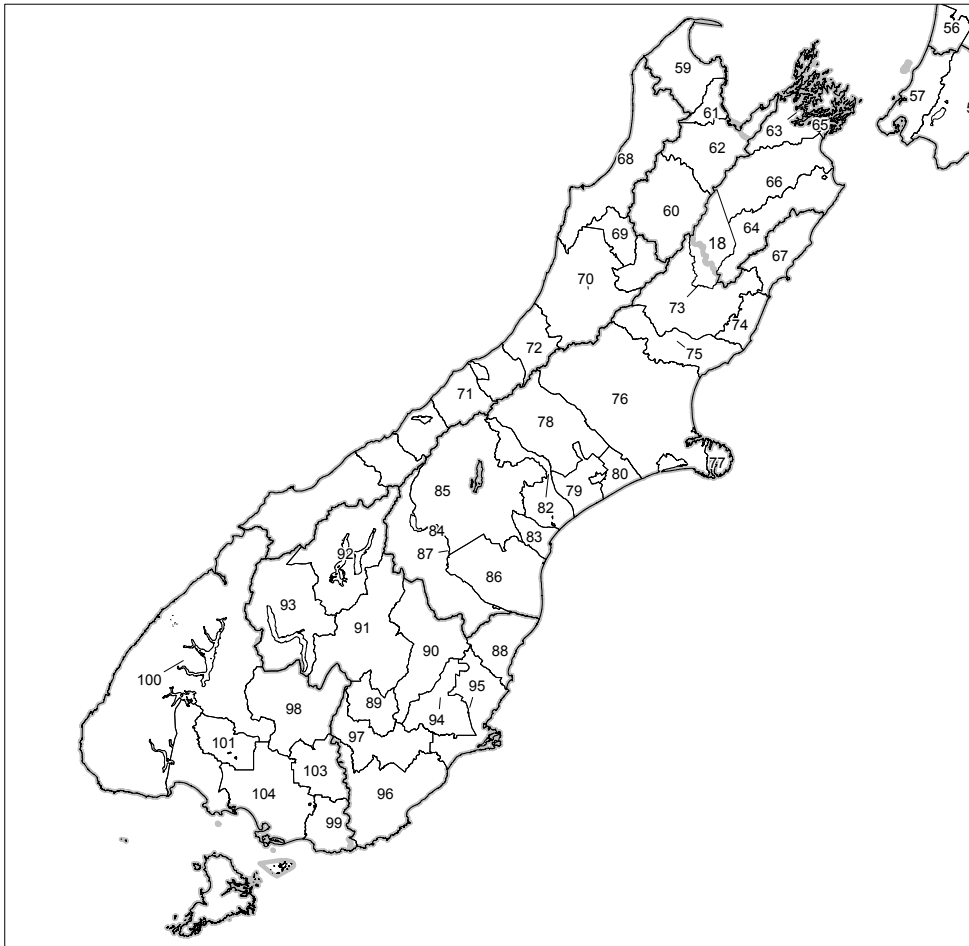


Figure 4
2001 Labour Market Catchment Areas in the South Island based on 2001 Area Units
(Labels refer to the local labour market catchment areas listed in Table 6)

Table 6
Labels for 2001 Labour Market Catchments on 1991 Area Units shown in Figures 1
and 2

1 Kaitaia	36 Tarnedale-Rakauaroa	71 Franz Josef
2 Kerikeri	37 Gisborne	72 Hokitika
3 Kaikohe	38 Wairoa District	73 Amuri
4 Whangarei District	39 Hastings Zone	74 Parnassus
5 Dargaville	40 Napier Zone	75 Hurunui
6 Rehia-Oneriri	41 Central Hawke's Bay District	76 Christchurch
7 Warkworth	42 New Plymouth	77 Okains Bay
8 Central Auckland Zone	43 Douglas	78 Mt Somers
9 Great Barrier Island	44 Eltham	79 Hinds
10 Whitianga	45 Kahui	80 Chertsey
11 Whangamata	46 Hawera	81 Ashburton
12 Thames	47 Raurimu	82 Orari
13 Hauraki Plains	48 Taumarunui	83 Timaru
14 Waihi	49 Tangiwai	84 Twizel Community
15 Waerenga	50 Wanganui	85 Mackenzie
16 Waihou-Walton	51 Taihape	86 Waihao
17 Morrinsville	52 Palmerston North	87 Aviemore
18 Matamata	53 Dannevirke	88 Oamaru
19 Hamilton Zone	54 Pahiatua	89 Teviot
20 Rotongata	55 Nireaha-Tiraumea	90 Maniototo
21 Otorohanga Rural East	56 Levin	91 Alexandra
22 South Waikato District	57 Wellington Zone	92 Wanaka
23 Marokopa	58 Masterton	93 Queenstown
24 Te Kuiti	59 Golden Bay	94 Silverpeaks
25 Turangi	60 Lake Rotorua	95 Dunedin
26 Marotiri	61 Motueka	96 Clutha
27 Taupo	62 Nelson	97 Tuapeka
28 Te Puke East	63 Marlborough Sounds Terrestrial	98 Waikaia
29 Tauranga	64 Ward	99 Toetoes
30 Golden Springs	65 Picton	100 Te Anau
31 Rotorua	66 Blenheim	101 Wairio
32 Whakatane	67 Kaikoura District	102 Te Waewae
33 Murupara	68 Westport	103 Gore
34 Opotiki District	69 Reefton	104 Invercargill
35 East Cape	70 Greymouth	

The overall self-containment characteristics of catchments based on 2001 area unit boundaries show less change with 1991 than when the 1991 area unit boundaries are preserved but more change when employment size is compared (see Table 4 and 7). The difference between the self-containment and employment size outcome is explained by results for Auckland. As explained below, a significant difference between the catchments produced from 1991 and 2001 area unit boundaries is the outcome for the largest labour markets. As would be expected by the efforts to preserve area unit boundaries, there is little variation in area unit characteristics between 1991 and 2001.

Table 7
Comparison of catchment and area unit attributes 2001, using 2001 area unit boundaries

Area attributes	Labour market catchments		Area units	
	Mean	Standard deviation	Mean	Standard deviation
Residential self-containment	87.0%	7.3%	28.1%	22.6%
Employment self-containment	88.3%	6.7%	41.4%	26.2%
Employed population	16,670	58,846	938	731
Number of jobs	16,670	59,168	937	2,091

When individual catchments are compared, the difference is more significant than the change indicated by the number of separate labour markets. For example, an important difference is that the Southern Auckland catchment disappears when 2001 area unit boundaries are used. When the 1991 area unit boundaries are preserved, Southern Auckland is the country's fourth largest catchment and its merger with Central Auckland on 2001 area unit boundaries is a substantial difference.

Examining the main urban labour markets further highlights the sensitivity of catchments according to the spatial units from which they are constructed (Table 8). Using the latest area unit definitions increases the size of the largest catchments. Indeed the six main urban catchments generated from 2001 area unit boundaries account for slightly over 70 percent of national employment.

Table 8
Comparison of main urban labour markets 2001 using 1991 and 2001 area unit (AU) boundaries

Labour market	Employment 2001		Work self-containment 2001	
	1991 AUs	2001 AUs	1991 AUs	2001 AUs
Central Auckland	301603	539172	0.85	0.98
Southern Auckland	173841	--	0.75	--
Hamilton	66418	88333	0.93	0.96
Palmerston North	44458	53357	0.94	0.94
Wellington	175432	194419	0.99	0.97
Christchurch	175719	191056	0.99	0.99
Dunedin	48195	52313	0.97	0.97

A further contrast between the 2001 catchments relates to the proportion shrunk or split compared with 1991 (Table 9). There appear to be differences between the two classifications, but this is probably a problem in distinguishing unambiguously between these types of change. The comparison of changes based on 1991 and 2001 boundaries was done at different times and the classification of a change as a split or shrinkage was judgemental rather than based on a strict threshold.

Table 9
Summary of the changes in labour market catchments 1991 and 2001 based on 1991
and 2001 area unit (AU) boundaries

	1991 AU basis	2001 AU basis
Same	44	47
Same Almost	10	17
Merged Whole ³	59	57
Expanded	7	4
Shrunk	5	13
Split	15	2
Sub Total	140	140

Sub group local labour markets in 2001

Accessibility to jobs is not just a function of workplace location and residence. The nature of the skills and experience of each person and their relationship to the distribution of corresponding job opportunities is also a major factor. The cost of travel in relation to employment returns will also vary in relation to wage rates and hours worked, affecting the area over which an individual will seek work.

One approach to uncovering these differences within the population would be to run the algorithm for different subsets of the population and compare the results. Another approach is to estimate and compare the level of self-containment (effectively the goodness of fit) of each labour market catchment for employment sub groups that may exhibit different travel to work patterns from the workforce as a whole. In this second approach, higher levels of self-containment are interpreted as indicating shorter commuting distances, although this may be a simplification depending on the particular geography of the catchment area and adjoining areas.

The former approach would require data below the spatial level that may be released from the Census under the confidentiality protection procedures that Statistics New Zealand operates. It would also require refining model parameters for each category. In contrast, the estimation of sub group self-containment is relatively straightforward.

The approach adopted here is to estimate residential self-containment values for a range of employee attributes. Letting T_{ij} denote the number of commuting trips from area i to area j , self-containment levels are identified as follows.

Residential (supply side) self-containment of area i

$$= \frac{T_{ii}}{\sum_{j=1}^n T_{ij}}.$$

³ This is where two or more 1991 catchment areas are grouped into one in 2001

The analysis presented here makes use of the 1991 area unit based local labour market catchments. Interpretation of the apparent variation in residential self-containment needs to note that travel to work patterns vary according to whether the labour catchment is in an urban or rural environment. Labour market catchments are typically larger and less self-contained for urban than rural areas. At the same time some labour market groups may be more strongly represented in an urban than rural area. Where such uneven representation occurs, further work is needed to distinguish the impact of a group's mobility choice from the impact of the labour market type on the representation of particular labour market groups within the catchment.

Gender

A different pattern of commuting for female and male workers may be expected given differences in the participation in household responsibilities and occupation profile. In practice, giving equal weight to each labour market area shows minimal variation in catchment self-containment levels between females and males (Table 10). There is a slightly higher level of self-containment for females and more variation in the self-containment levels for females than males. This difference suggests less geographical mobility among females but that overall the labour market areas do not contain a substantial gender bias. The pattern differs in the case of the largest urban labour market (Central Auckland) where the residential self containment level varies from 0.81 for males to 0.89 for females. In contrast, the next three largest labour markets (Southern Auckland, Wellington and Christchurch) have less gender variation than the country as a whole.

Table 10 Residential self-containment of 2001 labour markets by gender

	Male	Female	Total
Residential self containment	0.882	0.906	0.894
Standard deviation of self containment levels	0.093	0.095	0.091
Number employed	709,452	679,578	1,389,057

Occupation

A preliminary assessment of the variation in self-containment by occupation was conducted at the two digit level of the NZSCO90 which distinguishes 23 occupations. Overall a high level of self-containment is maintained for all occupational groups with variations readily explainable by the nature of work. The lowest level of self-containment is found for drivers and mobile machinery operators (0.84) followed by industrial plant operators (0.85). The highest level of self-containment exists among market-orientated agricultural and fishery workers (0.93) and salespersons (0.91).

Ethnicity

Overall those of New Zealand European ethnic origin are more self contained than other ethnic groups (Table 11). Māori have a lower level of self-containment mainly as a consequence of reduced male self-containment. Smaller ethnic populations exhibit the lowest levels of self-containment.

Table 11 : Residential self-containment of 2001 labour markets by ethnicity and gender

	Residential self containment		Standard deviation of self containment levels		Number employed	
	Male	Female	Male	Female	Male	Female
NZ European Only	0.891	0.913	0.092	0.094	538,476	512,979
NZ Māori	0.859	0.893	0.100	0.099	65,883	67,095
Other European	0.867	0.901	0.113	0.105	36,876	35,496
Samoan	0.865	0.873	0.095	0.101	13,362	13,215
Chinese	0.835	0.857	0.133	0.135	12,891	12,501
Indian	0.819	0.851	0.116	0.115	11,862	9,825
Cook Island Māori	0.856	0.866	0.127	0.123	5,124	4,962

Income

Those in the highest and lowest personal income pentiles have lower self containment than those in middle income groups (Table 6). In the case of low income workers, the reduced self-containment is most evident among males. This may in part reflect the different occupational distribution of male and female workers.

Table 12 : Residential self-containment of 2001 labour markets by income and gender

Income group pentile (5=highest)	Residential self containment		Standard deviation of self containment levels		Number employed among all income earners	
	Male	Female	Male	Female	Male	Female
1	0.888	0.914	0.085	0.080	17,592	19,470
2	0.922	0.934	0.056	0.062	43,023	75,249
3	0.909	0.928	0.067	0.074	49,320	107,667
4	0.901	0.917	0.075	0.090	115,869	162,978
5	0.885	0.894	0.093	0.115	203,529	177,576

Hours worked

Individuals working less than full time or excessive hours in their main job are generally more self-contained than those with 'normal' full time hours of work. Thus for both female and male work of less than 20 hours per work the self containment levels are over 0.9. The aggregate self-containment level drops to 0.86 among those working 45-49 hours per work.

Age

Levels of self-containment by age group largely follow expected patterns. The youngest working people (15-17) show high levels of self-containment (0.93) with older age groups showing more mobility up to the 50 to 54 year cohort, after which self-containment increases to 0.95 for those aged 75-79. Self-containment is lowest for persons aged 25-29 (0.87). An unusual finding is the comparatively low self-containment of working persons of over 85 years (0.87). This group numbers 627 and while it may include particular forms of employment, such as semi-retired business

owners, it is probably another reflection of the poor quality of some aspects of the 2001 Census data.

Comparing labour market catchments and local authority boundaries

A justification for preparing labour market catchments is that existing administrative boundaries do not provide a sufficient representation of labour markets. This was confirmed in the 1991 analysis to the extent that few labour markets matched territorial local authority boundaries (Newell and Papps 2001, p23). There are currently 74 lower tier authorities (cities and districts) and so the reduction in the number of labour market catchments identified since 1991 may have produced increased alignment of the two sets of boundaries as part of the shrinkage in the number of separate labour markets.

Using the 1991 area unit boundaries indicates that there is little overlap between labour market catchments and local government areas (see figures in Appendix One). In seven cases the area covered by a local authority and labour market match and in a further four cases there is almost a match (typically the labour market extends beyond the local authority boundary). In addition there are ten local authority areas that divide into multiple labour markets contained entirely within the local authority area. These fragmented local authority areas account for a further 29 labour markets.

The balance of 53 local authority areas and 68 labour markets generate a complex geography. There are 23 local authorities that are absorbed entirely within one larger labour market area. In over half of these cases, the local authority accounts for less than a quarter of the total employment located in the catchment of which they are a part (Table 13). These cases frequently involve urban authorities within the major metropolitan regions.

At the other end of the spectrum, ten local authorities divide into four or more separate labour market catchments (Table 14). These ten areas include one case from those mentioned above where the catchments are contained entirely within the local authority boundary. These most fragmented local authority areas typically comprise extensive rural areas and catchments with small amounts of total employment.

Table 13
Local authorities forming part of one labour market catchment 2001

Local authority	Labour market catchment	Employment within the local authority area	Local authority employment as share (%) of the labour market catchment
North Shore City	Central Auckland	70946	22.3
Waitakere City	Central Auckland	42910	13.5
Manukau City	Southern Auckland	92374	52.0
Papakura District	Southern Auckland	13091	7.4
Franklin District	Southern Auckland	17254	9.7
Hamilton City	Hamilton	55768	67.0
Waipa District	Hamilton	14675	17.6
Tauranga District	Tauranga	36269	91.2
Kawerau District	Whakatane	3236	24.5
Napier City	Napier	20850	91.1
Manawatu District	Palmerston North	9305	19.2
Palmerston North City	Palmerston North	35493	73.2
Kapiti Coast District	Wellington	10966	6.1
Porirua City	Wellington	13545	7.6
Upper Hutt City	Wellington	10878	6.1
Lower Hutt City	Wellington	38046	21.2
Wellington City	Wellington	105325	58.8
Masterton District	Masterton	8911	62.8
Carterton District	Masterton	2612	18.4
Nelson City	Nelson	20374	72.1
Waimakariri District	Christchurch	10119	5.7
Christchurch City	Christchurch	153158	86.0
Selwyn District	Christchurch	10603	6.0
Gore District	Gore	5994	92.8
Invercargill City	Invercargill	21473	72.2

Table 14
Local authority areas comprising four or more labour market catchments 2001

Local authority	Labour market catchments	Employment within the local authority area	Local authority employment as share (%) of the labour market catchment
Far North District	Kaitaia	5111	100
	Hokianga North	435	100
	Kerikeri	6165	100
	Kaikohe	5448	100
Western Bay Of Plenty District	Waihi	601	24.8
	Katikati	2595	100
	Te Puke	5508	100
	Tauranga	3490	8.8
South Taranaki District	Stratford	2468	45.8
	Kahui	2005	100
	Kapuni	830	100
	Hawera	6899	100
	Wanganui	909	5.5
Taranua District	Palmerston North	307	0.6
	Dannevirke	4514	100
	Pahiatua	1821	100
	Nireaha-Tiraumea	724	100
Tasman District	Golden Bay	2237	100
	Motueka	5493	100
	Golden Downs	513	100
	Lake Rotoroa	664	100
	Nelson	7905	28.0
Westland District	Greymouth	61	1.1
	Franz Josef	781	100
	Hokitika	2304	100
	Christchurch	430	0.2
Hurunui District	Amuri	990	100
	Parnassus	610	100
	Hurunui	1141	100
	Christchurch	1578	0.9
Ashburton District	Christchurch	297	0.2
	Mt Somers	1709	100
	Hinds	1609	100
	Chertsey	1013	100

	Ashburton	7674	100
Waitaki District	Mackenzie	157	8.6
	Aviemore	561	100
	Oamaru	7477	100
	Waihemo	721	100
	Dunedin	51	0.1
Southland District	Waikaia	1234	100
	Toetoes	824	100
	Te Anau	1642	100
	Mararoa River	1170	100
	Wairio	413	100
	Te Waewae	922	100
	Gore	468	7.2
	Invercargill	8272	27.8

At the regional council tier, the priority to be given to identifying labour market catchments depends largely on the perceived need to recognise the geography of employment within each region. Five of the 16 regions comprise a collection of whole labour markets. In addition, there are three regions where the overlapping labour market affects less than 5 percent of the region's total employment (see the second column of Table 15). In a further three cases, over 95 percent of employment in the overlapping labour market is within one region's area (see the third column of Table 15). This leaves five regions where the regional council boundary is substantially out of line with its labour market areas. In these problematic cases, combining neighbouring regions (Waikato and Bay of Plenty, Taranaki and Manawatu-Wanganui, Nelson and Tasman) produces a self-contained set of labour markets.

Table 15
Employment in labour market catchments that cross regional council boundaries 2001

Regional council	Share (%) of regional council employment in overlapping labour markets	Share (%) of jobs in the overlapping labour markets located within the region
Northland	0.8	5.2
Auckland	36.2	97.4
Waikato	15.1	10.0
Bay Of Plenty	27.9	65.0
Gisborne	0	0
Hawke's Bay	0*	0
Taranaki	3.1	7.7
Manawatu-Wanganui	20.4	76.5
Wellington	0	0
Marlborough	0	0
Nelson	100	72.0
Tasman	47.0	28.0
West Coast	3.3	0.2
Canterbury	81.4	95.8
Otago	9.18	99.4
Southland	100	100

* There is a small overlap with two labour markets, one shared with Bay of Plenty and one with Manawatu-Wanganui, but these account for less than 0.1 percent of Hawke's Bay employment.

The significance of employment foci needs to be included in the evaluation of the relative merits of local authority and labour market boundaries. Employment foci are those area units that are centres of in-commuting or that have little out-commuting. A local authority area that matches the sphere of influence of a key foci may be a useful division of a larger catchment. This possibility particularly arises in the case of the urban authorities that are absorbed within a large metropolitan-wide catchment. The identified employment foci provide the framework around which labour market catchments are assembled. It would be worth exploring the effect of different catchment thresholds on the identification of employment foci. It would also be of value to aggregate those employment foci which are adjacent and connected through high levels of cross commuting. Applying appropriate rules to the manner in which the non-foci surrounding catchments are best grouped with these resulting consolidated foci would then provide the basis for local sub catchments or neighbourhoods. Analysis at that level would be of value for main urban areas and other large catchments, and provide the potential for understanding better the processes underlying changes in larger labour market catchment boundaries over time and the processes driving those changes.

Conclusion

This paper has summarised how the aggregate working population has been apportioned to relatively self-contained labour market areas. The general conclusion is that the algorithm modified from the method developed by Coombes, and first applied in New Zealand with 1991 Census data by Newell and Papps (2001), provides a robust basis for delineating local labour markets. This is judged by the overall stability in labour market boundaries and the consistently high levels of aggregate self-containment for labour market sub groups. That said, four qualifications to the success of the method are acknowledged that provide opportunities to extend the analysis so far completed.

The 2001 update has been constructed from area unit data. The original intention of utilising mesh block data was abandoned because of the high proportion of Census returns that do not have a workplace address coded to a mesh block. This study has provided further evidence to suggest the importance of looking at the structure of catchments from meshblock level data as an expansion of area unit populations tends to result in an expansion of catchment populations. The study also suggests the value of looking at underlying changes within major catchments through an analysis of employment foci within individual catchments.

A further shortcoming is that the 2001 Census has a much higher proportion of responses with incomplete workplace information than occurred in 1991. Catchments are thus compiled from area units with a proportion of journeys estimated from those for which there are complete data. Some uncertainty, therefore, exists as to how far the estimation procedures and unresolved shortfalls in data quality are influencing the results. The quality and completeness of the data or "noise level" has a significant impact on the accuracy of the identified labour markets. It is an open question at this point what the relative influence of high noise levels in the 2001 data and real labour market catchments adjustments have been on boundary changes between 1991 and 2001. In retrospect, an analysis of changes in labour market catchments between 1981 (or 1986) and 1991 would have been more insightful than the comparison between 1991 and 2001. Pre 1996, Census data quality was both high and consistent from one Census to another.

Use of the self-containment level to determine the retention of catchment areas among different labour market groups provides a partial assessment of the variation in mobility between social groups. An alternative method is to generate specific sub group catchments, using scaled down size requirements. This approach would provide more insight into the daily labour markets of individual groups than the aggregate self-containment statistics. Particularly in the case of the large urban labour markets there is justification for exploring the catchment variation between social groups in more detail than presented in this study.

Even using the existing boundaries there is considerable scope to examine changes in labour market catchment areas from 1991 to 2001. A preliminary comparison, as presented here, suggests the contribution of urbanisation processes but there are also some rural areas that have experienced catchment changes. The sources of boundary changes and role of different sub groups in promoting change should form part of the larger evaluation of the usefulness of travel to work areas as a basis for monitoring local employment change.

The apparent increase of long distance commuting was highlighted as potentially an aspect of modern labour markets that challenges the existence of localised catchment areas. It was found that the treatment of long distance commutes has a significant impact on the number of catchments generated. A problem is that the marked increase in long distance commuting exists alongside the evidence of quality deficiencies in the 2001 Census capture of workplace information. The present study has removed selected long distance commutes that seemed improbable or potentially temporary. Further examination of long distance commuting is desirable to determine whether they are associated with particular occupations that may permit the geographical flexibility implied. If a real increase in long distance commuting is sustained, there is a need to consider how this affects the use of catchments that essentially envisage commuting as a daily occurrence. Better understanding of apparent long distance commutes in the data may also permit a more selective filter that takes account of industry and occupation as well as distance in the separation of noise from real observations.

Given the limitations of the 2001 catchments, it is recommended that the 1991 catchments be used in the first instance for regional analysis until or unless further effort is made to verify the 2001 results. It would be useful to gain some objective measures of the relative contribution of increased “noise” and actual changes in behaviour to the 2001 results. The most accurate and up-to-date catchments that could be compiled would appear to be those based on 1991 travel to work data converted to 2001 area unit geography. There is greater reliability in the 1991 catchment boundaries than in the 2001 boundaries. For the researcher wanting to use the most contemporary boundaries, it would be appropriate to consider using both the 1991 boundaries in the meantime.

Acknowledgements

The project arose from financial support jointly awarded to the New Zealand Treasury and Department of Labour from the Departmental Contestable Research Pool, Ministry of Research Science and Technology. The authors gratefully acknowledge Statistics New Zealand provision of access to the 2001 Population Census masterfile needed to prepare the various statistical inputs required for this project. Peter O'Brien, SAS programmer, Statistics New Zealand supervised running on the 2001 Population Census masterfile of custom SAS programmes drafted by James Newell. The authors are solely responsible for the use of the data and its interpretation in this paper.

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Appendix One : Regional Maps of 2001 Labour Market Catchments on Area Unit 1991 Boundaries

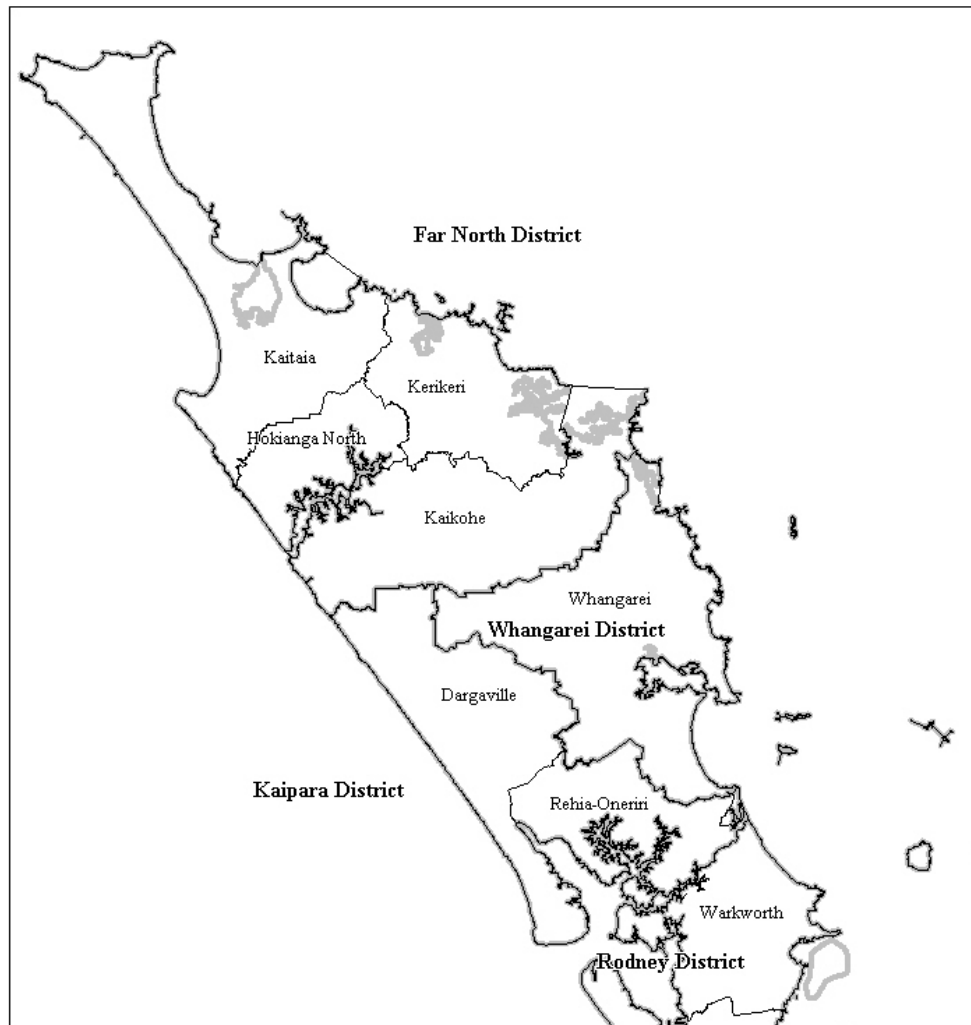


Figure 5
2001 Labour Market Catchment Areas for Northland based on 1991 Area Units

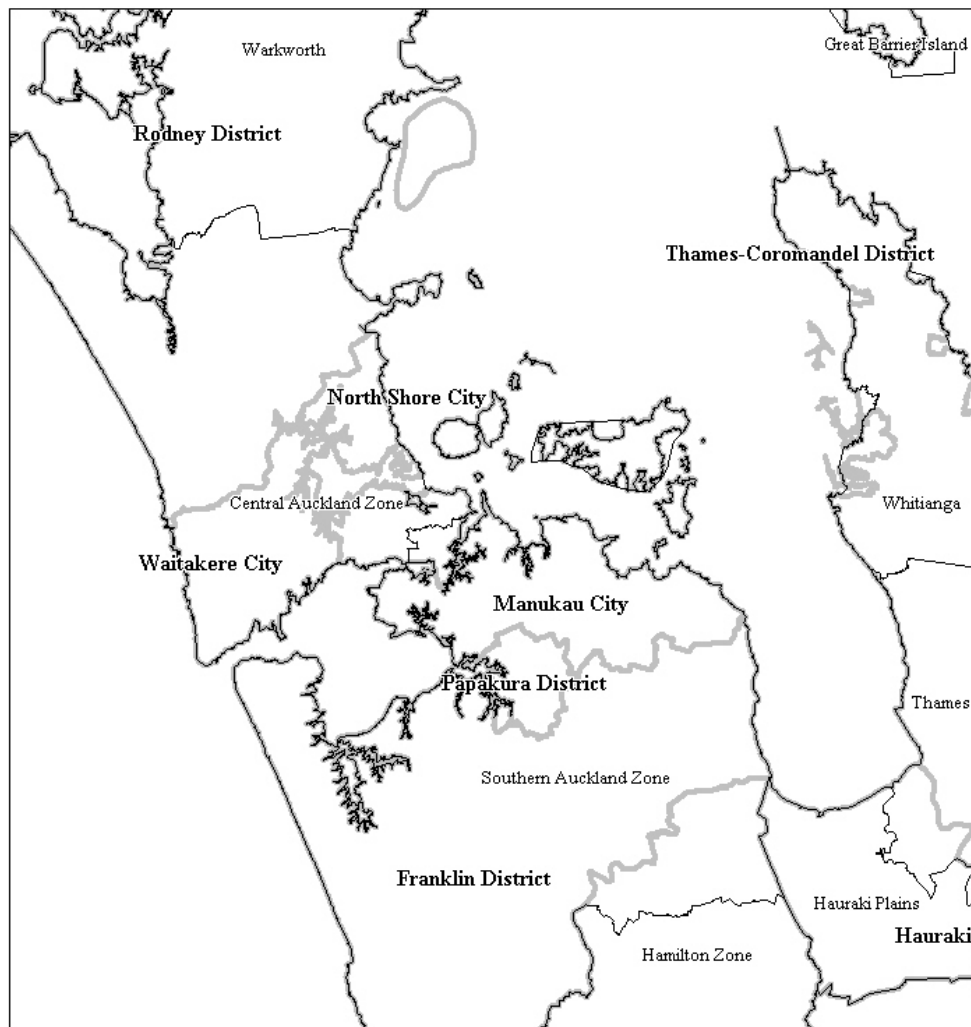


Figure 6
 2001 Labour Market Catchment Areas for Greater Auckland based on 1991 Area Units

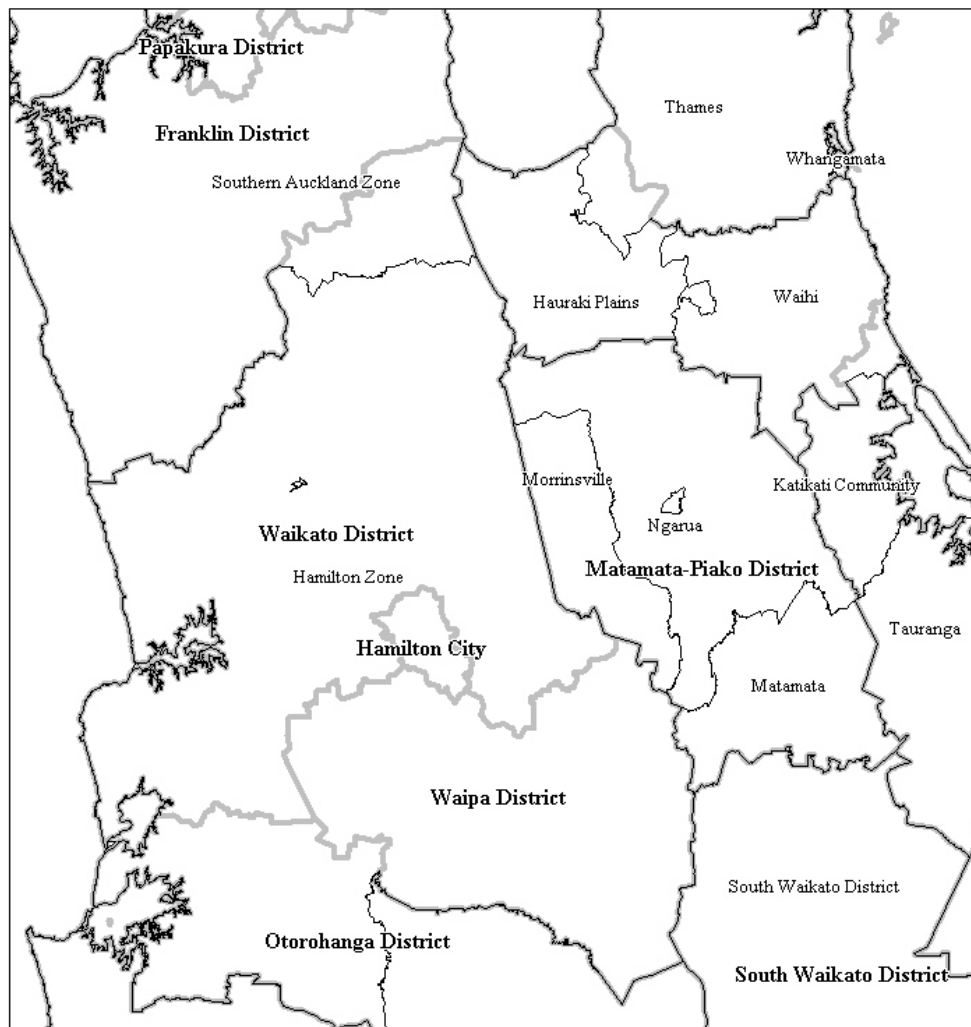


Figure 7
 2001 Labour Market Catchment Areas for the Waikato area based on 1991 Area Units



Figure 8
2001 Labour Market Catchment Areas for the Coromandel area based on 1991 Area Units



Figure 9
 2001 Labour Market Catchment Areas for the greater Tauranga area based on 1991
 Area Units

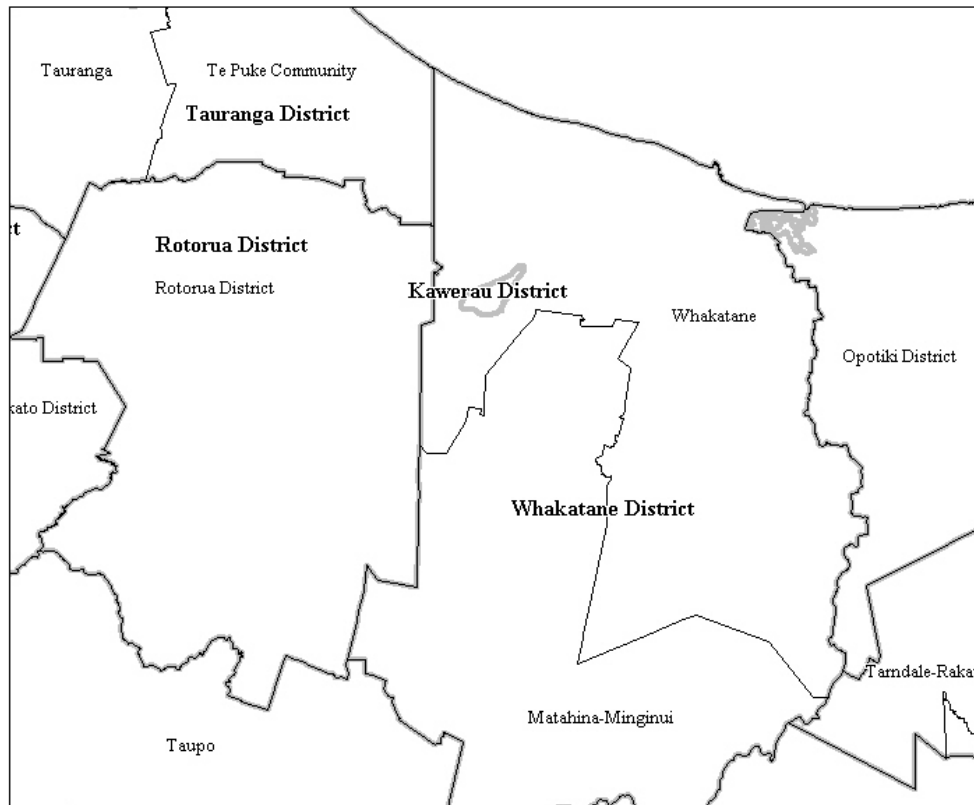


Figure 10
 2001 Labour Market Catchment Areas for the Bay of Plenty area based on 1991 Area Units

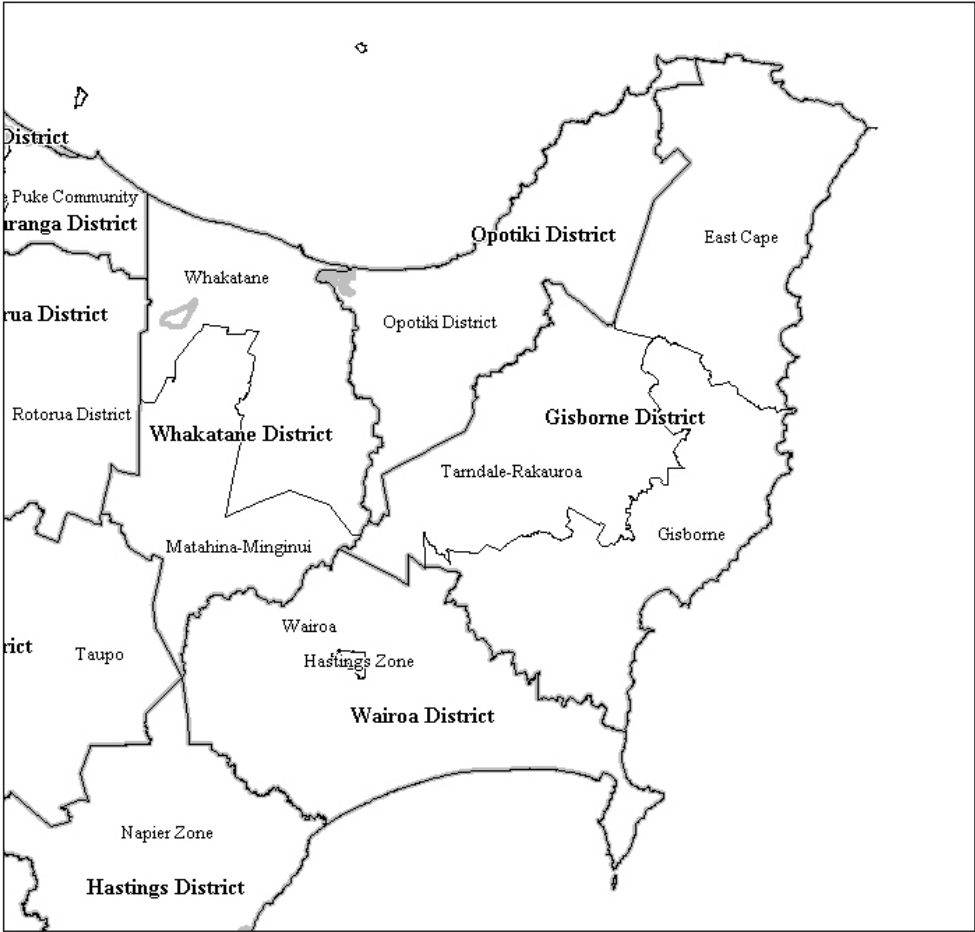


Figure 11
 2001 Labour Market Catchment Areas for the East Cape area based on 1991 Area Units

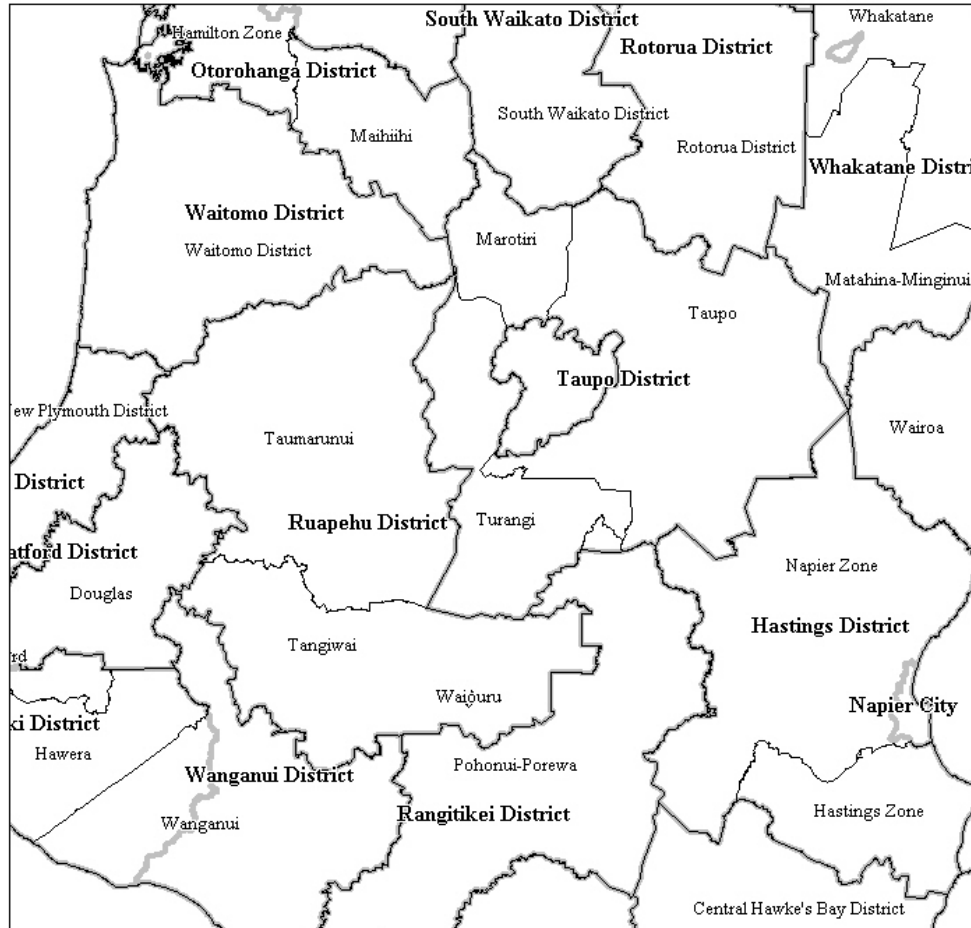


Figure 12
 2001 Labour Market Catchment Areas for the central North Island area based on 1991 Area Units

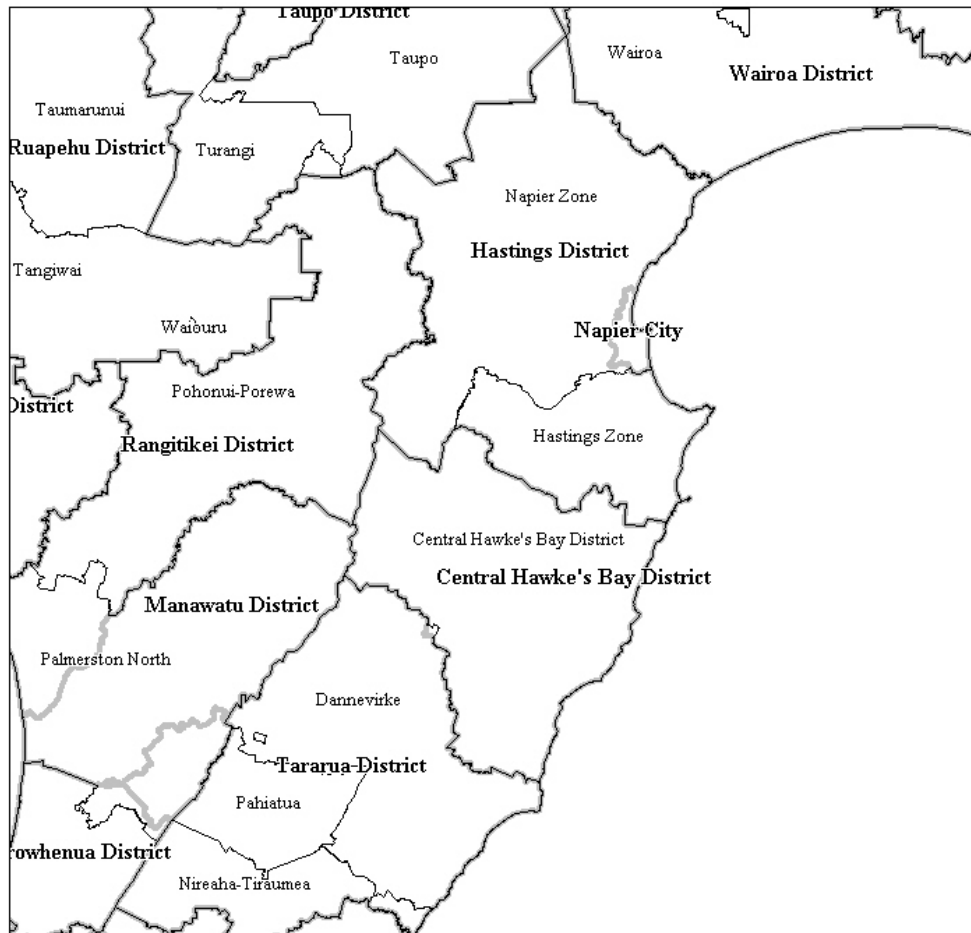


Figure 13
 2001 Labour Market Catchment Areas for the Hawkes Bay area based on 1991 Area Units

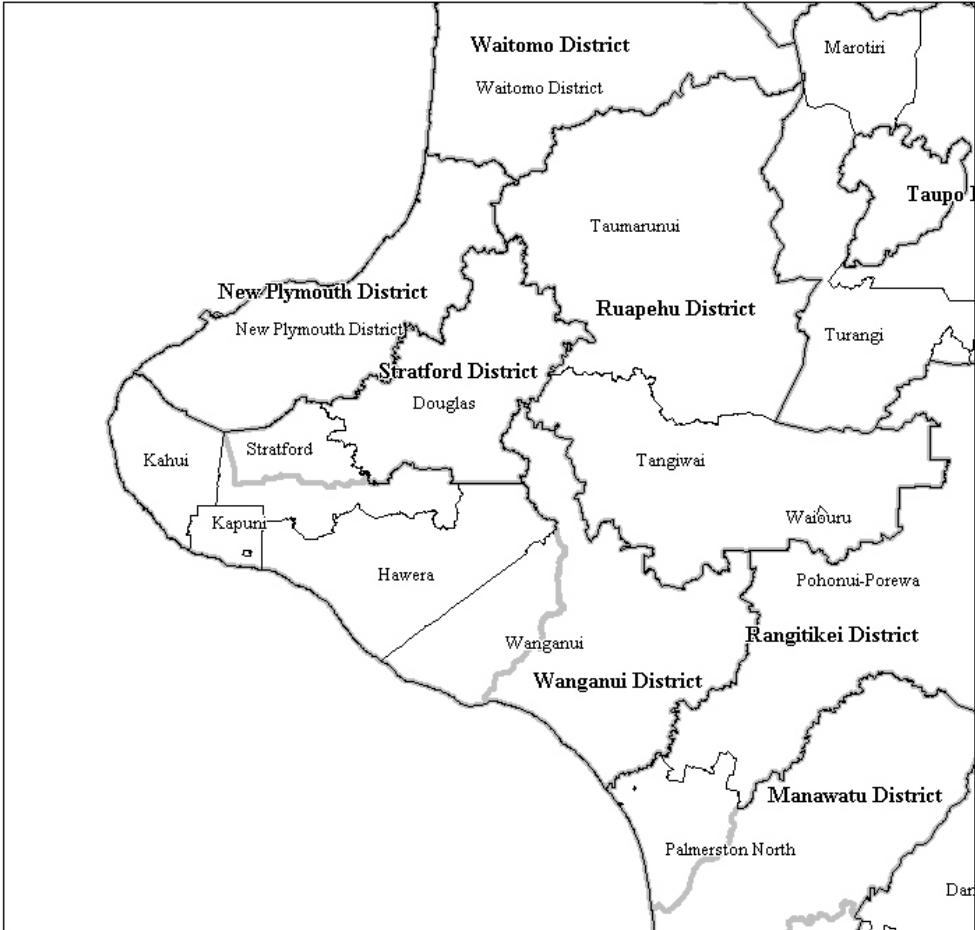


Figure 14
 2001 Labour Market Catchment Areas for the greater Taranaki area based on 1991
 Area Units



Figure 15
 2001 Labour Market Catchment Areas for the lower North Island area based on 1991
 Area Units



Figure 16
 2001 Labour Market Catchment Areas for the upper South Island area based on 1991
 Area Units



Figure 17
 2001 Labour Market Catchment Areas for the North Canterbury area based on 1991
 Area Units

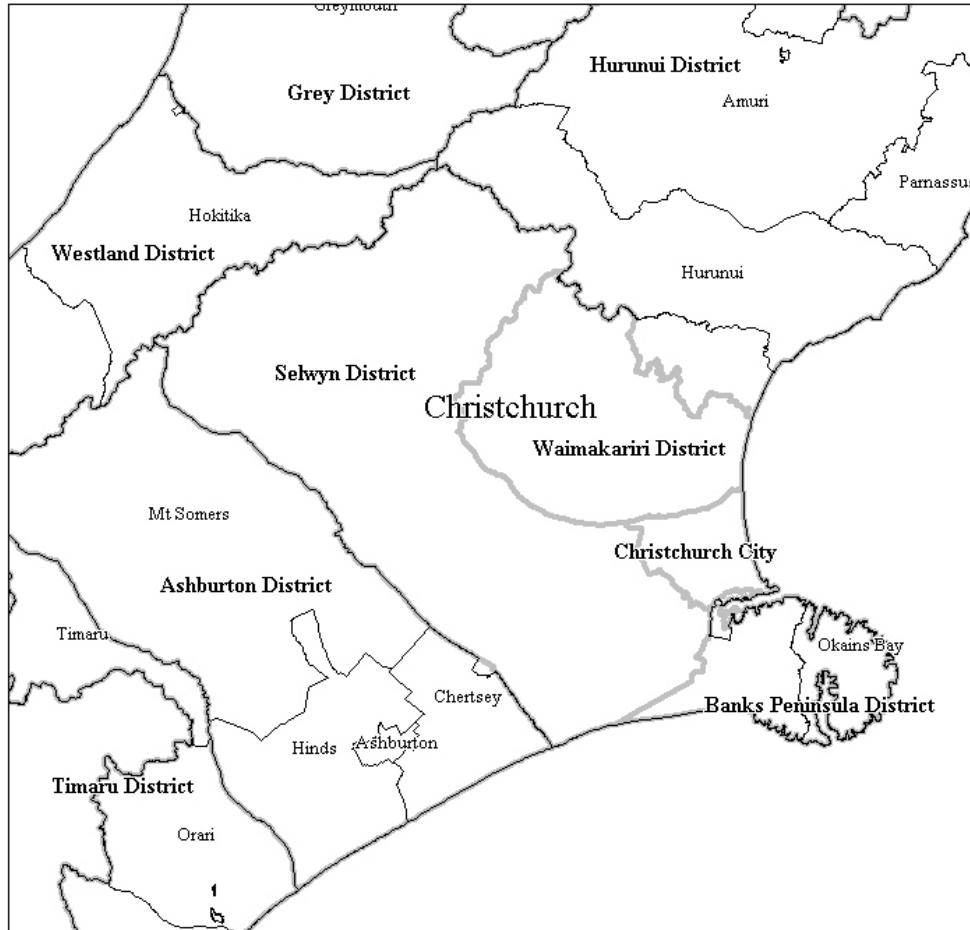


Figure 18
 2001 Labour Market Catchment Areas for the greater Christchurch area based on
 1991 Area Units

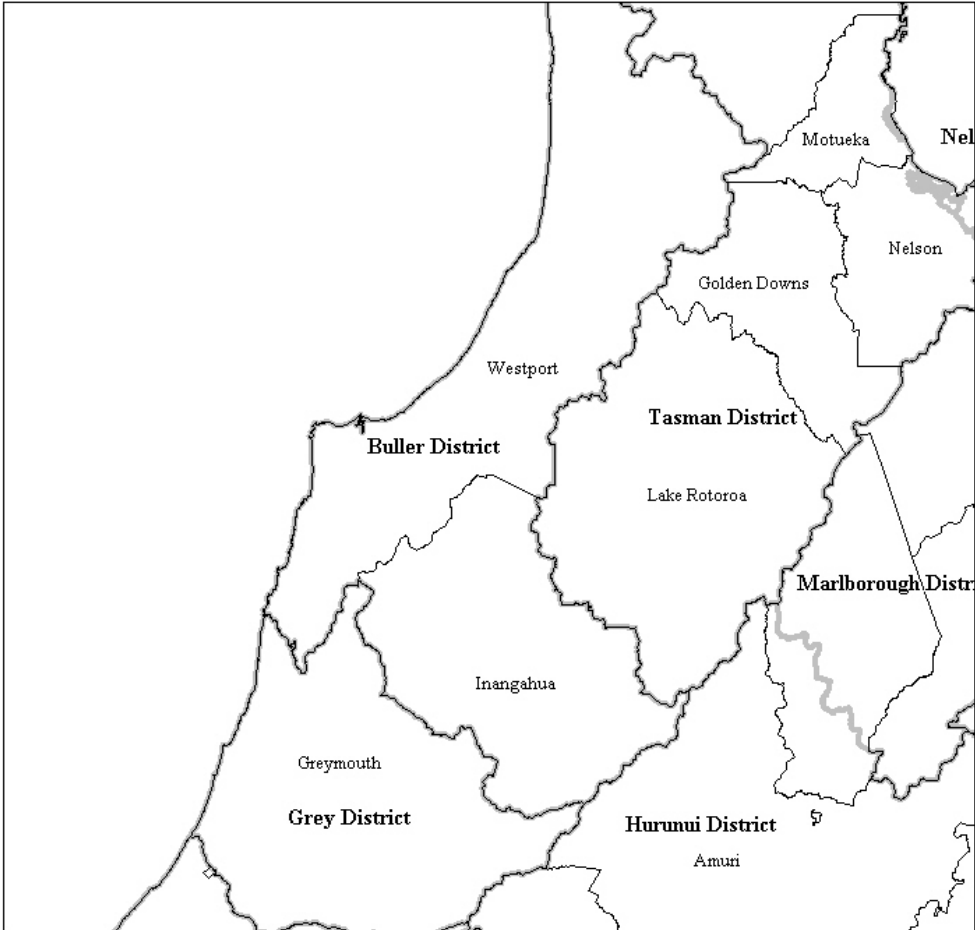


Figure 19
2001 Labour Market Catchment Areas for the northern West Coast Region area based
on 1991 Area Units

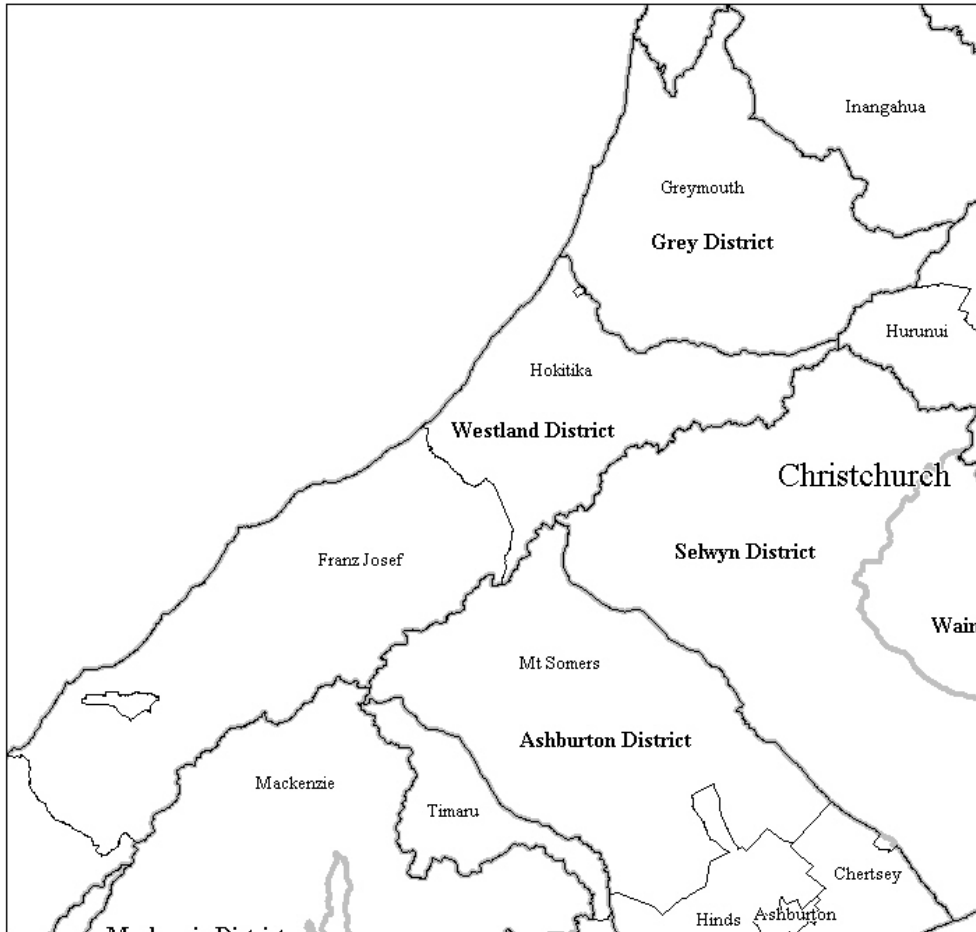


Figure 20
 2001 Labour Market Catchment Areas for the central West Coast Region based on
 1991 Area Units

Figure 21



2001 Labour Market Catchment Areas for the greater Timaru area based on 1991 Area Units



Figure 22
 2001 Labour Market Catchment Areas for the North Otago area based on 1991 Area Units

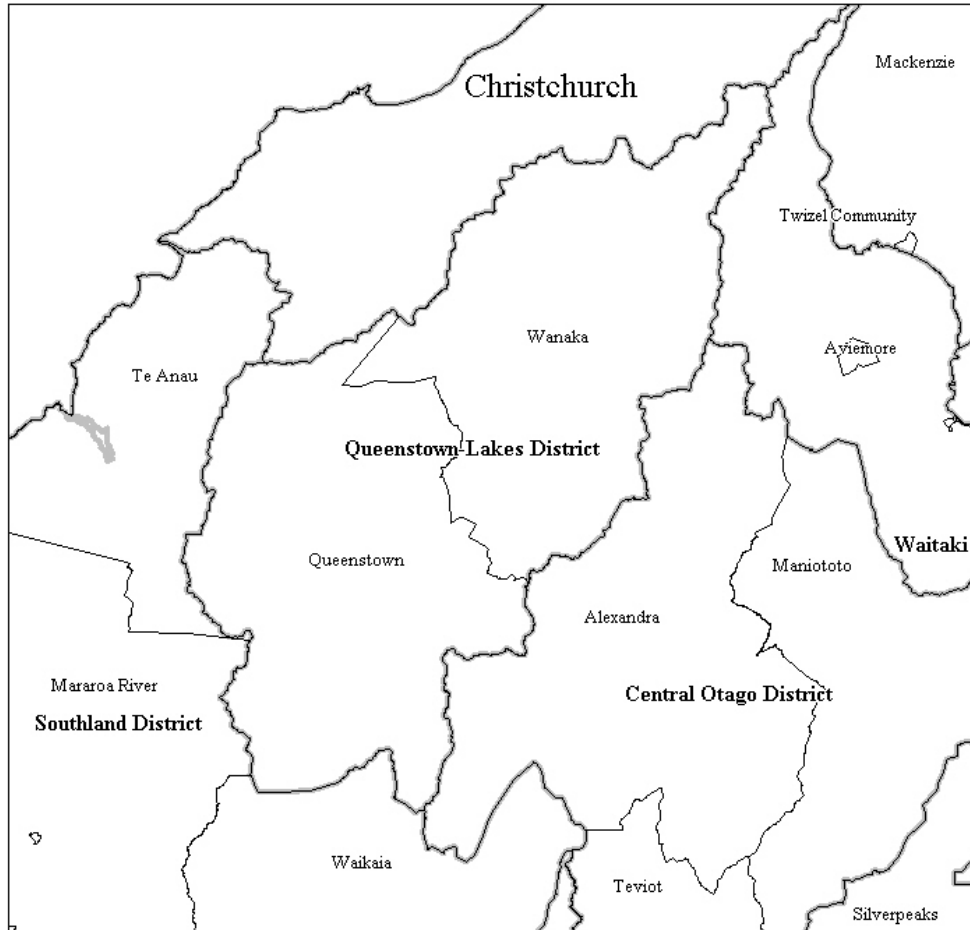


Figure 23
 2001 Labour Market Catchment Areas for the greater Queenstown area based on 1991
 Area Units

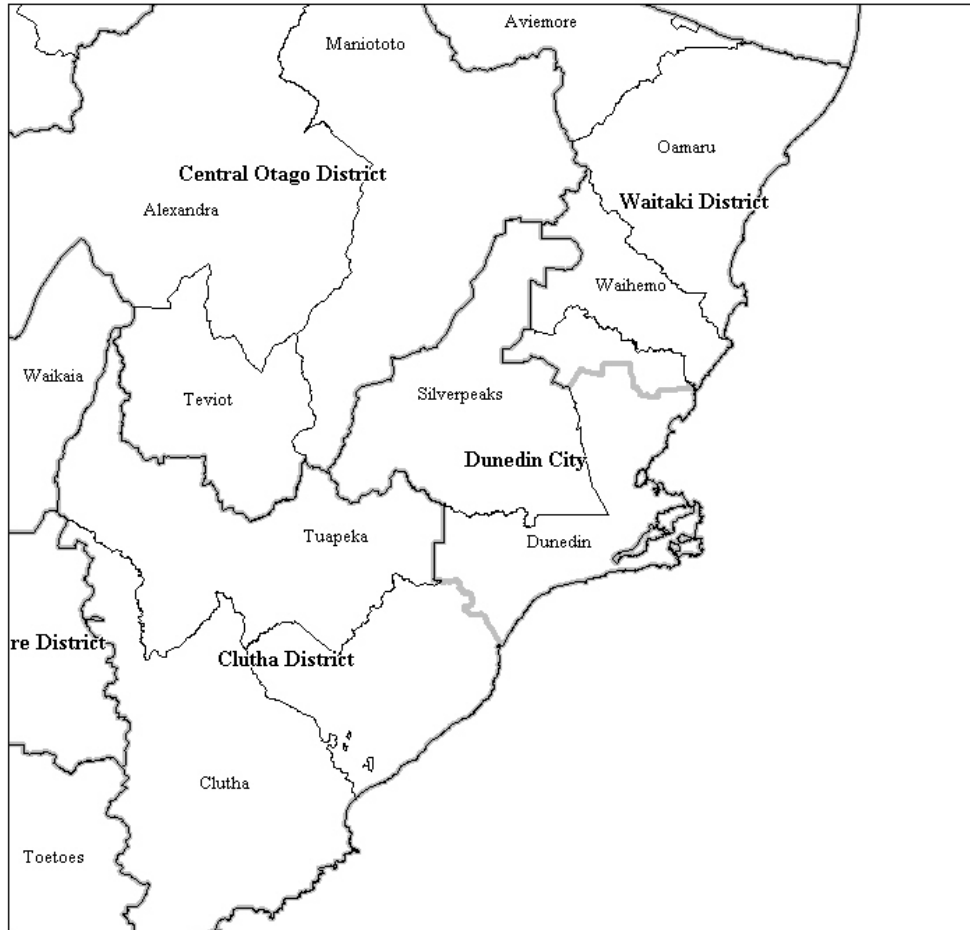


Figure 24
 2001 Labour Market Catchment Areas for the greater Dunedin area based on 1991
 Area Units



Figure 25
 2001 Labour Market Catchment Areas for the Southland Region based on 1991 Area Units