

**Exploring the Relationship between Individual Gambling Behaviour and
Accessibility to Gambling Venues in New Zealand**

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List of Acronyms

CAU	Census Area Unit
CBD	Central Business District
DIA	Department of Internal Affairs
EGD	Electronic Gaming Device
EGM	Electronic Gaming Machine
GBAS	Gaming and Betting Activities Survey
GIS	Geographic Information Science
GWR	Geographically Weighted Regression
HLS	Health and Lifestyles Survey
LINZ	Land Information New Zealand
MB	Meshblock
MBIE	Ministry of Business, Innovation and Employment
NZ\$	New Zealand Dollars
NGS	National Gambling Study
NZDep2013	New Zealand Index of Deprivation using the 2013 New Zealand Census of Population and Dwellings data
NZGS	New Zealand Gaming Survey
NZHS	New Zealand Health Survey
NZICC	New Zealand International Convention Centre
NZiDep	New Zealand Index of Socioeconomic Deprivation for Individuals
NZLC	New Zealand Lotteries Commission
NZRB	New Zealand Racing Board
NZSAC92	New Zealand Standard Areas Classification 1992
OR	Odds Ratio
PGSI	Problem Gambling Severity Index
PPAG	People's Participation in, and Attitudes to Gambling
RC	Regional Council
RSA	Returned Services Association
SOGS	South Oaks Gambling Screen
TA	Territorial Authority
TAB	Totalisator Agency Board
URP	Usual Resident Population
VLT	Video Lottery Terminal

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Attestation of Authorship

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning.

Aamir Eric Bonamis

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Abstract

Gambling is an important recreational activity in New Zealand, with high levels of participation by the general public. Although gambling activities are an important source of employment and a means of raising funds for various community and sporting purposes, gambling on electronic gambling machines (EGMs), both in casino and non-casino venues are known to be correlated with gambling-related harm, resulting in higher levels of personal, familial, health and societal problems.

After undertaking a review of relevant literature on participation in gambling activities and accessibility to gambling venues, it was found that although studies examining the accessibility of venues with EGMs have been researched to some extent in an overseas context, studies pertaining to such venues in New Zealand have been limited. This study therefore aimed to investigate the link between accessibility to gambling venues with EGMs, including distance-wise proximity to such venues and the number of these venues within a certain distance, and their impact on gambling behaviour of individuals.

Two measures of accessibility were investigated; the distance from a participant's residential location to the nearest casino and non-casino EGM venue, as well as the number of venues with EGMs within 500 metres, one kilometre, five kilometres and 10 kilometres, taking into account the travel network including roads, walkways and ferry routes. Three outcome variables were considered, in particular past-year gambling, gambling on EGMs at either a casino or non-casino venue and the risk of problem gambling for past-year gamblers. Logistic regression analyses were carried out on each outcome variable to test the significance of each distance and density variables separately after correcting for individuals' sex, age group, prioritised ethnicity, neighbourhood deprivation and individual deprivation. A final multiple variable model was then created for each of the three outcomes using the best subset model building process.

Final multiple variable models for all three outcomes found distance to the nearest casino to be an important predictor, signifying the importance of casinos as destinations for entertainment and tourism, while those predicting past-year gambling on EGMs and the risk of problem gambling additionally found the number of venues within 10 kilometres to be a strong predictor, thus signifying the importance of convenient driving distance in reaching their desired venue. The results of the multiple variable models were successfully illustrated using maps of different geographical areas in New Zealand.

Chapter 1 Introduction

Gambling is one of the most common recreational and social activities in New Zealand. In 2015, 75% of New Zealand adults had participated in some form of gambling during the past year, with the most popular continuous gambling activities partaken in being playing on electronic gaming machines (EGMs) and betting on horse and dog racing (Abbott, Bellringer, & Garrett, 2015). In the 2014-2015 financial year alone, \$2.1 billion were spent on the four main regulated types of gambling activities, namely on non-casino EGMs, on casino EGMs and table games, on products sold by the New Zealand Lotteries Commission (NZLC) and on track and sports betting provided by the Totalisator Agency Board (TAB) (Department of Internal Affairs, 2017a).

In addition to being regarded as an important social activity and an important source of employment (KPMG, 2013; Thorne, Bellringer, Abbott, & Landon, 2012), gambling occupies a unique niche in the country as proceeds from gaming are an important source of raising funds for sporting and community groups in New Zealand, many of which are dependent on income lost by gamblers (Department of Internal Affairs, 2015; Price, 2016; J. Rush, 2018).

Legalised gambling is a known public health issue due to the connection between participation in certain gambling activities and the prevalence of problem gambling (Volberg & Abbott, 1994). It was estimated that approximately 0.2% percent of New Zealand adults were problem gamblers in 2015, with a further 6.4% being classified as at risk of being problem gamblers (Abbott, Bellringer, & Garrett, 2015). It has been well-researched that problem gamblers are more likely to experience elevated negative personal, familial, work-related and health-related problems as a result of their gambling addiction (Lin, Casswell, You, & Easton, 2008; Ministry of Health, 2016).

1.1 Definition of gambling

The Gambling Act (2003), the main piece of legislation which regulates gambling activities in New Zealand, defines gambling as the 'paying or staking consideration, directly or indirectly, on the outcome of something seeking to win money when the outcome depends wholly or partly on chance' ("Gambling Act 2003," 2003). Similarly, in their study examining the nature and definition of gambling, Slade and McConville (2003) identify gambling as the 'staking of money on the outcome of games

or events involving chance or skill, whereby money is risked on the desire to gain a profit’.

In New Zealand, regulations concerning gambling are administered and enforced by the Department of Internal Affairs, while the funding and coordination of problem gambling services is allocated to the Ministry of Health ("Gambling Act 2003," 2003).

In many cases, the words ‘gambling’ and ‘gaming’ are used interchangeably (Department of Internal Affairs, 2001). It is important to note that instances of the words ‘gambling’ and ‘gaming’ that will be referred to in this study refer to acts that involve the wagering of money and not to other activities commonly referred to as gaming such as partaking in internet, video, card or sports games where no monetary reward is sought after. Additionally, although gambling in New Zealand encompasses a range of different activities in general, this study will concentrate mainly on the effects of gambling on casino and non-casino EGMs, which are known to be very strongly correlated with problem gambling (Paton-Simpson, Gruys, & Hannifin, 2001, 2003; Thimasarn-Anwar, Squire, Trowland, & Martin, 2017).

Continuous gambling, defined as gambling involving rapid cycles of stake, play and the determination of the outcome (Abbott, 2003), has been particularly linked to higher risk of problem gambling (Abbott & Volberg, 2000; Devlin & Walton, 2012), in particular to activities such as playing on EGMs, casino table games, scratch cards and race and sports betting (Department of Internal Affairs, 2001). Additionally, statistics relating to problem gambling counselling services have consistently found that the majority of clients that use problem gambling support services report problems related to the use of EGMs in non-casino venues, with EGMs in casinos being cited as the second-highest mode relating to problem gambling (Department of Internal Affairs, 2000; Ministry of Health, 2007; Paton-Simpson et al., 2001, 2003).

1.1.1 Problem gambling

A problem gambler is defined in Section 4 of the Gambling Act 2003 as ‘a person whose gambling causes harm or may cause harm to an individual, his or her family or the wider community’, where ‘harm’ is defined as the damage or distress arising from, caused by or worsened by a person’s gambling ("Gambling Act 2003," 2003). This includes harm to the gambler, the gambler’s family and friends, the gambler’s workplace and society at large.

There are several measures in place for measuring whether a person is at risk of problem gambling, the most commonly used ones being the Problem Gambling Severity Index (PGSI) and the South Oaks Gambling Screen (SOGS). The PGSI, developed by Ferris and Wynne (2001), is today regarded as the standard measure of at-risk behaviour in problem gambling. An individual is asked nine questions on their gambling behaviour where they are given the option of answering with a “never”, “rarely”, “sometimes”, “often” or “always” response. The answers to each of their questions are then scored depending on their response, with each “never” response being allocated a score of zero, each “rarely” or “sometimes” response being allocated a score of one, each “often” response being allocated a score of two and each “always” response being allocated a score of three. Total scores are then tallied up and individuals are grouped into four categories depending on the total score that they receive, namely non-problem gamblers (with total scores of zero), low-risk gamblers (total scores of one or two), moderate-risk gamblers (total scores from three to seven) and problem gamblers (with a total score of eight or higher). The SOGS is a questionnaire consisting of 20 questions based on the Diagnostic and Statistical Manual of Mental Disorders III criteria for pathological gambling (Lesieur & Blume, 1987) and measures the incidence of lifetime gambling, classifying participants into non-problem gamblers, problem gamblers and probable pathological gamblers.

Problem gambling is a recognised public health issue, with problem gamblers displaying clear signs of addiction, gaining pleasure and harm simultaneously from their gambling habit (Lloyd, 2003). Additionally, personal costs borne by problem gamblers include higher instances of depression and suicidality (DeCaria, Hollander, Grossman, & Wong, 1996; Lin et al., 2008) and financial debt (Abbott, Volberg, & Williams, 1999; Markland, 1996) while social costs borne by society at large include negative impacts on families of problem gamblers (Darbyshire, Oster, & Carrig, 2001; Downs & Woolrych, 2010), an increased burden on employers (Lin et al., 2008), crime (Thorne et al., 2012), and an increased cost to the government (Ministry of Health, 2016). The Ministry of Health has set out a detailed approach to tackling gambling harm and coordinating services to minimise gambling harm in its three-yearly ‘Strategy to Prevent and Minimise Gambling Harm’ (Ministry of Health, 2016). More on the social impacts of problem gambling are discussed in Section 1.5.2 .

A limited number of studies in New Zealand have linked increased accessibility of certain types of gambling venues to increased likelihood of problem gambling

(Ministry of Health, 2008a; Pearce, Mason, Hiscock, & Day, 2008), although there is currently a lack of understanding on how accessibility to these venues affect certain kinds of gambling behaviour and risk of problem gambling. Increasingly, many local governments are taking action to restrict both the number of venues in their areas and reduce the number of machines in these areas in order to reduce problem gambling harm (KPMG, 2013).

1.2 The New Zealand gambling industry

In New Zealand, the gambling industry is a heterogeneous sector run by individuals and commercial organisations alike and include a range of activities involving various degrees of chance or skill (Markland, 2003). These include the purchasing of lottery products such as Lotto tickets or instant scratch cards, playing on EGMs in casinos, bars or pubs, making bets on the outcome of horse or dog racing events, making bets on the outcome of sports games, partaking in bets between family and/or friends or participating in raffles, among other activities.

The Gambling Act (2003) classifies gambling according to various criteria depending on the type of activity, the premise at where the activity takes place, the amount of money wagered on an activity and the risk of problem gambling associated with that particular activity. The largest gambling sector in New Zealand in terms of expenditure lost by gamblers during the 2016-2017 financial year was the non-casino EGM sector, followed by the casino sector. EGMs, known colloquially as ‘pokie machines’, ‘slot machines’, ‘fruit machines’ or ‘one-arm bandits’, are currently found both in and outside casinos (D. Grant, 2003). Gambling on products offered by the New Zealand Lotteries Commission (NZLC) made up the third largest sector in terms of expenditure, while betting on horse and dog racing as well as on the outcome of sports events offered by the Totalisator Agency Board (TAB) were found to be the fourth largest form of gambling in terms of total expenditure (Department of Internal Affairs, 2017a).

Additionally, apart from the four forms of gambling mentioned above, private gambling such as placing bets with family and/or friends and gambling activities that are run for fundraising purposes other than the four forms mentioned above, such as raffles and ‘casino evenings’ are commonly participated in by the general public (Abbott, Bellringer, Garrett, & Mundy-McPherson, 2014b). Remote interactive

gambling, defined as gambling by a person by a distance by interaction through a communication device which by definition covers internet gambling, is prohibited in New Zealand by the Gambling Act 2003, except for activities run by the NZLC and the TAB. However, this prohibition does not cover remote interactive gambling that is run using overseas websites, allowing a person in New Zealand to gamble using the internet if the website that gambling is conducted through is based outside New Zealand ("Gambling Act 2003," 2003).

1.2.1 Gambling involving electronic gaming machines

Casino gambling

Since 2002, there have been six casinos operating in New Zealand; SkyCity Auckland Casino, SkyCity Hamilton Casino, Christchurch Casino, SkyCity Queenstown Casino, SkyCity Wharf Casino and Dunedin Casino, which collectively operate various types of table games including Blackjack, Roulette and Baccarat (Gambling Commission, 2013), in addition to EGMs, video keno and spinning reel games at their sites (Department of Internal Affairs, 2001). Table 1 shows the number of EGMs and the number of gaming tables at each casino venue in New Zealand during the 2012 year, as reported by the Gambling Commission (2013).

Christchurch Casino was the first casino to open in New Zealand in 1994, followed by SkyCity Auckland in 1996 (Curtis, 1999), which remains the largest casino venue in terms of the number of gaming machines and table games offered (Walker et al., 2003). In 2013, SkyCity signed a deal with the then National Party-led government which allowed the business to increase the number of gaming tables and slot machines at their Auckland venue in exchange for the building of a national convention centre (Bond, 2013). These additional machines were added to the venue in November 2015 (SkyCity Entertainment Group Limited, 2016). More information on the addition of machines to SkyCity's venue can be found in Section 1.3.2 .

Casinos are an important part of the New Zealand economy, employing a large number of workers in the hospitality sector and contributing millions of dollars in taxes to the Government and various community groups. In the 2016-2017 financial year, the SkyCity Group alone employed close to 3000 employees, paying \$307 million in salaries and wages to employees, \$165 million in taxes to the Government \$20 in

community contributions, levies and sponsorship programmes (SkyCity Entertainment Group Limited, 2017b). Christchurch Casino employed approximately 490 staff in 2018 (Hutchings, 2018), while Dunedin Casino employed approximately 170 employees in 2006 (New Zealand Press Association, 2006).

Table 1. List of casinos operating in New Zealand by number of gaming machines and gaming tables during the 2012 year.

Name	Location	Number of EGMs	Number of gaming tables
SKYCITY Auckland Casino	Auckland	1647	150
Christchurch Casino	Christchurch	500	36
SkyCity Hamilton Casino	Hamilton	339	23
Dunedin Casino	Dunedin	180	12
SkyCity Queenstown Casino	Queenstown	86	12
SkyCity Wharf Casino	Queenstown	74	6

Note: Adapted from the Report of the Gambling Commission for the Year Ended 30 June 2013, (p.3), by Reeves, G., 2013, Wellington: Department of Internal Affairs. Copyright (2013) by the Department of Internal Affairs.

Gambling on non-casino EGMs

Outside casinos, EGMs are found primarily in pubs, hotels and clubs. Gambling on non-casino EGMs is classified as Class 4 gambling under the Gambling Act 2003 (see Section 1.6.1). As of June 2018 there were 15,420 non-EGMs operating in New Zealand spread across 1,140 distinct venues, although numbers have been slowly decreasing over time since March 2003 (Department of Internal Affairs, 2017b). Class 4 gambling is mandated to be operated on a not-for-profit basis (Department of Internal Affairs, 2015), and after allocation of proceeds on fixed costs such as government duties, levies, licensing fees and costs to meet “actual, reasonable and necessary operating costs” while running the venue are met, non-club venues such as pubs, taverns and hotels are required to allocate the remaining net proceeds for authorised community purposes, which must include a minimum of 37.12% of their GST-exclusive gross proceeds (KPMG, 2013). Non-casino EGMs are also required to be electronically

monitored in order to determine the amount of money entered into these machines ("Gambling Act 2003," 2003).

EGMs in Class 4 venues are owned by corporate societies, also known as gaming machine societies or pokie trusts, which enter into an agreement with the venues in order to host the gaming machines owned in return for payments (Department of Internal Affairs, 2015). As of June 2014, 60% of machines in pubs were owned by six national corporate societies, namely the Lion Foundation, the New Zealand Community Trust, Pub Charity, Infinity Foundation Limited, the Trusts Community Foundation and the Southern Trust (Department of Internal Affairs, 2015). Societies may allocate their funds to a specific community purpose or to any purpose of their choice. The Gambling Act 2003 requires societies to publish details on applications received for grants, along with whether each application was accepted or declined ("Gambling Act 2003," 2003).

Clubs, which include Returned Services Associations (RSAs), sports clubs, chartered clubs and cosmopolitan or working men's clubs, provide Class 4 gambling for their respective members and guests only (Department of Internal Affairs, 2015). Clubs do not distribute the profits of Class 4 gambling to the community, but rather to the club and their members.

Grants from gaming machines proceeds have funded a wide range of organisations and causes in New Zealand, with many organisations have become increasingly dependent on grants obtained from gaming machines (Department of Internal Affairs, 2015). Recipients of funds from non-casino gaming machines have included cultural and sports clubs, community organisations, educational institutions, health institutions and even local government where they have funded museums, playground and park upgrades (Price, 2016; J. Rush, 2018; Wilson, 2017).

1.2.2 Other forms of gambling

Track and sports betting

Betting on horse and dog racing, collectively known as 'track betting', as well as on sporting events, is provided for by the TAB, an off-course agency run by the New Zealand Racing Board (NZRB). There are currently more than 700 TAB venues in New Zealand consisting of standalone dedicated TAB venues, which have set minimum

opening hours, and TAB self-service terminals in private-owned premises including hotels, bars and clubs (Totalisator Agency Board, 2018b). In addition to the ability to place bets at brick and mortar TAB venues, players have the option of placing bets online through the TAB website, through the TAB mobile phone application as well as its automatic telephone service (Totalisator Agency Board, 2018a, 2018d, 2018c).

Profits earned from track betting at TAB venues are distributed to the three racing codes; New Zealand Thoroughbred Racing, Harness Racing New Zealand and Greyhound Racing New Zealand through a funding model, while those earned from sports betting are distributed to various National Sports Organisations (New Zealand Racing Board, 2017).

Lotto New Zealand products

The NZLC, branded as ‘Lotto New Zealand’, offers a range of lottery products, including Lotto, Powerball, Strike, Keno, Bullseye, Play 3, Instant Kiwi and Instant Play (New Zealand Lotteries Commission, 2017a). Its flagship game Lotto offers players a chance to win a monetary prize depending on the unique number of balls plus one bonus ball, that match with those picked up at the time of the draw from a total of 40 balls. Players have the option of increasing their prizes with the purchase of Powerball and Strike features as additions with their original Lotto ticket. The game of Keno is similar to that of housie, whereby the prize awarded to a participant depends on how many numbers on a participant’s ticket are matched at the time of the draw. In the game of Bullseye, the player tries to match their six-digit allocated numbers as much as possible to those selected at the time of the draw. Play 3 involves a similar concept to the game of Bullseye but with a three-digit number instead of a six-digit one and involves a top prize of smaller monetary value. Additionally, scratch cards or ‘scratchies’, namely Instant Kiwi and its online equivalent called Instant Play, offer instant-win prizes (New Zealand Lotteries Commission, 2017b).

All Lotto New Zealand products, with the exception of Instant Play, are sold at approximately 1,500 physical retail outlets throughout the country as well as online through the My Lotto website (New Zealand Lotteries Commission, 2017b). Funds are distributed back to the community through the Lottery Grants Board (New Zealand Lotteries Commission, 2017a).

Other gambling venues

In addition to the four major forms of gambling mentioned beforehand, other forms of gambling activities including games of housie, raffles, casino evenings, internet gambling or private betting, which are not restricted to take place on any particular venues and are free to be conducted on any premise, such as such as community halls or in the privacy of people's homes.

1.3 History of gambling in New Zealand

1.3.1 The introduction of gambling activities to New Zealand

Historical records allude to the fact that gambling was an important historical activity in numerous ancient civilisations, being described by Abbott and Volberg (1999) as 'an ancient form of recreation'. However, prior to European contact, there have been no indications of gambling in pre-contact Māori society (Palmer, 2009), evidenced by the scarcity of words or phrases relating to gambling or betting activities in the Māori language (Herd & Richards, 2005).

Recreational gambling has been an important aspect of life in New Zealand since the colonial times, having been indulged in by sealers, whalers and ex-convicts alike, among other members of society (Abbott & Volberg, 1999; D. Grant, 2013d). Games such as poker, vingt-et-un, billiards, skittles, bridge, whist, forty-fives and traditional card games were commonly played in pubs, especially by working-class males (D. Grant, 2013d) as was betting on results of horse races, which remained the most popular form of gambling until the early 1980s (Phillips, 2005). New Zealand's first horse racing event was held in the Bay of Islands in 1835 and New Zealand's first thoroughbred horse was brought into the country in 1840 (D. Grant, 1994), the same year as the Treaty of Waitangi was signed. The arrival of Chinese miners in the 1860s brought additional games played for money or prizes such as fan-tan and pakapoo (D. Grant, 2013b).

As gambling activities flourished towards the end of the nineteenth century, so did opposition towards them, especially from Protestant churches, which maintained a stronghold on the morality of a large segment of the population (Stenhouse & Wood, 2005). Despite gambling activities being one of the most popular pastime activities since their introduction, many individuals and organisations alike have had hostile

attitudes to the concept of gambling for money. William Colenso, one of New Zealand's early missionaries and explorers, specifically warned against the practice of gambling using playing cards in his epistle to local Māori (Colenso, 1851).

Until the signing of the Treaty of Waitangi in 1840, New Zealand lacked legislation that governed gambling activities. Under the Treaty, all residents of New Zealand, both Māori and Pākehā, were to be subjected to British law, being given the same rights and privileges of British subjects (Ministry for Culture and Heritage, 2017b). In fact, Moodie (1976) argued that British laws made during the reigns of Charles II, Anne and William IV had continued to be in effect in New Zealand long after they had been legislatively repealed in the United Kingdom.

New Zealand's first piece of significant legislation regarding gambling was passed in 1881, titled 'An Act for the suppression of Gaming and Betting Houses and the more effectual abolition of lotteries'. Another act, the Gaming Act of 1908 essentially consolidated existing English legislation and rebranded them into New Zealand law, with the addition of a clause stating that individuals and organisations are not liable to pay prizes that have been allegedly won as a consequence of one's gambling (Moodie, 1976).

1.3.2 Gambling on electronic gaming machines

Casino gambling

Until the 1980s gambling was largely confined to lotteries and betting on horse-racing (Department of Internal Affairs, 2017a). The Casino Control Act (1990) allowed the establishment of casinos in New Zealand. Unlike the case for lotteries, the establishment of casinos emphasised tourism, employment and economic development rather than fundraising for community purposes, resulting in casinos being the first purely commercial form of gaming permitted in New Zealand (Markland, 2003). These for-profit venues were set up to cater for the needs of both domestic consumers as well as international high-rollers, many targeting tourists from Asia where such provisions were limited (D. Grant, 2003).

Christchurch Casino was the first casino to open in New Zealand in November 1994, followed by the opening of SkyCity Auckland in January 1996 (Curtis, 1999). Wharf Casino opened in September 1999 in Queenstown with Dunedin Casino opening

a month later, followed by SkyCity Queenstown Casino in December 2000, the second casino to open in Queenstown. SkyCity Hamilton Casino was the last casino to open in New Zealand in September 2002 (Walker et al., 2003) before the Gambling Act of 2003 prevented the establishment of any future casinos. In June 2013, SkyCity Queenstown Casino acquired Wharf Casino from the Lasseters NZ Group, rebranding the casino as SkyCity Wharf Casino (Bryant, 2013; Roxburgh, 2013). All casinos have been continuously operating since their respective establishment dates, with the exception of Christchurch casino which was closed for a period of four months due to the damaged caused by the 2011 Christchurch Earthquake (Gibson, 2011).

Concessions to SkyCity's Auckland venue

The need for a convention centre capable of hosting a large number of delegates was identified by the New Zealand Government in the mid-2000s. A feasibility study jointly carried out by the Ministry of Tourism, Ministry of Economic Development, and Auckland City Council (2009) found that New Zealand's competitive position in hosting international conferences was compromised due to the lack of a purpose-built convention centre that was of international standard and which could cater to large conferences (Horwarth HTL, 2009). Although several organisations contended to partner with the Government to build its proposed convention centre (Gibson, 2010a, 2010b), SkyCity was eventually successful in winning the bid due to its capability of funding the cost of building the centre by itself without the need for taxpayer dollars (Nippert, 2013). It was estimated that the construction and operation of the Convention Centre would add \$90 billion per annum to the country's economy and that the construction of the Centre would employ about 1000 people whereas the operating of the Centre would employ about 500 people (Ministry of Business, Innovation and Employment, 2015). The deal was sealed with the signing of a heads-of-agreement with the Government in July 2013 (Bond, 2013).

In return for agreeing to build the convention centre, SkyCity's Auckland venue received numerous concessions, including the installation of an additional 230 EGMs to its existing 1,647 EGMs which were commonly found to be at full capacity during peak times and promotional periods (SkyCity Entertainment Group Limited, 2013), the addition of 40 new gaming tables and the ability for gamblers to gamble using a bank card rather than cash ("New Zealand International Convention Centre Act 2013," 2013). Additionally, a further 12 new gaming tables which could be substituted for automatic

table game player stations that seated up to 20 players were allowed, along with the ability for 17% of EGMs and automatic gaming tables to accept banknotes with denominations greater than \$20 in restricted areas. SkyCity's gaming licence was also extended to 2048, which would have otherwise expired and be due for renewal in 2021. Despite strong opposition from community groups that an increase in the number of EGMs would increase the incidence of problem gambling (Epskamp, 2015; Levy, 2012), these concessions were ratified by Parliament by passing the New Zealand International Convention Centre (NZICC) Act 2013, which made clear that these concessions were the subject of special legislation and do not affect the provisions for other casinos in New Zealand.

In its 2016 presentation, SkyCity had confirmed that the majority of the gaming concessions granted by the NZICC Act were activated during November 2015 (SkyCity Entertainment Group Limited, 2016) while also stating that its Auckland venue was positively benefitting from the gaming concessions (Edmonds, 2016), with expenditure on its EGM machines up 10% from December 2015 to April 2016 on the previous corresponding period.

Gaming on non-casino EGMs

EGMs, also known colloquially as 'pokie machines', 'slot machines', 'fruit machines' or 'one-arm bandits', had been used in New Zealand as early as the 1930s (D. Grant, 2003). Over time, more advanced machines were imported into the country, where they became a vital component of fundraising in social and sports clubs.

In 1988, EGMs were made legal for sports clubs, chartered clubs, RSAs, pubs and hotels, although prior to this time, many machines were illegally operated without a gaming licence (Abbott, 2001b), being scarcely found to be ambiguity regarding their legal status (Department of Internal Affairs, 2007).

Due to the low cost, low maintenance and high turnover achieved with such machines, the number of machines increased exponentially from the start of the 1990s until 2003 (D. Grant, 2003). Data on the number of non-casino venues with EGMs in operation as well as the number of EGMs per venue currently in operation have been collected on a quarterly basis by the Department of Internal Affairs (2017b) and the total number of non-casino venues with EGMs over time since 1994 are illustrated in *Figure 1*. While in January 1991 there were an estimated 6,000 licenced non-casino

gaming machines (Abbott, 2001b), the number of machines exponentially increased to an all-time high of 25,221 in March 2003 (Department of Internal Affairs, 2017b). Between 2001 and 2003 alone, the number of EGMs grew in number by around 30%, largely in commercial premises, until the Gambling Act (2003) mandated severe restrictions on the maximum number of machines and the possible profits achievable from the use of these machines. After the Act was passed, the number of EGMs dropped for the first time after more than a decade of exponentially increasing in number (Figure 1).

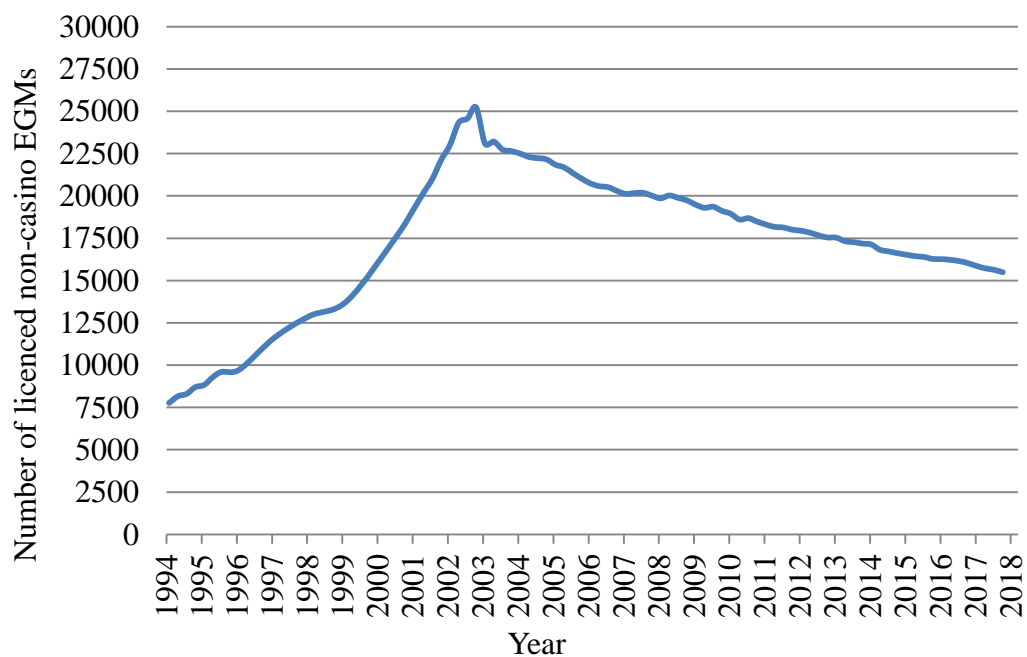


Figure 1. Number of licenced non-casino EGMs in New Zealand during 1994-2018, sourced from Department of Internal Affairs (2017a).

1.3.3 Other forms of gambling

Lotteries

Lottery games existed in various forms in New Zealand prior to the introduction of Lotto. Lotteries were initially run informally to raise money for various purposes under the euphemism of ‘art unions’ until 1932, after which they were contracted by the Government to be run by Neil McArthur and Bertie Hammond. In 1961, art unions were replaced with the Golden Kiwi lottery (D. Grant, 2013c).

Lotto was introduced in July 1987, with a first prize of \$359,808 and gross receipts of more than \$2 million dollars (D. Grant, 2013a). The spread and popularity of Lotto resulted in sales of Golden Kiwi decline, ensuing in the termination of Golden Kiwi by the NZLC in 1989. In the same year that Golden Kiwi was terminated, the NZLC introduced Instant Kiwi scratch cards, originally set up to assist in raising funds for the 1990 Commonwealth Games held in Auckland. Powerball was introduced in February 2001 while Big Wednesday commenced in October 2005 (D. Grant, 2013a). In October 2015, Big Wednesday was replaced by Lotto, Powerball and Strike being drawn twice a week on both Wednesdays and Saturdays (New Zealand Lotteries Commission, 2015). Instant Play, which offered players the opportunity to play instant games online, commenced in December 2017 (New Zealand Lotteries Commission, 2017b).

Track and sports betting

Initial widespread opposition to horse racing saw the Gaming Amendment Act being passed in 1910, which effectively banned bookmakers from being present at horse-racing meetings, as well as from hotels and other public places ("Gaming Amendment Act," 1910). However, many bookmakers practiced their trade illegally and continuing to make sums of money, with the annual turnover from illegal bookmaking during the 1940s being estimated to be \$2.0 billion in 2018 terms (Ministry for Culture and Heritage, 2017a).

After recommendations made by a royal commission, the Totalisator Agency Board (TAB) was established by the passing of the Gaming Amendment Act 1949 . The TAB was launched as New Zealand's sole horse racing betting operator, being the world's first off-course totalisator service. The Racing Act 1971 granted the TAB a monopoly on galloping, harness and greyhound racing. Additionally, the Act mandated that the profit from all race betting be paid to racing clubs, much of it through the Racing Industry Board ("Racing Act 1971," 1971).

Sports betting was introduced by the TAB in 1996 (New Zealand Racing Board, 2018b). Over time, the NZRB allowed participants to place bets interactively online through the TAB website since 1998, by using the Phonebet option by calling the NZRB contact centre since 2000 (New Zealand Racing Board, 2013), via Skybet through their television set using a Sky Television remote since 2003 (Sky Television,

2003) and through its mobile phone application in 2015 (New Zealand Racing Board, 2015). The Skybet option was withdrawn in 2011, while the Phonebet service became fully automated in 2016 (Fairfax New Zealand, 2016).

Internet and remote gambling

As per the Gambling Act 2003, only the New Zealand Lotteries Commission and the TAB are permitted to allow gambling through an online medium in New Zealand. As mentioned, both the NZLC and the TAB also offer players to buy their products through the mobile phone applications (Lotto New Zealand, 2018; Totalisator Agency Board, 2018d), with the TAB offering players the opportunity to place their bets using their automated phone service (Totalisator Agency Board, 2018c). Apart from these two providers, there are currently no New Zealand-based websites which offer gambling opportunities. In August 2018, SkyCity announced its intention to open an online casino in order to compete with overseas-based online casinos (Stock, 2018). Due to the prohibition on remote gambling in New Zealand, it was speculated that SkyCity would partner with an offshore-based casino operator in order to circumvent this prohibition.

1.3.4 Gaming reform

The rapid increase in participation and expenditure on gambling activities in the decade following 1987 led to the call for a reform of gaming legislation in New Zealand (Department of Internal Affairs, 2001). There were concerns that profits from non-casino EGM gaming were commonly allocated to non-genuine community purposes, with fraud, theft and misappropriation commonplace with regards to the distribution of funds (New Zealand Lotteries Commission, 1997). This resulted in increasing calls for scrupulous auditing of the manner in how such gambling activities were conducted, greater input from the wider community and increased government regulation to ensure standardisation across such practices (New Zealand Lotteries Commission, 1995).

The Casino Control (Moratorium) Amendment Act was passed in 1997 which effectively placed a moratorium on the establishment of new casinos in the country for three years from 1997, thereby preventing the planned openings of casinos in Rotorua and Wellington ("Casino Control (Moratorium Extension) Amendment Act," 2000; Brown, 2003). This moratorium was extended for another three years until 2003 with

the passing of the Casino Control (Moratorium Extension) Amendment Act in 2000 ("Casino Control (Moratorium Extension) Amendment Act," 2000). A review of gaming policy was announced by then Minister of Internal Affairs George Hawkins in 2000 (Department of Internal Affairs, 2001).

The Gambling Act 2003 and Racing Act 2003 were passed into law in September 2003 and March 2003 respectively and were a direct output of the gaming review, being intended to apply a public health approach to gambling policy (Bunkle & Lepper, 2004). The main objectives of the Gambling Act 2003 were to control the growth of gambling, to prevent and minimise gambling harm, to ensure that funds from gambling are distributed to the community in a fair manner and to involve the community in decision-making regarding the provision of gambling ("Gambling Act 2003," 2003). A summary of the major provisions of the Gambling Act 2003 are discussed in Section 1.6.1 , while provisions of the Racing Act 2003 are discussed in Section 1.6.2 .

A major consequence of the Gambling Act 2003 is the requirement for local governments to have policies in place regarding Class 4 gaming venues and standalone TAB venues, in particular with regards to the addition of new venues and relocation of existing venues. In practice, local governments have included policies that have severely restricted the addition of new EGMs or relocation of existing EGMs. Some councils, such as the Wellington City Council, have set restrictions in terms of locations, where venues may only be opened or relocated within certain areas and have forbidden the opening or relocation of venues in other areas (Wellington City Council, 2015). In the case of Wellington City, new venues may only be established in the Central Area Zone extending from Pipitea to Te Aro and the business areas of other wards in Wellington City. Some local governments have also set a maximum cap on the number of machines that may operate in the territorial authority or a certain part of that territorial authority at any one time, resulting in the number of machines in the territorial authority staying the same or decreasing over time. In extreme cases, local governments such as the Auckland Council, Christchurch City Council and Dunedin City Council have adopted a sinking lid policy on a district level or in certain areas (Christchurch City Council, 2018; Dunedin City Council, 2018; Regulatory Committee of the Auckland Council, 2013), where new venues are prevented from being established, but existing Class 4 licence holders are allowed to continue their operations, again leading to a decrease or no change in the number of venues over time.

The majority of territorial authorities in New Zealand have set a combination of restrictions with respect to setting up new venues, relocating existing venues and the maximum number of machines that may operate (KPMG, 2013).

As a consequence of the Gambling Act 2003, the total number of non-casino EGMs has been steadily decreasing from its peak of 25,221 in March 2003 (Figure 1). This period also witnessed an increase in gambling helpline and treatment services being offered as well as an increase in the number of clients seeking help for such services (Abbott, 2017). The number of non-casino venues which host EGMs has also steadily decreased over time over the same, declining from 2,104 in September 2003 to 1,140 in June 2018 (Department of Internal Affairs, 2017b). Although the total number of non-casino EGMs and the venues that host such machines has been in decline, it is worth noting that the mean number of non-casino EGMs per venue has generally increased over this period, increasing from a mean of 9.4 machines per venue in September 2001 to 13.5 machines per venue in June 2018 (Department of Internal Affairs, 2017b).

1.4 Expenditure on gambling activities

Data on expenditure on the four regulated forms of gambling, namely gambling on casino games (including EGMs and table games), on non-casino EGMs, on TAB products and Lotto New Zealand products, has been collected by the Department of Internal Affairs. Figure 2 shows the total expenditure on each of the four main forms of gambling, as reported by the Department of Internal Affairs (2017a). It is evident that the last 40 years has witnessed an enormous increase in total expenditure, from \$102 million in 1979 to \$2.3 billion spent in 2017, reflecting the expansion of gambling activities during this period as well as a profound change in the proportion of expenditure spent on various types of gambling.

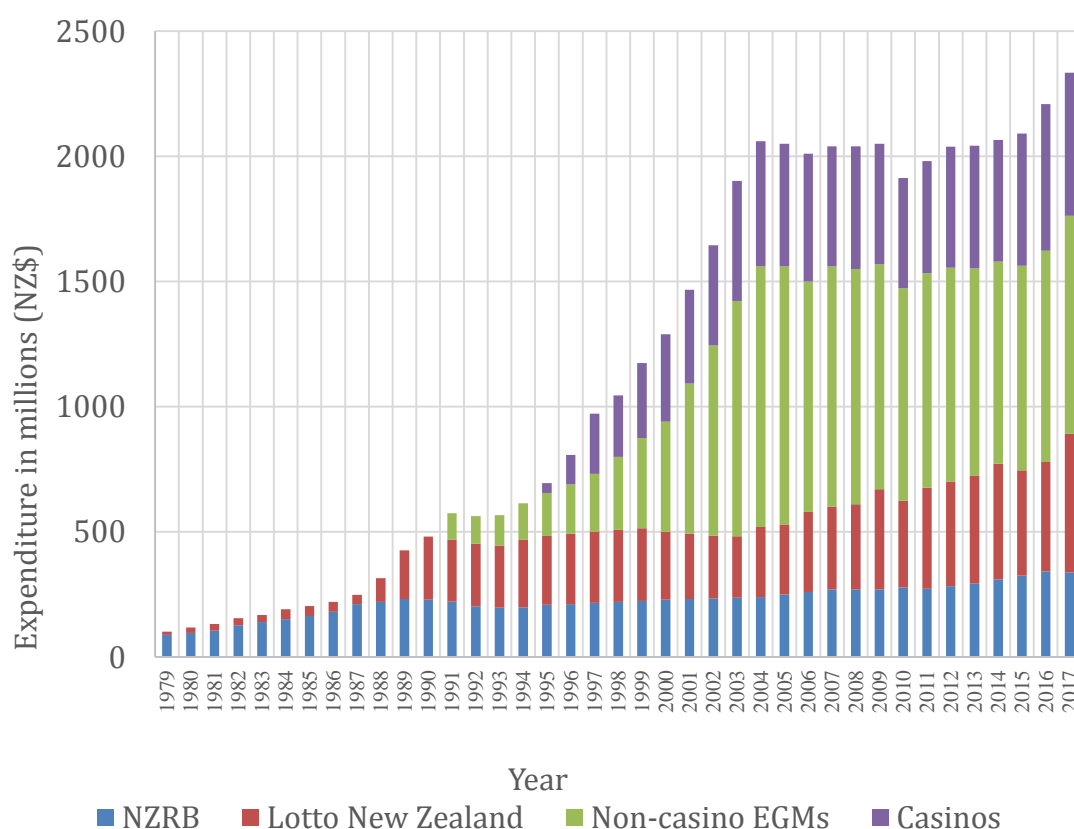


Figure 2. Expenditure on the four main forms of gambling from 1979 to 2017, sourced from Department of Internal Affairs (2017a).

Note: Figures have not been adjusted for inflation.

Up until the 1970s and most of the 1980s, the majority of spending on legal gambling took place on betting on horse and dog racing, with the remainder of gambling expenditure being spent on the Golden Kiwi lottery. With the introduction of Lotto and other Lotto New Zealand products starting from 1987, the legalisation of non-casino EGMs since 1988 and the introduction of six casinos during the 1990s and early 2000s, the proportion of spending on track and sports betting had fallen dramatically. In 1987, approximately 85% of spending on gambling was on horse racing, with the remainder of expenditure being spent on Lotto products. By 2000, the share of expenditure gambled on track and sports betting fell to 18%. In the 2017 financial year, 14% of gambling expenditure on the four main forms of gambling was spent on NZRB products, 24% on Lotto New Zealand products, 37% on non-casino EGMs and the remaining 24% on casino gambling activities (Department of Internal Affairs, 2017a).

From 1979 to 2017, the total expenditure on products by the NZRB (track and sports betting) had increased steadily from \$89 million in 1979 to \$338 million in 2017.

Since 2009, expenditure spent on TAB venues have increased considerably on a yearly basis, although they have increased slowly since 2015 (Department of Internal Affairs, 2017a).

In contrast, spending on products by Lotto New Zealand increased dramatically soon after the introduction of their flagship Lotto in 1987, more than sextupling in three years from \$38 million in 1987 to \$252 million in 1990. Expenditure continued to increase until 1999 before falling to \$245 million in 2003, after which it saw a steady increase until 2009. Since 2009, expenditure on Lotto New Zealand products has increased remarkably, rising to \$555 million in 2017, its highest expenditure on record (Department of Internal Affairs, 2017a).

Similarly, spending on non-casino EGMs increased from \$107 million in 1991, the first year for which expenditure on non-casino EGMs were collected, to \$1.04 billion in 2004, when many provisions of the Gambling Act 2003 came into effect (J. Thomas, Mora, & Rive, 2012), which mandated severe restrictions on the number of non-casino EGMs per venue. From 2004 to 2010, both absolute expenditure on non-casino EGMs as well as the percentage of gambling expenditure spent on non-casino EGMs had declined. However, since 2010 absolute expenditure on non-casino EGMs has remained relatively constant, despite a gradual fall in both the number of EGMs in total as well as the number of machines in these venues (Department of Internal Affairs, 2017a).

Spending on gambling in casinos has also increased considerably since the introduction of casinos, from \$40 million recorded in the 1995 year to \$400 million in 2002, reflecting the rapid increase in the number of casino venues in New Zealand during this period, before increasing steadily to \$572 million by 2017 (Department of Internal Affairs, 2017a).

1.5 Impacts of gambling

Gambling plays an important role in New Zealand in terms of providing benefits to the community, being a form of entertainment, a vital source of community funding, and a means of employment.

1.5.1 Economic impacts

Perhaps the most important economic impact of gambling is the funds raised for community purposes. New Zealand legislation stipulates that corporate societies that run Class 4 gambling venues, the TAB and the New Zealand Lotteries Commission must donate a set percentage of their income back to the community ("Gambling Act 2003," 2003; "Racing Act 2003," 2003).

As discussed, grants from gaming machines proceeds have funded a wide range of organisations and causes in New Zealand, so much so that numerous organisations have become reliant on such grants distributed by gaming machines societies (Department of Internal Affairs, 2015). In 2015 alone, approximately \$260 million was donated to community causes from the proceeds of non-casino EGMs (Price, 2016). Cultural clubs, sports clubs, community organisations, educational institutions and health institutions have been some of the biggest grant recipients and beneficiaries of grants sourced from non-casino EGM proceeds (Department of Internal Affairs, 2017c), many of which have openly voiced concerns that funding their activities would be difficult should funding from gaming machine societies be restricted (Price, 2016).

Profits earned from track betting at TAB venues are distributed to the three racing codes through a funding model and those earned from sports betting are distributed to the various National Sports Organisations (New Zealand Racing Board, 2017). The racing industry in New Zealand is heavily dependent on profits generated by the TAB, with almost 75% of revenues supporting racing generated through TAB profits from track betting (New Zealand Racing Board, 2014). Correspondingly, profits generated by the TAB from sports betting form an important part of funding to 34 National Sporting Organisations in the country, with funding amounting to approximately \$32.2 million dollars in the five years to 2018 (Reive, 2018), the major recipients of these commissions being Basketball New Zealand, New Zealand Rugby Union, New Zealand Football, Tennis New Zealand, New Zealand Rugby League and New Zealand Cricket (Sport New Zealand, 2018).

In a similar manner, profits generated by the New Zealand Lotteries Commission are distributed by the New Zealand Lottery Grants Board. From its initiation till the end of 2017 financial year, the Lottery Grants Board has donated more than \$4.3 billion in funding to various community activities in New Zealand, including arts, sports, recreation and health activities (New Zealand Lotteries Commission,

2017a). In particular, the biggest beneficiaries of grants from the Lottery Grants Board have been Sport New Zealand, Creative New Zealand and the New Zealand Film Commission as mandated by the Gambling Act 2003.

Although casinos are not required by law to donate a set of their earnings to the community, SkyCity's Auckland venue in particular contributes 2.5% of its profits to the SkyCity Charitable Trust (SkyCity Entertainment Group Limited, 2017a), which has until 2018 donated \$41.8 million to charities in the Auckland area while assisting charities such as the Leukaemia and Blood Foundation, the Prostate Cancer Foundation, Kidz First Children's Hospital and Variety the Children's Charity, in addition to having sponsored professional sports teams such as the New Zealand Breakers, the Auckland Blues and the New Zealand Warriors at some point in time (SkyCity Entertainment Group Limited, 2018).

Gambling activities are also important source of employment, contributing to numerous jobs both directly and indirectly (Markland, 1996). It is estimated that that Class 4 corporate societies employ up to 300 full-time equivalent (FTE) staff members (KPMG, 2013). In the 2016-2017 financial, the racing industry was estimated to have been responsible for generating more than \$1.6 billion in value-added contribution to the national economy (New Zealand Racing Board, 2018a), with the NZRB alone having employed 835 FTE employees (New Zealand Racing Board, 2017), while the total activities of the racing industry were estimated to support the employment of approximately 14,398 FTE positions (New Zealand Racing Board, 2018a). In the 2016-2017 financial year, the SkyCity Group employed close to 3,000 employees, paying \$307 million in salaries and wages to employees, \$165 million in taxes to the Government \$20 in community contributions, levies and sponsorship programmes (SkyCity Entertainment Group Limited, 2017b), while Christchurch Casino employed approximately 490 staff in 2018 (Hutching, 2018). The NZLC was estimated to add approximately 129 FTE jobs directly (New Zealand Lotteries Commission, 2017a), in addition to supporting approximately 5,000 retail jobs that sell Lotto products (New Zealand Lotteries Commission, 2018).

In addition to direct indirect employment generated by gambling institutions, Gazel (1998) argues that there are numerous indirect benefits experienced by businesses in the direct vicinity of these institutions, including increased purchases of goods and services from local retailers, taxes paid to local and central government and spending on

food and accommodation outside these venues. Nevertheless, a report by the Australian Productivity Commission argued that although the gambling industry is an important employer, having rates of part-time and female employment that exceeded the national average, the majority of expenditure on gambling would have been diverted from other industries, citing that the retail industry in particular would be the biggest loser from funds that would have otherwise been spent on their products (Productivity Commission, 2001). Similarly, a later report by the Australian Productivity Commission reiterated the view that employment in the gambling industry is not likely to contribute significant additional benefit to the economy because alternatives to consumer spending would result in money being spent elsewhere, thereby generating employment in other sectors of the economy (Productivity Commission, 2010). This sentiment is echoed by the United States General Accounting Office (2000), which stated that as convenience gambling locations are located in deprived areas where money that was otherwise spent on gambling could be spent on much-needed basic necessities, these venues provided little economic benefit and rather increased social costs in these areas.

1.5.2 Social Impacts

Many gambling activities are popular forms of entertainment, providing a means of socialising and personal entertainment with family and friends. Such is the case with card games which are popular pastime activities and housie, played especially by women (Department of Internal Affairs, 2007). Raffles have been an important means to raise funds for community purposes, while track betting also serves as a way to bring residents of rural communities together (Abbott, Bellringer, Garrett, & Mundy-McPherson, 2014c). Gambling venues, such as casinos, non-casino EGM venues and TAB locations, serve as venues that serve food, alcohol, sports and recreational facilities, acting as meeting places for the general community (Thorne et al., 2012). Casinos in particular are an important part of an area's touristic appeal as they are often seen as a major reason to visit a destination, with casino-related activities being major tourist attractions in cities such as Macau, Monaco, Las Vegas and Atlantic City, acting as catchment areas for tourists in places where such provisions are limited (Eadington, 1999; Gu, Li, & Tam, 2013; Wu & Chen, 2015).

However, although gambling activities are important in providing enormous economic benefits to the local and national economy, they are not without their drawbacks. Such activities are also responsible for numerous social impacts on the

minority of gamblers who are problem gamblers or who are at moderate risk of problem gambling, including personal, interpersonal, financial, parenting, work and study and criminal impacts.

Gamblers, especially problem gamblers, are known to have elevated physical and mental health problems in relation to the general population. In particular, problem gamblers were more likely to have elevated rates of hazardous drinking, tobacco usage and recreational drug use when compared to non-problem gamblers, in addition to consuming these products on a more frequent basis (Abbott, Bellringer, Garrett, & Mundy-McPherson, 2014a; Mason, 2006, 2009; Rossen, 2015). Additionally, problem gamblers were more likely to exhibit feelings of nervousness, depression and suicidality (DeCaria et al., 1996; Lin et al., 2008) when compared to the general population .

The Australian Productivity Commission (2001) estimated that the activities of each problem gambler may harm between four to 11 other people. This harm includes that caused to children of problem gamblers who are left with reduced opportunities for nourishment, warmth and housing due to money that would have been otherwise spent on gambling activities as well as pervasive loss to a child's life including pervasive loss including the breakdown of trust and parent-child relationships that arise as a consequence of the parent's gambling (Darbyshire et al., 2001), including higher instances of secrecy and deceit (Downs & Woolrych, 2010). More specifically, there is the obvious impact of directly neglecting children in cars as parents continue to gamble on EGMs outside non-casino EGM locations (Harowell, 2018) and casinos, where there were 119 instances of children being abandoned outside SkyCity's Auckland venue during the three years leading up to 2012 alone (Levy, 2012).

Both Abbott et al. (1999) and Markland (1996) noted that problem gamblers, in contrast to non-problem gamblers, tend to prefer continuous forms of gaming where money is spent more frequently than non-continuous forms, spend longer times in gaming sessions and gamble more frequently, leading to a larger and more detrimental loss in financial terms. Moreover, problem gamblers have been found to spend approximately 15 times more money than non-problem gamblers on a monthly basis (Abbott, 2001b). Additionally, problem gamblers have been found to have started gambling at a younger age as compared to non-problem gamblers, meaning that they contribute to their gambling habits for a longer period of their lives (Reid & Searle, 1996).

Work and study impacts of problem gambling include the time lost at work due to excessive time spent on gambling activities, including the possible resignation or termination of employment or training courses due to absenteeism caused by the person's gambling (Lin et al., 2008). Additionally, the heightened loss to income ratio due to losses spent on gambling activities has been shown to result in poorer work and study performance. Both Dickson, Derevensky, and Gupta (2008) and Rossen (2008) show that adolescents who are problem gamblers were more likely to exhibit poor academic performance and were significantly more likely to admit to being less connected to their school.

There has been shown to be a strong link between problem gambling and criminal activities. Bellringer et al. (2009) found that there exists mounting but not ambiguous evidence that levels of crime are associated with increased gambling activity, including embezzlement of employer funds and stealing from family members. The study also found that 55% of a sample of problem gamblers who had committed crimes had contemplated thinking about engaging in illegal activity in order to fund their gambling habits, while 41% admitting to having already committed a crime in the previous year. Twenty-four percent of participants from the survey reported that they had breached trespass orders or sold stolen items to finance their habit. Furthermore, Lin et al. (2008) found that in 25% of cases involving all criminal convictions that year, gambling was a major reason cited for their delinquent behaviour. Not all offences committed by problem gamblers lead to prosecution by authorities, however, as the Australian Productivity Commission (2001) argues, as crimes such as stealing from family members and friends commonly go unreported due to these family members and friends' fear of incriminating their loved ones.

Casinos in New Zealand in particular, have been found to harbour money launderers (Gower, 2007; van den Bergh, 2011), as well as being the site of heightened levels of criminal activities such as loan sharking and drug dealing (Savage, 2009). SkyCity's Auckland venue has been the site of 20 incidences of assaults, 40 incidences of cheating, 15 incidences of using counterfeit currency, 161 incidences of identity and document fraud, 15 incidences of loan sharking, over 265 incidences involving breaches of trespassing and 14 incidences of money laundering during the three years leading up to 2012 (Levy, 2012). In extreme cases, gambling syndicates, formed by gamblers who compete over the use of gaming machines in order to win prizes have been shown to intimidate rival gamblers, both inside and outside the casino venue in Auckland (Wall,

2002), while there have been instances of gamblers followed to their homes and robbed of their earnings from casinos at knifepoint (Yalden, 2017).

1.6 Current legislation

Two pieces of legislation currently regulate gambling in New Zealand, namely the Gambling Act 2003 and the Racing Act 2003, which were passed as a result of gaming reform conducted by the fifth Labour Government.

1.6.1 The Gambling Act 2003

The Gambling Act 2003 became law on 18 September 2003 and its provisions took effect on 1 July 2004 ("Gambling Act 2003," 2003), replacing the Gaming and Lotteries Act 1977 and the Casino Control Act 1990. The main provisions of the Gambling Act 2003 were the classification of gambling activities into various classes, the placement of restrictions on casino and on non-casino venues with EGMs, the setting of a minimum age for various gambling activities and the prohibition of certain gambling activities.

Section 220 of the Act established the Gambling Commission of New Zealand, an independent statutory decision-making body. In particular, the Commission hears casino licensing applications, makes appeals on licensing and enforcement decisions made by the Secretary of Internal Affairs in regard to gaming machines and other non-casino gambling activities and has powers of a commission of inquiry.

Classification of gambling activities

The Gambling Act 2003 classifies gambling activities in New Zealand into private and non-private gambling, with non-private gambling activities being further grouped into distinct classes depending on the amount of money wagered on the activity and the risk of problem gambling associated with that particular activity. These range from Class 1 gambling activities which represents low-stake and low-risk gambling activities to Class 4 gambling activities which represents high-risk and high-turnover. Class 1 gambling includes any gambling activity involving prizes with a total value of \$500, while Class 2 gambling includes gambling activities with prizes of a total value between \$500 and \$5000. Both Class 3 and Class 4 gambling include gambling with prizes of a total value exceeding \$5000, with Class 4 gambling involving the use of

EGMs. Additionally, activities carried out by casino operations and lotteries run by the New Zealand Lotteries Commission are treated as separate classes within the Act.

Any gambling activity that involves the use of a gaming machine outside a casino is classified as Class 4 gambling, as defined in Section 30 of the Act (Department of Internal Affairs, 2013c). As opposed to Class 3 gambling, Class 4 gambling must only be conducted by a corporate society for authorised purposes only. Class 2, Class 3 and Class 4 gambling are only to be conducted to raise funds for an authorised purpose and a licence is required in order to conduct Class 3 and Class 4 gambling.

Restrictions on casino gambling opportunities

The Act defines a casino venue as a building or room in which games are conducted and played in and to which both a casino venue licence and casino operator's licence applies. Currently, only casinos are permitted to operate gambling activities for the sole purpose of making a profit in New Zealand (Department of Internal Affairs, 2013c).

The Gambling Act 2003 prohibited the establishment of any new licences for casinos in New Zealand, prohibited existing casinos from expanding their gambling activities and prohibited internet gambling in New Zealand or directed at New Zealanders. However, current licence holders were permitted to retain their licences.

The period of licences of casino venues were set by the Act to expire after 25 years after the date it starts operating (Section 138), while clear requirements were set for a casino's licence renewal process, including a Casino Impact Report, greater participation by the community during the consultation process and proof that the proposed renewal will benefit local and regional communities of the country (Section 134).

The Act allows the New Zealand Racing Board to operate TAB outlets in casino premises by agreement with casino operators.

Restrictions on gambling venues with non-casino EGMs

A major outcome of the Gambling Act 2003 was the setting of a cap on the maximum number of EGMs in one particular venue. As per the Act, non-casino EGM

venues that had a licence to operate on 17 October 2001 may operate no more than 18 machines, while non-casino EGM machine venues established after 17 October 2001 may not have more than nine machines. Any venue which seeks to increase the number of machines at their venue requires local authority consent, so as long as this does not contradict their Class 4 venue policy.

The Gambling (Harm Prevention and Minimisation) Regulations 2004 and Racing (Harm Prevention and Minimisation) Regulations 2004 which complement the Gambling Act 2003, additionally prohibit venues of certain types from being Class 4 venues. These include venues at which the primary activity does not include onsite entertainment such as supermarkets, dairies or fast-food outlets, venues that are not permanent structures such as tents or vehicles, libraries and places of worship.

The Act requires that all EGMs at non-casino EGM venues be connected to an electronic monitoring system (Section 86), which collect information regarding gaming machine usage, including the amount of money gambled, the amount required to be banked and the amount of time players have gambled on the machine. Section 71 of the Act also stipulates that venues should surrender their Class 4 licence if no gambling has taken place for four weeks on these machines.

Section 101 of the Act mandates that local councils of territorial authorities must have in place a Class 4 venue policy which specifies whether or not Class 4 gambling can be established within their boundaries and restrictions on placement of venues. They may also set regulations that restrict the maximum number of machines that can be operated at a Class 4 venue within that territorial authority. The social impacts of gambling, including negative harm caused by problem gambling, must be considered while these policies are drafted. Draft policies must be consulted on by societies that hold Class 4 venue licenses as well as by authorities representing Māori interests. After a policy is adopted, it is required to be reviewed every three years.

Establishment of a minimum age for gambling

Under the Act, a person who intends to gamble in a casino must be at least 20 years of age ("Gambling Act 2003," 2003). The Act also establishes that a person must be at least 18 years of age in order to purchase Instant Kiwi scratch cards and similar games run by the Lotteries Commission, to gamble on EGMs located outside casinos and in order to place bets on horse or dog races and sports games provided by the TAB.

Prohibition on certain forms of gambling

Section 9 (2)(b) of the Gambling Act 2003 prohibits remote interactive gambling, which is defined in the Act as the gambling by a person in New Zealand at a distance through the interaction of a communication device ("Gambling Act 2003," 2003). This measure effectively bans gambling through websites which are based in New Zealand, although it is not an offence for a person in New Zealand to gamble which is conducted overseas or through a website which is based overseas (Department of Internal Affairs, 2013b). The Act specifically exempts the New Zealand Lotteries Commission and the New Zealand Racing Board from conducting remote interactive gambling activities.

Problem gambling levy

The Gambling Act 2003 allows for the provision of a problem gambling levy ("Gambling Act 2003," 2003). The levy is set to reimburse the government for costs involved associated with setting up the problem gambling integrated strategy to prevent and minimise problem gambling harm and is collected on the profits of the four main gambling operators, namely casinos, non-casino EGM venue operators, the NZRB and the NZLC. The levy is calculated using a formula in section 320 of the Act which takes into account rates of player expenditure on each subsector as well as rates of presentations of clients to problem gambling services that are attributable to each subsector (Ministry of Health, 2016).

1.6.2 The Racing Act 2003

The Racing Act 2003 came into force on 1 August 2003 and replaced the Racing Act 1971. The Act disestablished the Racing Industry Board and Totalisator Agency Board, establishing the New Zealand Racing Board (NZRB) in its place as the principal policy body for the industry and as the sole provider of racing and sports betting in the country (Department of Internal Affairs, 2013a), although NZRB products would use the 'TAB' brand name. The Act also gave greater autonomy to racing codes with regards to the distribution of TAB profits and deemed certain rules to be regulations ("Racing Act 2003," 2003).

Similar to the Gambling Act 2003, Section 63 of the Racing Act 2003 specifies that local councils of territorial authorities must have in place a Racing Board venue

policy which regulates venues that are owned or leased by the NZRB. This policy must specify whether a new board may be established in the territorial authority and restrictions on placement of venues. Social considerations must be considered, and draft policies must be consulted on by the New Zealand Racing Board and organisations representing Māori interests. After adoption, the policy must also be reviewed every three years ("Racing Act 2003," 2003).

1.7 Research question

It is clear that gambling on EGMs, at both non-casino and casino venues, has been shown to be cause of the vast-majority of addictive and harmful gambling behaviour (Barratt, Livingston, Matthews, & Clemens, 2014; Paton-Simpson et al., 2001, 2003). Additionally, gambling on these two forms have consistently been perceived as some the most undesirable forms of gambling, with a majority of individuals perceiving that there exist too many locations of non-casino venues with EGMs (Abbott et al., 2014c; Health Sponsorship Council, 2012; Holland, Tu, Gray, Hudson, & Li, 2017; National Research Bureau, 2007).

Although the epidemiology of gambling with respect to various demographic groups, the reasons for gambling and attitudes towards gambling have been well-researched to date, a limited number of studies have examined the relationship between accessibility of casino and non-casino gambling venues with EGMs and the likelihood of gambling at such venues in a New Zealand context. Of the studies that have been conducted (Ministry of Health, 2006; Pearce et al., 2008), numerous limitations exist in terms of estimations of participants' addresses as well as in their measurements of accessibility. Furthermore, while studies have briefly examined the impact of certain types of gambling on problem gambling, there has been a lack of research carried out which examines the effect of accessibility on risk of problem gambling. There is therefore currently a knowledge gap that links individuals' proximity to gambling venues and the density of such venues to individual gambling behaviour at these venues and the total risk of problem gambling in New Zealand.

The purpose of this study is to examine the effect of how locations of venues with EGMs affect gambling behaviour of individuals and their risk of problem gambling. Accessibility to venues with EGMs will be measured using two approaches; the distance from a participant's residential address to their nearest EGM venue in order

to examine the impact of a venue's proximity on an individual's gambling habits, and the number of such venues within distances of 500 metres, one kilometre, five kilometres and 10 kilometres from participants residential locations in order to assess the impact of the choices available to participants at varying distances. Specifically, the study aims to answer the question: 'how do distance to gambling venues with EGMs and the number of venues within certain distances affect gambling in general and gambling on EGMs?' It also looks at distance to EGM venues and density of EGM venues within the aforementioned distances and their impact on an individual's risk of problem gambling. Both casino and non-casino venues with EGMs will be considered in this study, with distances to EGM venues from individuals' residential locations being calculated from the existing road network using network analysis.

As territorial authorities are obliged to have in place a policy that minimises gambling harm, research from this study will aid in shaping public policy with regards to placement of future venues and renewal of current licences. It is hoped that results from this research will provide concrete results on the impact of spatial accessibility on various forms of gambling behaviour and on total risk of gambling harm.

1.8 Thesis structure

Chapter 1 of this document provides an introduction to the topic of gambling, including the role of gambling in New Zealand society, problem gambling, the gambling industry in New Zealand. It also provides a summary on the history of gambling in New Zealand, expenditure spent on gambling, the social and economic impacts of gambling on gamblers and society at large, the major pieces of legislation that govern gambling activities in New Zealand as well as the research question that this study aims to answer.

Chapter 2 provides a literature review of the topic of gambling including the epidemiology of gambling behaviour with respect to demographic factors such as age, gender, ethnicity, deprivation and geography. The literature review also explores individuals' main motivations for gambling, attitudes towards gambling, their preferences with respect to choosing a gambling venue, the geographic distribution of gambling venues in New Zealand and overseas, along with impacts on the population with respect to accessibility of gambling venues.

Chapter 3 provides information on the methods used to carry out this study. Specifically, it provides a summary of how the various data used in this study were sourced, the preparation of address data for geocoding, the geocoding of address data, the calculation of derived variables, the preparation of response variables and a summary on the statistical analyses carried out.

Chapter 4 covers the results of both the geospatial and statistical analyses carried out. The section also contains a brief summary of demographic data of participants who partook in the first phase of the National Gambling Study survey, as well as an analysis of the geographic distribution of venues with EGMs in New Zealand. The results of the multiple variable models used to predict various outcomes will also be presented.

Chapter 5 provides a discussion on the results achieved from the geospatial and statistical analyses of data in Chapter 4 as well as a summary of the major conclusions from this study. Limitations of the study will also be discussed and opportunities for future work will be recommended.

Chapter 2 Literature Review

This chapter provides a literature review on the concept of gambling, including rates of participation in various gambling activities as well as relative differences with respect to various demographic factors such as age, gender, ethnicity, deprivation and geography. Relevant publications on individuals' main motivations for gambling, their preferences with respect to choosing an EGM gambling venue, attitudes towards gambling, the social and economic impacts of gambling on gamblers and society at large, the geographic distribution of gambling venues in New Zealand and overseas, along with impacts on the population with respect to accessibility of gambling venues will also be reviewed.

Literature on various subjects relating to gambling was found via searches on scholarly databases such as Wiley, SCOPUS and Elsevier as well as Google Scholar using keywords such as 'gambling', 'problem gambling', 'gaming machines', 'casinos', 'pokies', 'accessibility' and 'density'. Survey results were obtained by extensively searching the websites of the Department of Internal Affairs, the Ministry of Health and the Health Promotion Agency. Additionally, the works of important authors and journal articles, reports and books cited in reference lists of important papers were also examined.

2.1 Epidemiology of gambling in New Zealand

2.1.1 Surveys measuring gambling participation and problem gambling

A number of studies have been carried out in order to gauge the extent of gambling participation by different segments of society in New Zealand. These include the People's Participation in, and Attitudes towards Gaming (PPAG) surveys carried out by the Department of Internal Affairs from 1985 to 2005, the New Zealand Gaming Surveys (NZGS) carried out in 1991 and 1999, the New Zealand Health Surveys (NZHS) of 2002/03, 2006/07 and 2011/12, the biennial Health and Lifestyle Surveys (HLS) from 2006 till present and the longitudinal National Gambling Study (NGS) from 2012 to 2015 carried out by the Gambling and Addictions Research Centre at the Auckland University of Technology. A summary of the results of participation in different gambling activities from the various surveys mentioned are tabulated in Table 2.

The DIA carried out its five-yearly 'People's Participation in, and Attitudes towards Gambling' (PPAG) surveys from 1985 to 2005, measuring participation in various gambling activities and attitudes to gaming of the New Zealand public, questioning participants on their involvement and views on a wide range of gambling activities, although no attempt was made to gauge the extent of problem gambling (Amey, 1985, 2001; Christoffel, 1992; Department of Internal Affairs, 2007; Reid & Searle, 1996).

The New Zealand Gaming Surveys (NZGS), consisting of two independent surveys carried out in 1991 (Abbott & Volberg, 1991) and 1999 (Abbott & Volberg, 2000), were the first in New Zealand to investigate the incidence of both gambling and problem gambling using a revised SOGS, an internationally validated instrument to assess problem gambling. Both these studies were longitudinal studies, with selections of participants from both re-interviewed at a later stage (Abbott, 2001a; Abbott & Volberg, 1992; Abbott et al., 1999). In addition to the two National Prevalence Surveys, the NZGSs also included two surveys interviewing male (Abbott, McKenna, & Giles, 2005) and female (Abbott & McKenna, 2005) prisoners on their gambling habits, both before and during their incarceration.

The Health Promotion Agency, previously the Health Sponsorship Council carried out its biennial Health and Lifestyles Survey (HLS) since 2006 in partnership with the Ministry of Health. Starting with its 2006/07 survey, the survey has been carried out every two years, questioning New Zealand adults on their health behaviour in relation to gambling, among other behaviours involving alcohol, tobacco, nutrition and sun safety (Gray, 2011; National Research Bureau, 2007; Thimasarn-Anwar et al., 2017; Tu, 2013; Tu & Puthipiroj, 2017). Additionally, the 2006/07, 2010 and 2014 surveys questioned participants on their attitudes to gambling participant and availability of gambling activities (Health Sponsorship Council, 2012; Holland et al., 2017; National Research Bureau, 2007). The 2006/07 survey is referred to as the 'Gaming and Betting Activities Survey', while all subsequent surveys from 2008 are referred to as 'Health and Lifestyles Surveys'.

The New Zealand Health Survey (NZHS), a periodic survey carried out by the Ministry of Health through face-to-face interviews on various topics concerning the health of New Zealanders, has asked questions relating to participants' gambling behaviour in the last 12 months in three of its surveys, namely in its 2002/03 (Mason,

2006), 2006/07 (Mason, 2009) and 2011/12 surveys (Rossen, 2015). The 2002/03 NZHS contained a set of questions attempting to screen the incidence of problem gambling, while the 2006/07 and 2011/12 surveys used PGSI questions in order to measure the incidence of problem gambling.

The National Survey of Lotteries, Betting and Gaming Activities 2012-2016, commonly referred to as the New Zealand National Gambling Study (NGS), were a set of longitudinal surveys carried out by the Gambling and Addictions Research Centre of the Auckland University of Technology. The survey questionnaires included questions on a wide variety of topics, including those on gambling behaviour and participation, mental health, substance use, social connectedness and attitudes towards gambling in addition to sociodemographic information (Abbott, Bellringer, & Garrett, 2015; Abbott et al., 2014c, 2014a, 2014b; Abbott, Bellringer, Garrett, & Mundy-McPherson, 2015, 2016). The PGSI was used to measure the incidence of problem gambling risk. More information on the NGS can be found in Section 1.1.1 .

2.1.2 Gambling participation by the general public

Overall gambling participation

In terms of past-year gambling on any activity, studies have consistently shown that rates have been decreasing over the last few decades, although the majority of people still had partaken in at least one gambling activity during the past year. The results of the 1985 PPAG survey showed that 85% of the sampled population took part in any form of gambling within the past 12 months (Wither, 1987). This rate increased to 90% in both the 1990 and 1995 PPAG surveys (Christoffel, 1992; Reid & Searle, 1996), before falling to 87% and 80% in the 2000 (Amey, 2001) and 2005 (Department of Internal Affairs, 2007) surveys respectively. The NZGSs, which were the only surveys to measure lifetime prevalence of gambling, also reported a small decrease in participation from 95% in the 1991 survey to 94% in the 1999 (Abbott & Volberg, 1991, 2000). This trend was continued in HLS surveys, which saw a decline from 83% in the 2006/07 HLS (National Research Bureau, 2007) to 70% in the 2016 HLS (Thimasarn-Anwar et al., 2017) while in the NGS, participation declined from 80% in the 2012 survey (Abbott et al., 2014b) to 75% in the 2015 survey (Abbott, Bellringer, & Garrett, 2015), as did the proportion of respondents who gambled on multiple activities (Abbott, Bellringer, & Garrett, 2015). The NZHS surveys also displayed this trend,

albeit with lower overall participation values, mainly due to the fact that the NZHS surveys asked participants to choose from a shorter list of gambling activities and participation in many common forms of gambling such as partaking in raffles and personal bets with friends, were not asked. As a result, lower participation rates in overall gambling were found in NZHS surveys, ranging from 70% in the 2002/03 survey (Mason, 2006) to 52% in the 2011/12 survey (Rossen, 2015).

Gambling on casino activities

As the first casino opened in New Zealand in 1994, the 1985 and 1990 PPAG surveys and the 1991 NZGS did not question participants on their participation in gambling in New Zealand casinos, while the 1995 PPAG, 1998 follow-up of the 1991 NGS and the 2002/03 did not differentiate between participation on casino EGMs or table games. All six casinos being fully functional by 2002, and the PPAG surveys therefore reflect this availability; whereas in the 1995 PPAG only 5% of respondents stated having gambled at a casino in the preceding 12 months, a full 16% of respondents in the 2000 PPAG survey indicated that they had done so (Amey, 2001; Reid & Searle, 1996).

Participation on casino activities has since then declined over time, falling to 11% of respondents in the 2005 PPAG survey (Department of Internal Affairs, 2007). The NZHS surveys show participation declining even further, with participation on casino EGMs falling from 8% in 2006/07 to 6% in 2011/12 and participation in casino table games remaining low at 2% in both surveys (Mason, 2009; Rossen, 2015). The HLS surveys showed participation on casino EGMs falling from 9% in 2006/07 to 5% in 2016 while that on table games remaining at 3% in both the 2006/07 and 2016 surveys (National Research Bureau, 2007; Thimasarn-Anwar et al., 2017). The NGS showed that participation in both casino activities fell during the four years it was conducted, with participation of casino EGMs falling from 12% in 2012 to 8% in 2015 and that on table games falling from 5% in 2012 to 3% in 2015 (Abbott, Bellringer, & Garrett, 2015; Abbott et al., 2014b; Abbott, Bellringer, Garrett, et al., 2015; Abbott et al., 2016).

Gambling on non-casino EGMs

All surveys except for the NGS surveys included questions that asked if participants had played on an EGM in either a club, pub or both, but did not provide separate results of participation for the two types of venues (Table 2).

Participation in playing on non-casino EGMs was found to be relatively high in initial surveys, where 28% of participants in the 1990 PPAG (Christoffel, 1992) and 26% of those in the 1998 longitudinal follow up study on the 1991 NZGS (Abbott et al., 1999) were found to have gambled on a non-casino EGM. Over time, participation on non-casino EGMs has fallen dramatically, falling to 19% in the 2005 PPAG survey (Department of Internal Affairs, 2007). Further decline has been seen in results of the NZHS, HLS and NGS surveys. The NZHS surveys show participation more than halve from 13% in 2002/03 to 6% in 2011/12 (Mason, 2006; Rossen, 2015), the HLS surveys show participation declining from 19% in 2008 to 10% in 2016 (Gray, 2011; Thimasarn-Anwar et al., 2017) and the NGS has seen participation gambling on EGMs in pubs drop from 12% to 9% and that of gambling on EGMs in clubs drop from 6% to 4% from 2012 to 2015 (Abbott, Bellringer, & Garrett, 2015; Abbott et al., 2014b).

Other forms of gambling

Since its inception in 1987, participation in Lotto has seen drastic changes over time. The 1985 PPAG survey revealed that only 3% of participants surveyed had purchased lottery tickets, not including Golden Kiwi, in the past year (Amey, 1985). As Lotto was unavailable in New Zealand at that time, it is assumed that these tickets would have been purchased overseas. After the introduction of Lotto in 1987, participation remained high and peaked during 1995, before declining over time, mirroring expenditure on Lotto products during this period (Figure 2). The PPAG survey of 1990 showed past-year participation at 78%, peaking at 80% in 1995 before declining to 66% in 2005 (Christoffel, 1992; Department of Internal Affairs, 2007; Reid & Searle, 1996). Similar trends were confirmed by the NZHS surveys, declining from 59% in 2002/03 to 45% in 2011/12 (Mason, 2006; Rossen, 2015), by the HLS surveys, showing 67% participation in the 2006/07 survey declining to 55% in the 2016 survey (Mason, 2009; Thimasarn-Anwar et al., 2017) and by the NGS surveys, declining from 60% in 2012 to 55% in 2015 (Abbott, Bellringer, & Garrett, 2015; Abbott et al., 2014b). Additionally, the 2011/12 NZHS also found that a large segment of past-year gamblers

(52%) gambled on Lotto only and not on any other form of gambling, not even on other products offered by the NZLC (Rossen, 2015).

In a similar manner, participation in Keno was highest soon after its introduction in 1994, reaching 11% in 1995 to 3% in 2005 (Department of Internal Affairs, 2007; Reid & Searle, 1996). The HLS surveys showed participation falling from 6% in 2010 to 2% in 2016 (Gray, 2011; Thimasarn-Anwar et al., 2017), while the NGS shows a similar fall from 3% in 2012 and 2013 to 2% in 2014 and 2015 (Abbott, Bellringer, & Garrett, 2015; Abbott et al., 2014b; Abbott, Bellringer, Garrett, et al., 2015; Abbott et al., 2016).

In terms of participation in buying Instant Kiwi and/or other scratch games, participation has seen a similar trend to that of Lotto and Keno, where participation peaked soon after introduction in 1989 and has fallen steadily since. The 1990 PPAG found that 66% of respondents bought an Instant Kiwi card or other scratch card during the past year, while the 2005 PPAG found that only 41% had done so (Christoffel, 1992; Department of Internal Affairs, 2007). Continuing this trend, the 2010 HLS found that 33% percent partook in purchasing an Instant Kiwi card during the past year, while this percentage fell to 27% in the 2016 HLS (Gray, 2011; Thimasarn-Anwar et al., 2017). The NGS found steady participation at approximately 29% to 30% in its four years (Abbott, Bellringer, & Garrett, 2015; Abbott et al., 2014b; Abbott, Bellringer, Garrett, et al., 2015; Abbott et al., 2016).

The incidence of betting on horse or dog races has seen a clear decline over time. While 25% of participants of the 1985 PPAG survey reported partaking in track betting, by 2005 only 14% of respondents had admitted to doing so (Amey, 1985; Department of Internal Affairs, 2007). This trend was continued by the NZHS, finding participation almost halving from 11% in 2002/03 to 6% in 2011/12 (Mason, 2006; Rossen, 2015). The HLS surveys found participation falling from 15% in 2012 to 10% in 2016 (Thimasarn-Anwar et al., 2017; Tu, 2013) and the NGS similarly found participation falling from 12% in 2012 to 9% in 2015 (Abbott, Bellringer, & Garrett, 2015; Abbott et al., 2014b).

Similarly, since the introduction of sports betting through the TAB in 1996, participation has fallen over time. The results of the PPAG surveys show that participation has fallen from 8% in 2000 to 4% in 2005 (Amey, 2001; Department of Internal Affairs, 2007), while the NZHS surveys show a decline from 4% in 2002/03 to

3% in 2011/12 (Mason, 2006; Rossen, 2015). The NGS surveys found a decline from 5% in 2012 to 3% in 2015 (Abbott, Bellringer, & Garrett, 2015; Abbott et al., 2014b), while the HLS found participation to decline from 8% in 2012 to 5% in its 2016 survey (Thimasarn-Anwar et al., 2017; Tu, 2013).

Participation in gambling over the internet, other than Lotto products or TAB products, has been found to be small although increasing. Both the 2000 PPAG and 2005 PPAG found that less than one percent of respondents participated in gambling over the internet (Amey, 2001; Department of Internal Affairs, 2007), although the latest HLS found a participation rate of 3% in 2016 (Thimasarn-Anwar et al., 2017).

Problem gambling

The NZGS surveys, NZHS surveys, HLS surveys and the NGS all contained questions on participants' problem gambling behaviour. While the HLS surveys and the latter two NZHS surveys used the PGSI to measure the incidence of problem-gambling (Gray, 2011; Mason, 2009; Rossen, 2015; Thimasarn-Anwar et al., 2017; Tu, 2013; Tu & Puthipiroj, 2017), the NZGS used a revised version of the SOGS (Abbott & Volberg, 1991, 2000). The NGS used both the PGSI and the revised SOGS used by the NZGS surveys (Abbott, Bellringer, & Garrett, 2015; Abbott et al., 2014b; Abbott, Bellringer, Garrett, et al., 2015; Abbott et al., 2016), while the 2002/03 NZHS used a custom problem gambling screen to measure problem gambling incidence (Mason, 2006).

The 1991 survey found that 2.7% of the population were lifetime pathological gamblers, with a further 4.3% found to be lifetime problem gamblers (Abbott & Volberg, 1991). By 1999, the proportion of adults in both categories was found to decrease, with only 1.0% found to be lifetime pathological gamblers, while 1.9% were found to be lifetime problem gamblers (Abbott & Volberg, 2000). Caution must be taken when interpreting these results, as the revised SOGS used measured lifetime prevalence of problem gambling as opposed to past-year prevalence by the PGSI (Lesieur & Blume, 1987).

The majority of surveys that have been conducted since 2000 have found the incidence of problem gambling to be under one percent of the adult population. The NZHS found a steady decrease in both the percentage of problem gamblers as well as the combined proportion of problem gamblers and moderate-risk gamblers over time. The proportion of adults classified as problem gamblers fell from 0.7% in the 2002/03

survey, to 0.4% in the 2006/07 survey while falling further to 0.2% in the 2011/12 survey (Mason, 2006, 2009; Rossen, 2015). Similarly, the combined percentage of those classified as problem gamblers or moderate-risk gamblers was found to fall from 1.9% in 2002/03 to 1.7 in 2006/07, before again falling to 1.2% in 2011/12 (Mason, 2006, 2009; Rossen, 2015).

The results of the NGS show similar results, with the rate of problem gambling of participants surveyed found to decrease over time. The rate of problem gambling was found to decrease from 0.6% in the first year of the survey to 0.2% in 2015 (Abbott, Bellringer, & Garrett, 2015; Abbott et al., 2014b; Abbott, Bellringer, Garrett, et al., 2015; Abbott et al., 2016). Similarly, the combined percentage of those classified as either problem gamblers or moderate-risk gamblers fell from 2.3% in 2012 to 2.0% in 2015 (Abbott, Bellringer, & Garrett, 2015; Abbott et al., 2014b; Abbott, Bellringer, Garrett, et al., 2015; Abbott et al., 2016).

The results of the HLS in contrast found a small increase in the incidence of problem gambling in recent years, although only combined results were available for combined problem gambling and moderate-risk gamblers. The combined incidence of problem gambling or moderate-risk of problem gambling was found to be the highest in 2010 at 4.4% (Gray, 2011) after falling to a low of 2.0% in 2012 (Tu, 2013). Since then, this rate has increased only slightly to 2.1% in 2014 (Tu & Puthipiroj, 2017) and to 2.3% in 2016 (Thimasarn-Anwar et al., 2017).

As noted by Abbott (2001b), estimates of problem gambling incidence are likely to be conservative, and true estimates may be up to twice the measured incidence rate. This hypothesis was further endorsed by the Department of Internal Affairs (2001), which noted that the majority of counselling cases for problem gambling involved individuals suffering from severe gambling related problems, meaning that the actual percentage of individuals suffering from gambling-related harm would be expected to be much higher than reported.

Table 2. A summary of participants' participation in selected gambling activities in the previous 12 months.

Activity	1985 DIA (Amey, 1985)	1990 DIA (Christoffel, 1992)	1991 NZGS (Abbott & Volberg, 1991)*	1995 DIA (Reid & Searle, 1996)	1998 Follow-up of the 1991 NZGS (Abbott et al., 1999)*	1999 NZGS (Abbott & Volberg, 2000) *	2000 DIA (Amey, 2001)	2002/03 NZHS (Mason, 2006)	2005 DIA (Department of Internal Affairs, 2007)	2006 GBAS (HLS) (National Research Bureau, 2007)	2006/07 NZHS (Mason, 2009)	2008 HLS (Gray, 2011)	2010 HLS (Gray, 2011)	2011/12 NZHS (Rossen, 2015)	2012 HLS (Tu, 2013)	2012 NGS (Abbott et al., 2014b)	2013 NGS (Abbott, Bellringer, Garrett, et al., 2015)	2014 HLS (Tu & Puthipiroj, 2017)	2014 NGS (Abbott et al., 2016)	2015 NGS (Abbott, Bellringer, & Garrett, 2015)	2016 HLS (Thimasarn-Anwar et al., 2017)
At least one activity	85	90	90	90	88	86	87	70	80	83	65	77	81	52	70	80	78	70	77	75	70
Lotto	-	78	78	80	78	73	75	59	66		55		60	45	55	62	60	55	60	56	55
Keno	-	-	-	11	5	3	6	2	3	67§	2	64§	6	1	7	3	3	4	2	2	2‡
Instant Kiwi	-	66	51	58	49	36	48	29	41		27†		33	13†	30	32†	30†	30	29†	30†	27
Played on a casino EGM	-	-	-	5	17	11	14	8	10	9	8	12	10	4	11	8	6	7	6	6	5
Played a casino table game	-	-	-	5	17	5	6	8	4	3	2	4	3	2	7	4	3	3	3	3	3
Played on a pub EGM	-	28	16	24	26	14	18	13	19	18	10	19	16	6	14	12	9	14	8	8	10
Played on a club EGM	-	28	16	24	26	14	18	13	19	18	10	19	16	6	14	6	4	14	4	4	10
Bet on horse or dog racing	25	23	15	23	20	28	17	11	14	18	9	14	14	6	15	12	11	13	9	9	10
Sports betting	-	-	-	-	8	5	8	4	4		5			3	8	5	3	5	3	3	5
Raffles	71	62	57	67		48	67	-	55	52	-	44	43		34	47	48	30	46	45	27#
Casino evenings	8	9	2	10		-	10	-	4		-			-		-	-		-	-	
Bets with family/friends	19	23	16	30	-	17	24	-	22	10	-	9	29			15	12		13	13	4
Housie or Bingo	8	5	3	6		3	4	2	3	3	2	3	3		2	2	1	2	1	1	1
Internet game	-	-	-	-	-	<1	<1	1	<1	<1	<1	1	2	2	1	2	1	1	<1	<1	3
None	15	10	10	10	12	14	13	30	20	18	35	23	19	48	30	20	22	29	23	25	30

* Participation was measured only for activities taken in the previous six months.

† Includes results for participation in purchasing Instant Kiwi as well as any other scratch cards.

‡ Includes results for participation in purchasing Keno, Bullseye or Play 3 tickets.

§ Includes results for participation in purchasing any Lotto New Zealand product, including Lotto, Keno or Instant Kiwi

|| Includes results for participation in raffles, casino evenings or bets with family/friends.

Includes results for participation in raffles or casino evenings.

- Indicates that this particular question was not asked in the survey.

Note: Adapted with modifications to include results from the 2013, 2014 and 2015 National Gambling Study surveys and the 2012, 2014 and 2016 Health and Lifestyles Surveys, from the New Zealand 2012 National Gambling Study: Overview and Gambling Participation, (p.120), by Abbott, M., Bellringer, M., & Garrett, N., 2014, Auckland: Gambling and Addictions Research Centre, Auckland University of Technology. Copyright (2014) by the Auckland University of Technology.

2.1.3 Gambling by various demographic groups

When taking account demographic and social factors such as individuals' age group, sex, ethnicity, deprivation status and geographical status, major relative differences in gambling participation have been found to exist when

Age

A strong correlation with age group and overall gambling as well as specific forms of gambling have been found in all surveys (Abbott et al., 2014b; Abbott & Volberg, 1991, 2000; Gray, 2011; Mason, 2006, 2009; National Research Bureau, 2007; Rossen, 2015; Thimasarn-Anwar et al., 2017; Tu, 2013; Tu & Puthipiroj, 2017). The vast majority of surveys have divided participants into between four to six age groups, with all HLS surveys and the 2002/03 NZHS having a separate category for participants under 18 years of age.

Overall gambling

In terms of past-year gambling all surveys have found participants' age to be statistically significant, reporting that the 45 to 54 years old and the 55 to 64 years old age group had the highest incidences of past-year gambling when compared to other age groups (Abbott et al., 2014b; Abbott & Volberg, 1991, 2000; Gray, 2011; Mason, 2006, 2009; National Research Bureau, 2007; Rossen, 2015; Thimasarn-Anwar et al., 2017; Tu, 2013; Tu & Puthipiroj, 2017). In contrast, these surveys found the lowest participation rates for the youngest age groups.

The PPAG surveys did not report past-year gambling results in terms of age group. However, the 45 to 54 years age group was found to be the age group with the highest annual spend on gambling activities in most surveys, with the 55-64 age group a close second while the 15-24 age group being the group with the smallest expenditure (Amey, 1985, 2001; Christoffel, 1992; Department of Internal Affairs, 2007; Reid & Searle, 1996).

Casino gaming

In terms of participation in gambling on EGMs and on table games in casinos, most surveys, including all NZHS surveys (Mason, 2006, 2009; Rossen, 2015), HLS

surveys (Gray, 2011; Thimasarn-Anwar et al., 2017; Tu, 2013; Tu & Puthipiroj, 2017) and the NGS (Abbott et al., 2014b) have found participation rates for both activities to be highest for participants in their early twenties to early thirties, with participation declining with increasing age group. The PPAG surveys from 1995 onwards have shown that participation was found to be highest for the 25-34 age group, although the 2000 PPAG survey also found a relatively high participation rate for the 45-54 years' age group (Amey, 2001; Department of Internal Affairs, 2007; Reid & Searle, 1996).

All HLS surveys as well as the 2002/03 NZHS, which contained a separate category for survey participants below 18 years, found that participants below 18 years were found to have negligible participation rates in both gambling on casino EGMs as well as on table games (Gray, 2011; Mason, 2006; Thimasarn-Anwar et al., 2017; Tu, 2013; Tu & Puthipiroj, 2017). This result is explained by age restrictions set out by the Gambling Act 2003 which mandates that individuals be aged at least 20 years or older to enter casinos ("Gambling Act 2003," 2003).

In line with the overall rate of participation in gambling on casino EGMs, participation rates across all ages were generally found to be low in the 1995 PPAG survey reflecting limited availability of casinos during that time (Reid & Searle, 1996), peaking in the results of the 2000 survey before dropping again in the 2005 survey (Amey, 2001; Department of Internal Affairs, 2007).

Gambling on non-casino EGMs

Similar to participation in gambling on casino EGMs, the majority of surveys (Abbott et al., 2014b; Gray, 2011; Mason, 2006, 2009; Rossen, 2015; Thimasarn-Anwar et al., 2017; Tu, 2013; Tu & Puthipiroj, 2017) showed that participation in gambling on non-casino EGM was found to be highest in age groups representing individuals in their early twenties to early thirties. Participation was also seen to decrease in age groups with increasing age. Results from the PPAG surveys show that the 15-24 years' age group to have had the highest rate of gambling on non-casino EGMs during the past year in all surveys, except for the 2005 survey which shows the 25-34 age group having a slightly higher rate than this age group (Amey, 2001; Christoffel, 1992; Department of Internal Affairs, 2007; Reid & Searle, 1996).

The HLS surveys and the 2002/03 NZHS survey showed that participation rates for those under 18 years was negligible, again reflecting the age-restriction on playing

on non-casino EGMs ("Gambling Act 2003," 2003) and the fact that the majority of non-casino EGMs were located in premises with alcohol licences (Gray, 2011; Mason, 2006; Thimasarn-Anwar et al., 2017; Tu, 2013; Tu & Puthipiroj, 2017).

Other forms of gambling

All studies have consistently shown that the 45-54 years and the 55-65 years old age group have been the groups with the highest participation rate in terms of purchasing Lotto tickets in the past year (Abbott et al., 2014b; Abbott & Volberg, 1991, 2000; Gray, 2011; Mason, 2006, 2009; National Research Bureau, 2007; Rossen, 2015; Thimasarn-Anwar et al., 2017; Tu, 2013; Tu & Puthipiroj, 2017). In contrast, participation was found to be low for age groups representing younger age groups. Similar to the case with gambling on casino and non-casino EGMs, participation was almost negligible for participants aged below 18 years due to age restrictions set by the NZLC on buying Lotto products.

In contrast, most studies have found participation in purchasing Instant Kiwi or other scratch cards was found to be the highest for younger age groups, with decreasing participation with increasing age (Abbott et al., 2014b; Abbott & Volberg, 1991, 2000; Gray, 2011; Mason, 2006, 2009; National Research Bureau, 2007; Rossen, 2015; Thimasarn-Anwar et al., 2017; Tu, 2013; Tu & Puthipiroj, 2017).

In terms of betting on horse and dog racing, the PPAG surveys have shown a change in behaviour with respect to age groups over time. Whereas in the 1990 survey, participation was similarly high across all age groups except for the 65 years and over group which had the lowest participation rate (12%), participation has declined drastically for the younger age groups such that by 2005, the participation was highest in the 55-64 age group while only seven percent of the 15-24 years' age group had participated on track betting (Amey, 2001; Christoffel, 1992; Department of Internal Affairs, 2007; Reid & Searle, 1996). Similar results were found from the NZHS and HLS surveys, where the highest rates of track betting were found in the 45 to 55 years and the 35 to 44 years group and low participation rates for the younger age groups (Gray, 2011; Mason, 2006, 2009; Rossen, 2015; Thimasarn-Anwar et al., 2017; Tu, 2013; Tu & Puthipiroj, 2017), although the NGS found highest rates of participation for younger age groups with participation decreasing with increasing age (Abbott et al., 2014b).

For sports betting, participation was found to be highest in the 18 to 24 years group and the 25-34 years' age group, with participation decreasing with increasing age (Abbott et al., 2014b; Gray, 2011; Mason, 2006, 2009; Rossen, 2015; Thimasarn-Anwar et al., 2017; Tu, 2013; Tu & Puthipiroj, 2017). The under 18 years age group also had significantly lower rates of participation compared to those over 18 years (Gray, 2011; Thimasarn-Anwar et al., 2017; Tu, 2013; Tu & Puthipiroj, 2017).

Problem gambling

The majority of studies have found that younger age groups tend have the highest risk of problem gambling when compared to other age groups (Abbott et al., 2014b; Amey, 1985, 2001; Christoffel, 1992; Department of Internal Affairs, 2007; Gray, 2011; Mason, 2006, 2009; Reid & Searle, 1996; Rossen, 2015; Thimasarn-Anwar et al., 2017; Tu, 2013; Tu & Puthipiroj, 2017). The risk of problem gambling is generally seen to decrease with increasing age and was found to be the lowest in older age groups.

Both the 1991 and 1999 NZGS found that the 18-24 years age group had the highest rates of problem gambling risk, followed by the 20-29 years age group (Abbott & Volberg, 1991, 2000). All four waves of the NGS also found similar results, with the participants in the 18-39 years old group found to have the highest rate of combined problem gambling or moderate-risk gambling incidence, while the those over 60 were found to have the lowest combined rate (Abbott, Bellringer, & Garrett, 2015; Abbott et al., 2014b; Abbott, Bellringer, Garrett, et al., 2015; Abbott et al., 2016). The 2016 HLS was the only HLS survey to analyse the effect of age group on problem gambling, finding that the 18 to 24 age group in particular had the highest rates of problem gambling harm, compared all other groups aged 25 and over, although the survey, which included a separate 15-17 years age group, found no problem gamblers in the 15-17 years age group (Thimasarn-Anwar et al., 2017).

In contrast, the 2002/03 and 2011/12 NZHS surveys found the highest rates of problem gambling or being at moderate-risk of problem gambling in the 25 to 34 years age group (Abbott, 2003; Rossen, 2015). The 2006/07 survey found that the 35 to 44 years group had the highest rate of problem gambling (Mason, 2009), while the 2011/12 survey also found particularly high rates for the 45 to 54 age group (Rossen, 2015). All three surveys found the low rates of problem gambling in the oldest age groups.

Sex

The sex of a participant has been found to be an important factor in determining specific types of gambling. Till date, all studies have consistently investigated the effect of a participant's gender in a binary light, grouping participants into either male or female categories.

Overall gambling

The majority of studies have consistently found no significant differences in past-year gambling between male and female respondents (Abbott et al., 2014b; Gray, 2011; Mason, 2006, 2009; Rossen, 2015; Thimasarn-Anwar et al., 2017; Tu, 2013; Tu & Puthipiroj, 2017),

Casino gaming

Similar participation rates for gambling on casino EGMs were found for both males and females in the PPAG surveys (Amey, 1985, 2001; Christoffel, 1992; Department of Internal Affairs, 2007; Reid & Searle, 1996), the NGS survey (Abbott et al., 2014b) and the HLS surveys (Thimasarn-Anwar et al., 2017; Tu, 2013; Tu & Puthipiroj, 2017). However, participation rates of gambling on table games for men were found to be higher than those for women in the NGS (Abbott et al., 2014b), HLS surveys (Gray, 2011; Thimasarn-Anwar et al., 2017) and the latter two NZHS surveys (Mason, 2009; Rossen, 2015).

Gambling on non-casino EGMs

Although no significant differences were found in participation rates for males and females in terms of gambling on non-casino EGMs by the NGS (Abbott et al., 2014b), the first two NZHS surveys (Mason, 2006, 2009) found males being significantly more likely than females to have played on a non-casino EGM during the past year. No differences in gambling behaviour were found in the 2011/12 NZHS and all NGS and HLS surveys after, suggesting that rates for the two sexes have converged over time (Abbott et al., 2014b; Rossen, 2015; Thimasarn-Anwar et al., 2017; Tu, 2013; Tu & Puthipiroj, 2017).

Similarly, the PPAG surveys showed a convergence over time in rates of male and female gambling, where the 1990 and 1995 surveys show males with significantly

higher participation rates than females (Christoffel, 1992; Reid & Searle, 1996), but in the 2000 and 2005 surveys, these rates have been found to be similar (Amey, 2001; Department of Internal Affairs, 2007).

Other forms of gambling

No significant differences were found when comparing male and female participation in Lotto and Keno during the past-year by the PPAG surveys and the NGS (Abbott et al., 2014b; Amey, 2001; Christoffel, 1992; Department of Internal Affairs, 2007; Reid & Searle, 1996). The exception was the 2011/12 NZHS found males to have a significantly higher rate of participation in Lotto than females (Rossen, 2015).

In terms of track betting and sports betting, all PPAG surveys, NZHS surveys, HLS surveys and the NGS have consistently reported that males have had higher participation rates than females (Amey, 1985, 2001; Christoffel, 1992; Department of Internal Affairs, 2007; Mason, 2006, 2009; Reid & Searle, 1996; Rossen, 2015; Thimasarn-Anwar et al., 2017; Tu, 2013; Tu & Puthipiroj, 2017)

In contrast, all PPAG surveys, NZHS surveys, HLS surveys and the NGS have shown that females have been found to have higher participation rates of playing Instant Kiwi and other scratch cards and participation in housie than males (Amey, 1985, 2001; Christoffel, 1992; Department of Internal Affairs, 2007; Reid & Searle, 1996) (Mason, 2006, 2009; Rossen, 2015; Thimasarn-Anwar et al., 2017; Tu, 2013; Tu & Puthipiroj, 2017).

Problem gambling

Significant differences in problem gambling rates have been found with respect to gender, with the majority of surveys finding males being more likely to be at risk of problem gambling than females. However, similarly to rates of gambling in general, studies have shown differences in rates between males and females to have decreased over time.

The NZGS surveys found that males were significantly more likely to be problem or pathological gamblers than were females. The 1991 NZGS found that males had twice the rate of problem gambling than females and four times the rate of pathological gambling than females (Abbott & Volberg, 1991), while the 1999 survey found that males were three times more likely to be problem gamblers and 33% more

likely to be pathological gamblers (Abbott & Volberg, 2000), suggesting a decrease in relative difference over time.

The 2002/03 NZHS showed that males were 42% more likely to be problem gamblers than females, although this result wasn't significant (Mason, 2006). Both the 2006/07 and 2011/12 found males more than twice as likely to be either problem gamblers or moderate-risk gamblers than females (Mason, 2009; Rossen, 2015). The first phase of the NGS found that males were two and a half times more likely to be a problem gambler than females and were 45% more likely than females to be problem gamblers or moderate-risk gamblers (Abbott et al., 2014a), while the 2016 HLS found that the rate of problem gambling or moderate-risk gambling was 2.3 times that of females (Thimasarn-Anwar et al., 2017).

Ethnicity

Significant differences exist for both overall gambling as well as gambling in certain activities in terms of individuals' ethnic affiliations. In terms of ethnicity, studies that have been carried out in New Zealand have traditionally grouped participants into the four broad ethnic groups commonly used by Statistics New Zealand; European, Māori, Pacific Island and Asian. Participants that do not identify with any of the four broad groups listed above have usually been lumped with the European category. All HLS surveys used prioritised ethnicities rather than reported ethnicities (Gray, 2011; National Research Bureau, 2007; Thimasarn-Anwar et al., 2017; Tu, 2013; Tu & Puthipiroj, 2017). The 1990 and 1995 PPAG surveys did not break down participation rates for Asian and Pacific ethnic groups separately due to the relatively small number of participants from these two groups (Christoffel, 1992; Reid & Searle, 1996).

Overall gambling

In terms of past-year gambling on any activity, studies carried out in New Zealand have consistently found that ethnicity is significantly associated with gambling. All NZHS surveys, HLS surveys and the NGS found that in comparison to the European/Other ethnic group, those identifying with the Māori ethnic group had slightly higher rates of gambling, while rates for those identifying with the Asian and Pacific Island ethnic groups were substantially lower (Abbott et al., 2014b; Gray, 2011; Mason, 2006, 2009; Rossen, 2015; Thimasarn-Anwar et al., 2017; Tu, 2013; Tu & Puthipiroj,

2017). Abbott et al. (2014b) also noted that while general participation has reduced over time since the 1990s, the relative differences between ethnic groups remained relatively constant.

Casino gaming

When questioned on participation of casino EGMs, participation rates have been found to vary from survey to survey. Compared to the European/Other ethnic group, the majority of surveys have found that those identifying with Māori ethnicity have similar rates of gambling on casino EGMs (Abbott et al., 2014b; Gray, 2011; Mason, 2006, 2009; Rossen, 2015; Thimasarn-Anwar et al., 2017; Tu, 2013; Tu & Puthipiroj, 2017). However, rates for the Pacific and Asian ethnic groups vary. The 2012 HLS and the NGS found that those identifying with Asian ethnicity were significantly more likely to partake in gambling on casino EGMs and table games (Abbott et al., 2014b; Tu, 2013), while the 2014 HLS found that those identifying with Pacific Island ethnicity were more likely than any other ethnic group to partake in gambling on casino EGMs (Tu & Puthipiroj, 2017). The 2016 HLS showed similar participation rates in gambling on casino EGMs for all four broad ethnic groups, but that those of Asian ethnicity were more likely to have played a casino table game than those of other ethnicities (Thimasarn-Anwar et al., 2017).

Gambling on non-casino EGMs

Compared with the European/Other group, most studies have found that Māori were found to be significantly more likely, and Asians were found to be significantly less likely, to have gambled on a non-casino EGM (Abbott et al., 2014b; Gray, 2011; Mason, 2006, 2009; Rossen, 2015; Thimasarn-Anwar et al., 2017; Tu, 2013; Tu & Puthipiroj, 2017). Surveys have shown that those identifying with Pacific ethnic groups to have similar participation rates to the European/Other group (Abbott et al., 2014b; Gray, 2011; Thimasarn-Anwar et al., 2017; Tu, 2013; Tu & Puthipiroj, 2017).

Other forms of gambling

The results of the 1990 and 1995 PPAG surveys did not break down participation rates for Asian and Pacific ethnic groups separately, but showed that Māori had similar rates of participation in Lotto when compared to that of the general population (Christoffel, 1992; Reid & Searle, 1996). However, the 2000 and 2005

PPAG surveys showed that rates for Māori were higher when compared to the general population, while those for Pacific ethnicities were lower (Amey, 2001; Department of Internal Affairs, 2007). Rates for the Asian ethnic group were not significantly different when compared to those for the general population in 2000, but were the lowest of all broad ethnic groups in the 2005 survey (Amey, 2001; Department of Internal Affairs, 2007).

In terms of differences in participation in Instant Kiwi or scratch cards, participation rates for Māori were slightly higher than that of the general population, while those for Pacific and Asian ethnic groups were significantly lower (Amey, 1985, 2001; Christoffel, 1992; Department of Internal Affairs, 2007; Reid & Searle, 1996).

When considering participation in Keno during the past year, many studies have shown that those of Pacific and Asian ethnicities have higher rates of participation compared to the general population, although these rates were relatively low compared to other forms of gambling (Amey, 1985, 2001; Christoffel, 1992; Department of Internal Affairs, 2007; Reid & Searle, 1996).

Pacific Island and Asian ethnic groups were found to be less likely to have participated in track betting when compared to the European/Other ethnic group, with Māori having relatively similar rates (Abbott et al., 2014b; Gray, 2011; Mason, 2006, 2009; Rossen, 2015; Thimasarn-Anwar et al., 2017; Tu, 2013; Tu & Puthipiroj, 2017).

Problem gambling

The majority of studies have found ethnicity to be a strong predictor of problem gambling, with certain ethnic groups found to be at a higher risk of problem gambling than others.

Both NZGS surveys found that the Māori, Pacific and Asian ethnic groups had higher rates of problem gambling than the European ethnic group (Abbott & Volberg, 1991, 2000). In terms of pathological gambling however, the surveys found that rates were highest for the Māori and Pacific ethnic groups but lower for the European ethnic group and lowest for the Asian ethnic group.

All three NZHS surveys found that participants identifying with Māori and Pacific ethnicity to have significantly higher rates of combined moderate-risk gambling or problem gambling than the other two major ethnic groups. In particular, the 2011/12

survey found that Māori and Pacific peoples had three times the odds of being either a moderate-risk gambler or problem gambler compared to those identifying with European ethnicity (Mason, 2006, 2009; Rossen, 2015).

All four NGS surveys found that those of Pacific ethnicity, closely followed by those of Māori ethnicity, with the highest rates of combined problem gambling or moderate-risk gambling. In contrast, rates for those of Asian and European ethnicities were substantially lower (Abbott, Bellringer, & Garrett, 2015; Abbott et al., 2014b; Abbott, Bellringer, Garrett, et al., 2015; Abbott et al., 2016).

The 2016 HLS found that people of Māori ethnicity, followed by those of Asian ethnicity and then by those of Pacific ethnicity were found to have the highest combined rate of moderate-risk and problem gambling, with those of the European/Other group having the lowest rate (Thimasarn-Anwar et al., 2017).

It is worth noting that people of Māori and Pacific Island ethnicity have higher proportions of their populations living in the most-deprived meshblocks and CAUs than do people of other ethnic groups, with 56% of Māori and 72% of those of Pacific Island ethnicity living in the three most-deprived deciles, compared to just 30% of the general population (Atkinson, Salmond, & Crampton, 2014; Wheeler, Rigby, & Huriwai, 2006). As neighbourhood deprivation is an important factor in predicting problem gambling (refer to the section below), caution should be taken when interpreting these results.

Deprivation

Although the results of all three NZHS surveys as well as the first phase of the NGS showed that neighbourhood deprivation was not statistically significant when past-year gambling status was involved, those living in the most-deprived quintile were found to be significantly more likely to have played on non-casino EGMs, be at risk of problem gambling and being at risk of harm due to someone's else's gambling during the past-year when compared to those living in the least-deprived quintile (Abbott, Bellringer, Garrett, et al., 2015; Mason, 2006, 2009; Rossen, 2015). The NGS found that compared to participants living meshblocks in the least-deprived quintile, participants living in the most-deprived quintile were more than three times more likely to be either a moderate-risk gambler or problem gambler (Abbott et al., 2014a), while the 2016 HLS found that compared to people living in the least deprived three deciles,

those living in the three most-deprived deciles were seven times more likely to be moderate-risk gamblers or problem gamblers (Thimasarn-Anwar et al., 2017).

Additionally, the NGS measured individual deprivation of participants using the New Zealand Deprivation Index. The study found that the majority (95%) of problem gamblers experienced at least one item of deprivation as listed in the New Zealand Individual Deprivation Index, compared to 72% of moderate-risk gamblers, 61% of low-risk gamblers and 44% of all respondents (Abbott et al., 2014a).

Geography

Till date, only a limited number of studies have examined the geographical impact of individuals' place of residence with respect to their gambling habits. All three New Zealand Health Surveys as well as the first phase of the NGS examined looked at the urban-rural nature of gamblers' localities i.e. whether an individual lived in an urban or rural locality and whether this had an impact on their gambling habits and in particular, the 2006/07 NZHS further divided urban areas into main urban areas, secondary urban areas and minor urban areas (Abbott, Bellringer, Garrett, et al., 2015; Mason, 2006, 2009; Rossen, 2015).

The 2006/07 NZHS found that secondary urban dwellers and rural dwellers were both more significantly more likely to have gambled in the past year than other geographical areas and that secondary and minor urban dwellers were significantly more likely to have gambled on non-casino EGMs and bought Instant Kiwi scratch cards during the past year (Mason, 2009).

2011/12 NZHS found that adults living in rural areas were also significantly less likely than those living in urban areas to have gambled on casino EGMs, non-casino EGMs and on sports betting, while urban dwellers more likely to have gambled on four or more activities during the past year (Rossen, 2015).

Although most surveys found no significant differences in problem gambling rates between the various geographical categories, the 2011/12 NZHS found that people living in urban areas were more likely to be problem gamblers than were people who lived in rural areas (Rossen, 2015).

Studies investigating that rates of gambling of both incarcerated males and females found that rates were substantially lower for both groups than that of the

general population. As opportunities for gambling in prisons are severely restricted, the results of the study showed that availability of gambling opportunities plays a huge role in determining gambling behaviour (Abbott & McKenna, 2005; Abbott et al., 2005).

A study by the Ministry of Health (2006) found that the vast majority of face-to-face problem gambling counselling service centres were located in major and secondary urban areas, with a much smaller availability of such services in minor and rural areas, although breakdowns of problem gambling service users with respect to the geographical area were not available. However, studies measuring accessibility to venues for other health-related conditions such as alcohol addiction treatment centres (Booth, Kirchner, Fortney, Ross, & Rost, 2000), general practitioners (Brabyn & Barnett, 2004) and mental health services (Todd, Douglas Sellman, & Robertson, 2002) found that those living in rural areas had more difficulties than their urban counterparts with accessing such services.

2.1.4 Association between problem gambling and certain gambling activities

Strong evidence of an association between gambling activities that are continuous in nature and the prevalence of problem gambling have been found in both surveys and by agencies providing problem gambling counselling alike.

In New Zealand, evidence shows that since the legalisation of EGMs in non-casino and casino locations, the majority of problem gambling intervention services have reported that gamblers whose main form of gambling was on such machines have collectively made up a majority of those seeking intervention (Department of Internal Affairs, 2000; Paton-Simpson et al., 2001, 2003). In 1999, 63% of new problem gambling helpline callers seeking help from problem gambling cited gaming on non-casino EGMs as the gambling activity associated with their problem gambling, while those seeking citing tracking betting and gambling on casino EGMs made up 15% and 14% of new callers respectively (Department of Internal Affairs, 2000). Four percent of new callers cited gambling on casino table games as the activity associated with their problem gambling. Clarke, Pulford, Bellringer, Abbott, and Hodgins (2012) compared the relative effects of casino EGMs and non-casino EGMs on problem gambling by interviewing a non-representative sample of 138 problem gamblers, finding that gambling on non-casino EGMs was a stronger predictor of current problem gambling than EGMs in casinos, after controlling for demographic variables.

Data obtained from the Ministry of Health (2018) showed that although the proportions of new clients citing EGMs as their main cause of problem gambling has fallen since 1999, these two forms still collectively made up a majority of new cases. In the 2016-2017 financial year, 52% of new clients cited gambling on non-casino EGMs as their main cause of problem gambling, while 10% cited gambling on EGMs in casinos as their main cause (Ministry of Health, 2018).

Data from the HLS and the NGS shows similar results. Higher percentages of gamblers who primarily gamble on EGMs fit the criteria of being either low-risk gamblers, moderate-risk gamblers or problem gamblers, than do gamblers whose main mode of gambling were other forms (Abbott et al., 2014b; Gray, 2011; National Research Bureau, 2007; Thimasarn-Anwar et al., 2017; Tu, 2013; Tu & Puthipiroj, 2017). The 2016 HLS found that only 49% of gamblers who participate at least monthly on non-casino EGM venues were non-problem gamblers i.e. they were neither low-risk gamblers, moderate-risk gamblers or problem gamblers. In contrast, 74% of those partaking at least monthly in track or sports betting, 90% of those partaking at least monthly in purchasing Lotto products and 89% partaking at least monthly in any type of gambling were non-problem gamblers (Thimasarn-Anwar et al., 2017). Similarly, the NGS found that 27.1% of past-year gamblers on non-casino EGMs and 25.4% of past-year gamblers of casino EGMs were either moderate-risk gamblers or problem gamblers compared to 5% of gambler on any activity (Abbott, Bellringer, Garrett, et al., 2015).

Of those reported to be negatively affected by friends' or family members' gambling more than they intended to, gambling on non-casino EGMs was found by far to be the mode of gambling most often cited, with 53% of such respondents doing so. The next most common modes cited were track betting (15%) and gambling on casino EGMs (12%). In comparison, only 3.6% cited friends or family members gambling more than they intended to on Lotto products (Thimasarn-Anwar et al., 2017). Similarly, of those reported to have experienced gambling harm in their household due to a household member's gambling habits, 48% cited non-casino EGM gambling as their gambling household member's main mode of gambling, while 12% cited casino EGM gambling and 12% cited track betting. Only 5.1% cited Lotto products as their gambling household member's main mode of gambling (Thimasarn-Anwar et al., 2017).

2.1.5 Reasons for gambling

Most surveys have found that the main motivations for gambling include winning prizes or money, for entertainment or fun, to support worthy causes or charities, socialising, for excitement and gambling out of habit. Huge variations are found in participants' reasons for gambling when different gambling activities are taken into account. The PPAG surveys, New Zealand Gaming Surveys as well as phase one of the 2012 NGS questioned participants on their reasons for taking part in gambling activities.

When questioned on their main motivation for gambling on any activity, the main reasons for gambling in the 1999 NZGS were to win money (57%), which was also the main reason (53%) given in the 1991 survey (Abbott & Volberg, 1991, 2000). This was followed by gambling for entertainment or fun (30% in 1991 vs. 37% in 1999), to support worthy causes (19% in 1991 vs. 28% in 1999), for socialising (15% in both 1991 and 1999) and for excitement or challenge (15% in 1991 vs. 13% in 1999). Both surveys also found that gamblers on non-continuous forms were more likely to gamble to win prizes or money, while gamblers on continuous forms of gambling were more likely to state gambling for entertainment or for excitement.

The PPAG surveys found large differences in motivations for gambling when different gambling activities were considered. The 2005 PPAG found that high proportions of participants partaking in Lotto (86%), Keno (84%) cited winning prizes or money for their reason for gambling compared to other forms of gambling such as track betting (58%), gambling on casino EGMs (57%) and on non-casino EGMs (57%) (Department of Internal Affairs, 2007). High proportions of participants stated their reason for gambling as entertainment or for excitement or challenge for housie (60% for entertainment, 42% for excitement/challenge), tracking betting (50% for entertainment, 42% for excitement/challenge) and sports betting (44% for entertainment, 69% for excitement/challenge), although winning prizes or money was still the most common reason for gambling (68% for house, 58% for track betting at 70% for sports betting).

More people stated that their main motivation was gambling for entertainment than winning prizes or money of those who gambled on casinos (69% for entertainment, 57% for winning money/prizes) and non-casino EGMs (60% for entertainment, 57% for winning money/prizes). Gambling on games of housie (52%), casinos (25%) and non-casino EGMs (16%) were the activities with the highest proportion of people gambling

to get out of the house or be with friends, while participants of housie (24%) had by far the highest proportion who mentioned gambling in order to support worthy causes. Similar results were found in the earlier four PPAG surveys (Amey, 1985, 2001; Christoffel, 1992; Reid & Searle, 1996).

The results of the 2012 NGS showed similar relative differences in reasons for gambling for different activities and showed that the proportion people gambling to win money or prizes has increased for most activities. Comparatively high proportions of participants of Lotto (91%), Keno (89%) and Instant Kiwi (77%) gave gambling for money as a reason for gambling, with the lowest proportions were found for Housie (65%), casino EGMs (66%), track betting (66%) and non-casino EGMs (67%) (Abbott et al., 2014b). Higher proportions of people mentioned gambling for winning prizes or money rather than gambling for excitement in the case of gambling on casino (66% for winning prizes/money, 43% for excitement/challenge) and non-casino EGMs (67% for winning prizes/money, 41% for excitement/challenge) in contrast to the PPAG surveys.

Compared to the general population, both male and female prisoners stated similar reasons for gambling; to win money, for entertainment or for fun, for excitement or challenge (Abbott & McKenna, 2005; Abbott et al., 2005). However, relative to men and women in the general population, supporting worthy causes for was less likely to be given as a reason for gambling by both male and female prisoners, while gambling for entertainment or fun was more likely to be given as a reason.

Of non-gamblers, when questioned on reasons for not taking part in gambling activities during the past year, the PPAG surveys found that lack of interest, perceiving gambling as a waste of time or money, moral or religious reasons and perceiving changes of winning as not good were consistently given as the most common reasons for not gambling in any activity overall in descending order (Amey, 1985, 2001; Christoffel, 1992; Department of Internal Affairs, 2007; Reid & Searle, 1996). Lack of interest was the most common reason cited for all gambling activities, ranging from 62% to 77% in 2005, while perceiving the activity was a waste of time or money was the second most common reason cited for all activities, ranging from 30% to 44% in 2005 (Department of Internal Affairs, 2007). The 2012 NGS survey found that by 2012, not gambling due to moral or religious reasons had overtaken lack of interest as the main reason given for not gambling (Abbott et al., 2014c). These were followed by

perceiving gambling as a waste of time or money and perceiving chances of winning as not good.

A number of studies have investigated the differences in reasons for gambling between various ethnic groups in New Zealand, finding that while many gamblers were motivated by common causes, some groups were more likely to gamble as a result of certain economic, personal, environmental, recruitment and social reasons. Participants of all ethnic groups were found to state that the main reason for gambling on most activities was to win money or for perceived excitement or thrill brought about by their participation in that activity (Abbott et al., 2014b; Tse et al., 2012). Gambling in order to win money in order to support families and to ease financial problems was commonly cited by participants of Pacific ethnicities (Bellringer, Kolandai-Matchett, Taylor, & Abbott, 2017), while gambling in order to ease boredom was often cited by those of European and Pacific ethnicities (Tse et al., 2012). Partaking in gambling activities in order to cope with stress caused by being unemployed or underemployed was reported by many of Pacific and Asian ethnicities (Gerritsen, 2016; Tse et al., 2012), while gambling to cope with stress due to familial or relationship problems was reported by many Māori (Tse et al., 2012).

Many participants stated that being brought up in an environment of excessive gambling or severe lack of gambling played a big role in their gambling behaviour. Participants of Māori or Pacific ethnicity commonly stated that the presence of gambling activities, especially at extended family gatherings had resulted in them being acclimatised to gambling activities (Bellringer et al., 2017; Tse et al., 2012), while many participants who were immigrants of Asian ethnicity stated that the illegality of gambling in their countries of origin, coupled with the perceived elegant and opulent atmosphere of casinos, enticed and encouraged them to visit casinos once in New Zealand (Sobrun-Maharaj, Rossen, & Wong, 2013; Tse et al., 2012; Wong & Tse, 2003). Those of Asian descent were also more likely to report being targeted by advertising by casinos as an attractive place to visit (Tse et al., 2012).

2.1.6 Attitudes toward gambling

Attitudes have been found to vary towards gambling and towards various types of gambling, the availability of gambling and the impact of gambling activities on

society. All five PPAG surveys, the 2010 and 2014 HLSs and the 2012 NGS questioned participants regarding their attitudes towards gambling.

The majority of New Zealanders have been found consistently to believe that some forms of gambling are more harmful than others (Health Sponsorship Council, 2012; Holland et al., 2017). When asked which gambling activities in particular were more harmful than others, gambling on non-casino EGMs were consistently mentioned as the most harmful activity in all surveys, followed by gambling on Lotto products, casino EGMs, internet games, and track betting (Health Sponsorship Council, 2012; Holland et al., 2017).

Similarly, a majority individuals have been found to believe that some forms of gambling are more socially undesirable than others (Health Sponsorship Council, 2012; Holland et al., 2017), with gambling on non-casino EGMs cited as the most socially undesirable form of gambling. This was followed by gambling on casino EGMs, internet games and mobile games, with the PPAG surveys witnessing views of undesirability most activities increasing over time from 1985 to 2005 (Amey, 1985, 2001; Christoffel, 1992; Department of Internal Affairs, 2007; Health Sponsorship Council, 2012; Holland et al., 2017; Reid & Searle, 1996). When asked specifically whether EGMs make a pub or bar more enjoyable to spend time at, more than half of respondents either stated that they disagree or strongly disagree with the idea (Holland et al., 2017).

When questioned on whether fundraising from gambling does more good than harm, equal harm than good or more harm than good, the proportion of respondents who believed that fundraising from gambling does more harm than good was still the most common belief held by respondents (43%), while only a small proportion (23%) thought that it did more good than harm (Holland et al., 2017).

Although only a small minority of gamblers from the 2014 HLS have stated that they gambled more than they intended to (2.8%), the majority of participants who admitted to gambling more than they intended to stated gambling at non-casino EGMs (58%) as an activity in which they gambled more time or money than planned, followed by track betting (21%), sports betting (14%) and casino EGMs (12%) (Holland et al., 2017).

A total of 5.5% of all respondents in the 2014 HLS reported experienced household harm due to gambling. When questioned on which form of gambling was

associated with harm, half (50%) of respondents cited non-casino EGMs as the activity associated with household harm, followed by track racing (12%), table games at casinos (128%) and EGMs in casinos (8%) (Holland et al., 2017).

When questioned on their opinion on running gambling activities for various reasons, the majority of the public was found to be in favour of running gambling for a worthy cause (84% in 2005) and for sharing profit between a promoter and worthy cause (55% in 2005). Forty-five percent believed that gambling activities should be run for sales promotions, while only 22% and 18% believed that activities should for business enterprise and as a means of raising government revenue respectively in 2005. Between 1985 and 2005, the proportion of respondents who supported gambling for each option decreased over time (Amey, 1985, 2001; Christoffel, 1992; Department of Internal Affairs, 2007; Reid & Searle, 1996).

The 2005 PPAG asked participants on their opinion on the number of places available to gamble in their local area. Most respondents either mentioned that there is about the right number of places (46%) or too many places (41%) (Department of Internal Affairs, 2007). In contrast, only a small minority (13%) of respondents thought that there were not enough places. When participants who thought that there were too many venues were asked specifically on which types of venues there are too many of, an overwhelming proportion mentioned non-casino EGMs, followed by TAB venues (20%), Lotto terminals (14%) and casinos (14%) (Department of Internal Affairs, 2007).

When questioned on whether there is a problem with gambling in society, most respondents either agreed (48%) or strongly agreed (39%) that there is a growing problem of people's heavy gambling (Abbott et al., 2014c).

When questioned on who should have a big role in preventing gamblers from excessive gambling, an overwhelming proportion of individuals (94%) agreed that gamblers themselves should have either a big role or very big role, while a similar proportion (95%) agreed that families of gamblers should be responsible. In contrast, smaller proportions agreed that gambling operators (67%), the Government (67%) and the whole community (46%) should have a big role (Health Sponsorship Council, 2012).

2.1.7 Association between gambling and health

The health and social consequences of problem gambling have been well-understood, with common forms of comorbidity with problem gambling being established such as alcoholism and substance dependency (Abbott, 2001b; Dickerson, 1989; Jazaeri & Habil, 2012) as well as the inability to pay daily expenses (Bellringer et al., 2009), poor mental health (Lin et al., 2008) and suicidality (Productivity Commission, 2001). Pathological gamblers are also known to be at an increased risk of developing certain stress-related conditions (Fong, 2005).

The results of the all NZHS surveys as well as the first phase of the NGS found several addictive behaviours that were significantly associated with problem gamblers, in addition to having worse self-rated health (Abbott et al., 2014a; Mason, 2006, 2009; Rossen, 2015). Moderate-risk or problem gamblers were more likely to have potentially hazardous drinking behaviour when compared to non-problem gamblers (51% vs 15% respectively in the 2011/12 NZHS), were more likely to be cigarette smokers when compared with non-problem gamblers (57% vs 18% respectively in the 2011/12 NZHS) and were more likely to have taken recreational drugs in the past year when compared to non-problem gamblers (31% vs 9.4% in the 2011/12 NZHS) (Rossen, 2015). When controlling for sociodemographic variables, problem gamblers were also found to be likely to increase the amount of tobacco consumed while gambling when compared to non-problem gamblers (61.2% vs 32.4% respectively in the 2006/07 NZHS) as well as being more likely to increase the amount of alcohol consumed while gambling when compared to non-problem gamblers (13.2% vs 6.3% respectively in the 2006/07 NZHS) (Mason, 2009). Additionally, when compared to non-problem gamblers, problem gamblers were more likely to describe being feeling nervous, depressed, worn out and in poorer general health (Abbott et al., 2014a; Mason, 2009; Rossen, 2015).

2.2 Preferences of gamblers on venue choices

A small number of studies have analysed gambler's preferences in terms of the physical characteristics of gaming venues, with proximity to gambling venues being cited as the most-preferred characteristic in the overwhelming majority of cases.

Vasiliadis, Jackson, Christensen, and Francis (2013) reviewed 39 articles from a wide range of countries on the empirical influence of EGM venues on gambling behaviour, finding that while both proximity and density to gaming venues are related

to increased gambling participation, proximity is more strongly correlated with problem gambling than is density. Marshall (2005), who sought to connect the reasons behind increased accessibility to gaming facilities and increased gambling consumption, suggested that temporal accessibility to venues being equally important as spatial accessibility, arguing that venues that are open for longer hours and more days of the week offer better accessibility than those that are open for shorter periods of time.

It is important to note, however that although spatial and temporal accessibility remains a key factor in the selection of venues for gambling, numerous other factors play a major role in site selection. For example Abbott (2006) found that gamblers on EGMs greatly value privacy and adequate number of machines when selecting a venue, making the observation that even in countries with relatively high numbers and accessibility of venues with EGMs, gambling prevalence on these machines remained comparatively low due to the presence of only one or few machines per venue and the placement of these machines in direct view of people not involved in gambling, suggesting that a limited availability of machines per venue restricts gamblers' choice of games.

J. Thomas et al. (2012) investigated the influence of environmental characteristics of gambling venues and how these had an impact on eight problem gamblers from the Auckland Region. Accessibility to venues was rated the most important feature, not only in terms of closeness to gamblers' residences but in terms of entering and exiting venues in terms without being detected and recognised by acquaintances. Most participants who gambled on non-casino EGMs stated that they also regularly gambled at casinos, with many preferring to gamble at Class 4 venues due to their casino-like environments but with the added advantage of being less likely to be frequented by acquaintances so as to maintain their anonymity. The choice of games available and timings of the venue were also found to be important, with many participants stating they would travel longer distances to gamble on machines which gave access to popular games and new games as well as those which were open for 24 hours. Participants mentioned that interaction with staff was important to them, with instances of staff approaching participants about their gambling habits resulting in gamblers tending to avoid that particular venue temporarily.

Both Sobrun-Maharaj et al. (2013) and Tse et al. (2012) investigated the gambling habits of Asian communities in New Zealand, finding that many individuals,

especially those having an immigrant background, prefer to frequent casinos rather than other types of gambling venues due to the perception of casinos as a safe environment, as a place to socialise with others sharing a similar culture or language and as a means to escape from the hardships of daily life. Additionally, it was found that because gambling activities were the primary focus of visiting a casino, participants, especially women, preferred such venues due to being less likely to be approached uninvitedly by others compared to non-casino EGM venues, most of which are also alcohol-licensed premises (Sobrun-Maharaj et al., 2013).

A study by A. Thomas et al. (2011) interviewed 28 gamblers and measured both proximity and non-proximity related factors which may have an effect on participants' gambling activities. The study grouped factors into two major groups; 'social accessibility', the level to which gambling activities were enjoyed due to being social places where entertainment and a pleasant atmosphere were provided, and 'accessible retreat', the level to which venues were enjoyed due to being temporarily and geographically available due to the provision of anonymity and few interruptions or distractions. It was found that while increased geo-temporal measures of accessibility such as venues that were open for longer hours and close to residential, work and other routes were preferred by most gamblers, they were more strongly preferred by problem gamblers.

Moreover, Moore, Thomas, Kyrios, Bates, and Meredyth (2011) investigated both proximity and non-proximity related factors discussed by A. Thomas et al. (2011) which were likely to affect gambling frequency of 303 participants, measuring the extent to the two major dimensions of accessibility, i.e. social accessibility factors and accessible retreat factors, were correlated with the desire to gamble and problem gambling. For both dimensions, factors relating to proximity were ranked lowest in direct contrast to findings by J. Thomas et al. (2012), with non-proximity-related factors being more preferred. In the case of social accessibility, the availability of gaming machines that were not in use by other patrons, factors related to social connectedness and the presence of a lively atmosphere were found to be most important, while proximity to one's residence was found to be the least important item in terms of gamblers' preferences. In terms of accessible retreat, lack of interruption, minimal distractions and anonymity were found to be most important while proximity to one's residence was again found to be the least important of gamblers' preferences. Increasing social accessibility was weakly but positively associated with gambling more often and

spending more money, while increasing accessible retreat was correlated with stronger urge to gamble and problem gambling.

Auer, Malischnig, and Griffiths (2014), who analysed the effect of pop-up messages on EGMs after a thousand consecutive plays, found that players who saw pop-up messages while playing on EGMs were nine times more likely to cease their gambling session than those who did not, therefore affirming the preference of uninterrupted sessions by EGM gamblers. However, findings by Palmer du Preez, Landon, Bellringer, Garrett, and Abbott (2016) found that participants often adapt to such messages, where only about half of participants who encountered such messages reported having read the contents of these pop-up messages.

2.3 Geographic distribution of electronic gaming machine venues

2.3.1 Distribution of venues in New Zealand

In a New Zealand context, only a limited number of studies have so far analysed the geographic distribution of gambling venues. Studies by Rankine and Haigh (2003), Allen & Clarke (2015), the Ministry of Health (2006) and Wheeler et al. (2006) were some of the most well-known, which investigated the distribution of casinos, non-casino venues with EGMs, venues with Lotto terminals and TAB venues in the country.

Casino venues

As the number of casinos in New Zealand has been relatively small compared to those of non-casino EGM venues, TAB venues and Lotto terminals, a limited number of analyses have been carried out on the distribution of casino venues in New Zealand. A study by the Ministry of Health (2006) analysed the distribution of gaming venues on a national scale, investigating the geographic distribution of gambling venues including casinos, non-casino gaming venues and TAB venues and problem gambling counselling services in New Zealand. The study took an empirical approach, measuring the number of casino EGMs per 10,000 people in the territorial authority that each of the six casinos were located in, finding that the density of casino EGMs was especially high in the Queenstown-Lakes District (67.2) compared to that in the next two authorities with casinos, namely Auckland (38.7) and Hamilton (25.8). In contrast, the Christchurch

City (14.4) and Dunedin City (14.7) were found to have the lowest casino EGM densities.

Allen & Clarke (2015), in their report to the Ministry of Health, similarly analysed the number of casino EGMs per 10,000 people, normalising rates by taking into account the population of the entire urban area of cities that hosted casinos rather than just the territorial authority that these casinos were located in. The study found similar results, with Queenstown again having the highest casino EGM density (51.8) compared to Hamilton (22.1), Dunedin (14.4), Christchurch (13.8) and Auckland (10.8), although the authors acknowledged that Queenstown's reputation as a destination for tourism meant that a large proportion of casino patrons would be external visitors rather than local or regional residents.

Non-casino EGM venues

Rankine and Haigh (2003) analysed the distribution of non-casino EGM venues on behalf of the Manukau City Council, empirically examining the distribution and density of non-casino EGM venue sites in the seven wards of the former Manukau City before its subsequent incorporation into the Auckland Unitary Authority. In terms of machine density, the study found that the two most-deprived wards, namely the Manurewa and Otara Wards, had the highest density of machines while the least-deprived Clevedon Ward had the lowest density. In terms of the distribution of non-casino EGM, the study revealed that the three most-deprived wards of Manurewa, Otara and Papatoetoe collectively housed 63% of the city's 1245 non-casino EGMs and 59% of the city's 90 non-casino EGM venues, despite being home to only 49% of the total residential population of the former territorial authority, with the Manurewa Ward alone home to 33% of all machines and 32% of its sites, despite housing 23% of the city's population.

Moreover, the Rankine and Haigh (2003) also pointed out that between the years 2001 and 2003, the Otara and Papatoetoe Wards saw a comparatively large increase in the number of non-casino EGMs within their boundaries compared to the other wards, with there being a large increase in both the number of non-casino EGMs and venues with EGMs in the Manurewa Ward. Although there were found to be variations between wards, the study only measured the concentration of venues and EGMs on an empirical basis, not taking into account the possible variations in socioeconomic

deprivation within wards and the distribution of sites and machine numbers were only analysed on a ward-level, failing to take into account variations on a neighbourhood-level.

The study by the Ministry of Health (2006), which also analysed the distribution and density of non-casino EGM venues, TAB outlets and Lotto terminals on a national scale, found that both non-casino gaming venues and TAB outlets were likely to be located in more socioeconomically deprived areas, with approximately 53% of non-casino gaming machines being located in deciles 8 to 10, despite being home to only 30% of the population. It was found that over five times as many non-casino EGMs were located in the two most-deprived deciles than were located in the two least-deprived deciles. Allen & Clarke (2015) found comparable results, finding that 54% of venues with non-casino EGMs were located in CAUs having deprivation deciles scores of 8 or higher, and that 56% of all non-casino EGM expenditure was spent on venues with decile scores of 8 or higher.

Additionally, the study looked at densities of EGMs in each main urban area (areas with populations greater than 30,000 residents), secondary urban area (areas with populations greater than 10,000 but less than 30,000 residents) and minor urban area (areas with populations between than 3000 and 10,000 residents). Density was estimated by calculating the number of non-casino EGMs per 10,000 people (as at 30 June 2005) and it was found that the density of EGMs per 10,000 people was highest in Greymouth (136.0), Te Awamutu (92.1) and Whakatane (91.4) with the lowest densities being recorded in the Western Auckland (27.5), Northern Auckland (35.0) and Southern Auckland (35.2) zones, suggesting that secondary and minor urban areas were likely to have greater concentrations of EGMs than main urban areas.

Wheeler et al. (2006) investigated small-scale gambling opportunity by looking at the distribution of non-casino EGM venues using geographically-weighted regression (GWR) to analyse the possibility of the existence of inequity in non-casino EGM provision across the country. The study geocoded all venues with non-casino EGMs and measured the number of CAUs within various straight-line distances ranging from of 250 metres to five kilometres. The study found that over half (52%) of all CAUs contained at least one venue, 68% of all CAUs were within 250 metres of a venue and 96% of CAUs were within five kilometres of a venue. Additionally, after logistic regression testing was carried out in order to measure the odds of a CAU being within

250 metres of a venue, the study found that CAUs having a deprivation decile rating of 8 were 5.6 times more likely, CAUs with a decile of 9 were 7.2 times more likely and CAUs with a decile of 10 were 6.2 more likely being within 250 metres of a non-casino EGM venue compared to CAUs with a deprivation decile rating of 1 (Wheeler et al., 2006).

Other type of gambling venues

Allen & Clarke (2015) and the Ministry of Health (2006) made an important observation that other types of gambling venues were also more likely to be distribution in more disadvantaged areas. Allen & Clarke (2015) found that there was excess provision of venues with Lotto facilities in areas of higher socioeconomic deprivation, with higher numbers of venues with Lotto terminals in CAUs with higher socioeconomic deprivation. It was found that 44% of such facilities were found in CAUs with deprivation decile scores of 8 or higher and that there were at least three times as many venues in CAUs in the two most deprived deciles than they were in CAUs with the two least-deprived deciles.

The Ministry of Health (2006) found that the distribution of TAB outlets mirrored the situation with the distribution of non-casino EGM venues and venues with Lotto facilities, with increasing numbers of venues with TAB facilities found in CAUs with increasing socioeconomic deprivation scores, finding that almost half of all TAB outlets were located in CAUs with the three most socioeconomically-deprived deciles. Allen & Clarke (2015) found similar results, reporting that 45% of all venues with TAB facilities were found in CAUs with deprivation deciles of 8 to 10 and that there were at least five as many venues located in CAUs with deprivation deciles of 9 and 10 than those with deciles of 1 and 2.

In order to compare distribution of other retail venues to that of gambling venues, Allen & Clarke (2015) also analysed the distribution of pharmacies in the Auckland, Waikato and Bay of Plenty District Health Board areas in a similar manner to that conducted for gambling venues already mentioned. It was found that pharmacy venues were similarly distributed to gambling premises in that there was excess provision of pharmacies in more deprived CAUs, with 54% of pharmacies being located in CAUs with the three highest deprivation decile scores. The authors therefore advised caution when examining the distribution of venues with respect to socioeconomic

deprivation, as it was observed that CAUs in which central business districts and retail districts were located in were more likely to be more socioeconomically deprived compared to other areas, and that the colocation of buildings which contain gambling venues with venues providing other services may be more a result of greater availability of spaces, lower costs associated with locating premises in such areas and greater accessibility of such areas than socioeconomic deprivation.

A study by Pearce, Blakely, Witten, and Bartie (2007) and Sushil, Vandevijvere, Exeter, and Swinburn (2017) which looked at provisions of different types of food outlets in areas of varying socioeconomic deprivation across New Zealand, found that although unhealthy food outlets such as fast food restaurants were more likely to be concentrated in areas of higher socioeconomic deprivation, such areas also had higher concentrations of healthy sources of food such as supermarket and smaller grocery stores. They therefore concluded that governmental planning regulations, lower land use costs and rental costs in such areas act as an incentive for most types of venues in general to locate their businesses in such areas, complementing results by Allen & Clarke (2015).

2.3.2 Distribution of venues internationally

The majority of international research on the distribution of gambling venues has been concentrated on the distribution of non-casino venues with EGMs, with studies conducted in Australia (Marshall, 1999; Marshall & Baker, 2001, 2002; McMillen & Doran, 2006; Young, Lamb, & Doran, 2009), the United Kingdom (Macdonald, Olsen, Shortt, & Ellaway, 2018; Wardle, Keily, Astbury, & Reith, 2014), Canada (Gilliland & Ross, 2005; Robitaille & Herjean, 2008) and the United States (Miller, 2013; National Gambling Impact Study Commission, 1999) finding that a range of different factors, including social deprivation, connectivity to transport routes, supply and demand for such venues and legal restrictions were the most important determinants of the geographical distribution of such venues.

In Australia, there is strong evidence that non-casino EGM venue locations are located in areas of economic disadvantage, especially in metropolitan cities in Victoria (Marshall & Baker, 2001), New South Wales (Marshall & Baker, 2002) and South Australia (Marshall, 1999). Marshall and Baker (2001) observed the distribution of EGM venues in three local government areas (LGAs) in metropolitan Melbourne on

both a macro level and a local level, namely Boroondara, one of the most affluent LGAs in Melbourne, Kingston, an LGA of average socioeconomic deprivation and Maribyrnong, the most socioeconomically deprived LGA in the metropolitan area. On a macro level, the study found striking contrasts in the number of venues per capita, with the LGA of Boroondara having a much lower number of EGMs per capita (1.5 per 1000 people) than those of Kingston (7.7 per 1000 people) and Maribyrnong (13.5 per 1000 people). On a local level, the distribution of EGMs was found to be strongly related to affluence, where higher concentrations of EGM venues were found in more disadvantaged areas in all three localities. Similar results have been found when urban areas of Sydney (Marshall & Baker, 2002) and Adelaide (Marshall, 1999) were analysed, where socioeconomic deprivation was found to be a strong predictor of the concentration of venues with EGMs and expenditure on these machines.

McMillen and Doran (2006) took a different approach to measuring distribution, choosing to observe concentrations of EGM venues in three Victorian LGAs; Maribyrnong, Melbourne Central Business District (CBD) and Greater Geelong and correlate these concentrations with both social disadvantage and monetary spending on EGMs, arguing that the placement of venues is more an outcome of supply and demand rather social deprivation. The study, which used kernel density functions to express and analyse the geographical distribution of both EGM venues and expenditure on such venues, found that the largely suburban LGAs of Maribyrnong and Greater Geelong exhibited different patterns to that of Central Melbourne, which contained Melbourne's CBD area. Although all three LGAs were sites of elevated concentrations of EGM venues, there were found to be no direct correlation between increased intensity of EGM expenditure or social disadvantage or clusters of venues in both the Maribyrnong and Greater Geelong LGAs, and that even in Maribyrnong, hot spots of EGM venues were found in relatively affluent parts of the LGA. However, compared to the two largely suburban LGAs, Central Melbourne exhibited a strong correlation between clusters of multiple venues and EGM venue expenditure, even though residents of the city were not particularly disadvantaged when compared to the other two LGAs. The authors concluded that this effect was most likely the result of such venues being situated next to hubs of main transports routes, including train, tram and road facilities which were in close proximity to workplaces and retail outlets, and that because the CBD area is known to be a catchment area for residents from all parts of the entire

metropolitan area, it is unlikely that patrons of EGM venues in the CBD area were residents of the area.

A similar approach to was taken by Young et al. (2009), who examined spatial patterns of EGM distributions in smaller urban areas of Darwin, Palmerston and Alice Springs in Australia's Northern Territory using kernel density analysis to investigate the spatial distribution of venues and expenditure on EGMs. The study identified that three spatial patterns of EGM distribution and expenditure existed in such areas; namely those of suburban gambling complexes, city centre gambling agglomerations and opportunistic gambling nodes. Suburban gambling complexes consisted of small groups of venues in areas of community congregation in suburban areas, city centre gambling agglomerations consisted of venues in and around the CBD area while opportunistic gambling nodes were situated in areas that took advantage of their locations in specific markets, such as tourist areas and areas deemed as popular nightlife spots. The study found numerous suburban gambling complexes in the Palmerston area, arguing that such zones are commonplace away from areas where casinos are present, arguing that residents of smaller urban areas away from city centres may seek and use local EGM venues as alternatives to casinos due to limited recreational outlets locally. City-centre gambling agglomerations were argued to rely on their pulling power from adjacent areas rather than their sense of attraction. Lastly, opportunistic gambling nodes were commonly found in areas of passing trade that would attract business due to their placement on important routes.

Gilliland and Ross (2005) examined the distribution of video lottery terminals (VLTs), analogous to non-casino EGMs in New Zealand, in the adjacent Canadian municipalities of Montreal and Laval with respect to neighbourhood socio-economic conditions. The study obtained and geocoded addresses of VLT locations and overlaid them with boundaries of neighbourhoods represented by census tracts. A composite neighbourhood distress index, comprised of the rate of unemployment, the level of education and the percentage of households headed by single parents taken from the 1996 Canadian Census, was used to characterise neighbourhood deprivation. The study found that the prevalence, adoption and density of VLTs were strongly correlated with lower borough socioeconomic measures. In particular, VLT locations were practically absent in the most affluent neighbourhoods, particularly the West Island and downtown areas, while more distressed areas had more concentrated numbers of VLT locations.

Robitaille and Herjean (2008) continued on the work carried out by Gilliland and Ross (2005), looking at the impact of geographic accessibility of venues with video lottery terminal (VLT) permits in the Montreal urban area on gambling behaviour of populations. Accessibility to venues was measured by the time taken to travel from the centroid of each neighbourhood to each venue with a VLT permit using the street network. The study found increased geographic accessibility to venues with VLT permits in the city centre and pericentral areas, many of which were socioeconomically disadvantaged, as well as in areas along axial highways.

Similarly, studies by Wardle et al. (2014) and Macdonald et al. (2018) who analysed the distribution and density of gaming machines in Britain, found a significant correlation between machine density and socio-economic deprivation. Wardle et al. (2014) found that higher concentrations of machines exist in areas of greater levels of income deprivation, more economically inactive people and younger age profiles than in other areas. In addition to areas with the aforementioned demographic and socioeconomic characteristics, areas of high machine density were found to be disproportionately present in seaside locations and areas with relatively new development. Similarly, Macdonald et al. (2018) found concentration levels of gambling outlets as well as other 'environmental bads' such as alcohol, fast food and tobacco outlets, to increase linearly from the least to the most income deprived areas.

While a static approach was taken to analysing concentrations of machines in deprived areas, Wardle et al. (2014) argue that the dynamic movement of people must also be considered, where the presence of high machine density areas in seaside towns is explained by the relatively high transient population of these areas and is not necessarily a reflection of residents of those towns themselves. Additionally, as newer developments in the United Kingdom contained areas that are more likely to be focal centres for employment, recreation and entertainment, these areas also witness a higher transient population at certain periods of time and therefore placement of machines in these areas would serve to maximise patronage on these machines.

Legislation concerning the establishment of EGMs has also been found to play a major role in the resulting distribution of such venues. The United States is an anomaly among the majority of jurisdictions, where federal laws protecting Native American lands from state interference have resulted in disproportionately high concentrations of casinos on tribal lands (Schaap, 2010). Since 1986, when the *California v. Cabazon*

Band of Mission Indians case was decided (Powell Jr, 1986), the number of casinos on Native American reservations have increased dramatically such that by 2012, 38% of the 853,197 EGMs present in the United States were located in casinos situated on tribal lands (Miller, 2013). On the other hand, legislation preventing the establishment of non-casino EGMs in the Australian state of Western Australia has resulted in the state being the only jurisdiction in Australia till date to not have EGMs present, with the exception of those located in Perth's Crown Casino (Allan-Petale, 2017). Conversely, Canberra Casino in the Australian Capital Territory was for a long time the only casino in Australia where EGMs were absent due to legislative prohibition preventing EGMs in casino venues (but not in non-casino venues), although negotiations with the government had resulted in permission being granted to install 200 EGMs in 2016 in return for substantially redeveloping the casino site (Burgess, 2018).

Gambling on non-casino locations, referred to as 'convenience gambling' in the United States, has seen an increase in recent years since a number of US states have legalised standalone electronic gambling devices (EGDs), comparable to EGMs in New Zealand (United States General Accounting Office, 2000). In contrast to EGMs in New Zealand and Australia, the vast majority of EGDs in the United States are found in casino locations, with only nine percent of EGDs being located in non-casino venues (Miller, 2013). A study carried out by the National Gambling Impact Study Commission (1999) found that EGDs could be found in a wide range of public locations such as supermarkets, airports and truck stops in addition to bars and alcohol outlets, and were concentrated in areas of close proximity to families and children in impoverished neighbourhoods and in residential areas where patrons are more likely to encounter them in their day-to-day activities.

2.4 Access to venues and their impact on the population

2.4.1 Access to gambling venues and their impact on population behaviour.

Although numerous studies have confirmed the disproportionate concentration of EGM venues in more disadvantaged neighbourhoods, few have established causality between EGM accessibility and gambling behaviour. Several important studies have investigated the link between access to gambling opportunities and individual gambling behaviour, both in New Zealand and overseas contexts.

Although limited research has been carried out in assessing the impact of non-casino EGM venues, there is currently negligible research carried out on accessibility of casinos and their impact on casino gambling behaviour. In the results of the 1999 NZGS, Abbott and Volberg (2000) found that rates of casino gambling were substantially higher in Auckland and Christchurch, being the only two locations at the time in which casinos were present in New Zealand. Similarly, Wu and Chen (2015), who studied the impact of casinos on residents of Macau and Singapore, two city-states which are heavily dependent on tourism, found that majorities of populations in both countries had either frequently or occasionally visited casinos over their lifetimes. It is important to note that no Geographic Information Science (GIS) analysis had been carried out in either study, although in the cases of Singapore and Macau, the relatively small and compact sizes of these cities would result in greater accessibility to all residents of both these entities than would be expected for all New Zealand residents.

B. Rush, Veldhuizen, and Adlaf (2007), who examined geographic variation in problem gambling in the Canadian province of Ontario, considered both proximity to gambling venues, including commercial casinos, charity casinos and the nearest non-casino EGM facility, as well as proximity to treatment centres for problem gamblers. Data on gambling behaviour were sourced from the 2002 Canadian Community Health Survey. The study found that proximity to gambling venues was marginally important in the prediction of risk for problem gambling, although geographic access to treatment of problem gambling was not found to be associated with the risk of being a problem gambler. It is important to consider that this study had several limitations, including that participants' locations were approximated by assigning point locations to the centroid of postal codes of addresses that participants lived in and that distances to venues were calculated by estimating the linear distance from participants' locations to EGM venues instead of taking into account the road network. Additionally, although no link was found between geographic access to problem gambling treatment and probability of being a problem gambler, the study did suggest that low levels of treatment seeking may play a role in that outcome being reached (B. Rush et al., 2007).

Pearce et al. (2008) investigated the effect of geographic accessibility to three types of gambling venues, namely casinos, non-casino EGM venues and outlets for track and sports betting, on individual-level gambling behaviour in New Zealand. In particular, the study quantified accessibility using three measures; the distance from neighbourhood centres to the nearest gambling venue, the number of gambling venues

within walking distance of each participant's neighbourhood centre (800 metres) and the number of gambling venues within close driving distance (five kilometres) of each participant's neighbourhood centre. Participant data was taken from the 2002/03 New Zealand Health Survey and casino, non-casino venues and venues with TAB facilities were included.

The study found that the distance from participants' neighbourhood centres to the nearest gambling venue was strongly correlated with past-year gambling behaviour. In particular, compared with living in the quartile of neighbourhoods furthest from gambling venues, the study found that living in neighbourhoods closer to these venues was significantly associated with having gambled at a gambling venue during the past year as well with being a problem gambler who had gambled at a gambling venue during the past year, but not with having gambled on any type of gambling activity (i.e. including other forms of gambling). In addition, living in a neighbourhood close to an EGM venue was significantly correlated with having gambled at a non-casino EGM during the past year and being a problem gambler who had gambled on a non-casino EGM during the past year. In a similar fashion, living in a neighbourhood closer to a TAB venue was significantly associated with having gambled at a TAB venue during the past year. In terms of gambling venue density, having at least some non-casino EGM venues within 800 metres of the neighbourhood centre was correlated with a small increase in the odds of having gambled on an EGM during the past year, while having at least some venues within five kilometres of the neighbourhood centre was significantly correlated with having gambled at those types of venues during the past year. Results of the same study have been published in-depth by the Ministry of Health (2008a) in their publication 'Raising the Odds'.

Although Pearce et al. (2008) provided an important insight into the effect of accessibility on gambling behaviour, there are several important limitations to this study. Firstly, participants' actual locations were not used, but rather their population-weighted meshblock centroids were used as proxies for participants' residential locations. Secondly, although the road network was used to measure the distance to the nearest venues, due to time constraints only the Euclidean or straight-line distance was used to measure the number of gambling venues within 800 metres and five kilometres. Although Euclidean distances provided a crude approximation to accessibility, they failed to take into account the road connectivity and network where venues within certain straight-line distances may not be accessible in reality due to spatial constraints.

Thirdly, participant data and TAB venue data were taken from different time periods. Addresses of TAB venues were obtained using the TAB website in 2005, meaning that there may have been significant changes in TAB locations between the time the survey was taken in 2002 and the time the TAB address data was accessed in 2005. Finally, the study did not examine the impact of casino locations on casino gambling behaviour, instead lumping casino locations with those of non-casino EGM venues.

Pearson, Pearce, and Kingham (2013) examined the concept of ‘resilient areas’ in New Zealand, consisting of places that had low incidences of mortality despite being areas of high social deprivation. By using area-level mortality and socioeconomic data, a ‘Resilience Index New Zealand’ (RINZ) ranging from a value of one (least resilient) to five (most resilient) was created to measure a neighbourhood’s level of resilience across population areas in New Zealand, with relationships between RINZ and a selection of built, physical and social characteristics, including mean distances to gambling outlets among other facilities, being examined. The study found that the most resilient of places were found to be densely-populated urban areas, despite a lower mean distance to the nearest gambling venue, suggesting that although accessibility to gambling venues was found to be a major factor in predicting gambling behaviour (Pearce et al., 2008), social environment plays a major role in determining health outcomes. These results complement results found by Mason (2009), finding that major urban areas, which are known to be the most-densely populated urban areas in the country, are known to have lower incidences of past-year gambling and gambling on EGMs despite having some of the highest concentrations of EGM densities compared to other types of urban and rural areas. Similar to the study undertaken by Pearce et al. (2008), neighbourhoods were represented by CAUs and distances to the nearest gambling outlets were calculated from population-weighted centroids of each CAU using network analysis. The study made no mention of the type of gambling outlets that were used in the study.

Young, Markham, and Doran (2012b) measured the effect of proximity to the most-frequented gambling venue on the gaming outcomes of Australia’s Northern Territory’s residents, finding that the frequency of visitation of a venue was inversely proportional to the residential distance to that venue, after adjusting for individual and neighbourhood-level characteristics. Similarly, Young, Markham, and Doran (2012a) scrutinised the type of EGM venue as well as their proximity to other public facilities, finding particularly that venues in accessible locations, especially casinos and clubs

located near supermarkets as well as those with a higher numbers of EGMs, were more likely associated with gambling-related harm. This is complimented results by J. Thomas et al. (2012) that EGM gamblers were more likely to gamble at venues in close proximity to their residences and public facilities.

Marshall (2005) appraised the hypothesis that increased gambling availability lead to increased gambling consumption, analysing densities of EGMs per capita in the Richmond-Tweed region of New South Wales and gambling behaviour of residents in this region. By analysing gambling participation results, it was found that residents of areas with higher densities of venues with EGMs were more likely to gamble on EGMs, do so more often and spend greater amounts of money than those in areas with lower EGM densities. Similarly, Storer, Abbott, and Stubbs (2009) examined the hypothesis that greater availability of EGMs in Australia and New Zealand has led to an increase in problem gambling prevalence and related harms and that individuals adapt to this exposure over time, thereby causing a plateau in problem gambling prevalence. The study found that there was a meaningful association between increasing per capita EGM density and prevalence of problem gambling and that there was indeed a decrease in problem gambling prevalence over time, suggesting the individuals adapt to exposure of EGM availability.

Ladouceur, Jacques, Ferland, and Giroux (1999) investigated accessibility to casino venues in a temporal sense, measuring the number of casino venues with lottery terminals and VLTs over a seven year period as well as the change in past-year gambling behaviour, amount lost in a day and pathological gambling behaviour, finding that significantly more people gambled during the past year, more money was spent in a single day and 75% increase in the number of pathological gamblers since a 86% increase in the number of lottery terminals, the addition of three casinos and the addition of over four thousand VLT locations when there were previously none, from 1989 to 1996.

Barratt et al. (2014) investigated the effect of non-casino EGM density in Victorian LGAs (excluding those in the Melbourne metropolitan area) with help-seeking for problem gambling, namely telephone and face-to-face sessions. By analysing problem gambling counselling data obtained from counselling services such as Gambler's Helpline and Gambler's Help and the number of venues with EGMs per LGA. The study found that both types of help-seeking measures were independently

correlated with EGM density, supplementing previous studies by (Ladouceur et al., 1999), (Marshall, 2005) and (Storer et al., 2009) that densities of gaming machine venues play an important role in influencing gambling behaviour.

However, Blaszczyński (2013) put forward the argument that the majority of studies that link EGM availability with problem gambling harm tend to elicit information on preferred forms of gambling, which inevitably result in gambling on EGMs being overrepresented when cited as the main form of gambling associated with problem gamblers. Instead, Blaszczyński recommended interaction between cultural values, accessibility and availability of all venues that are equally capable of causing harm be investigated in order to obtain a better picture of which forms of gambling may interact with each other to result in gambling disorders.

It must be noted that while accessibility to physical venues makes a big impact on gambling behaviour of individuals who frequent these venues, the increasing availability of gambling through interactive media such as mobile phones, landlines and the internet has also caused a shift in gambling behaviour over time. Gambling activities which can be accessed through mobile phones and via the internet offer potential unlimited accessibility both in a spatial and temporal sense (Griffiths & Wood, 2000), thereby making the issue of proximity to venues increasingly irrelevant. Sales of Lotto products made online via Lotto New Zealand's MyLotto website and through the Lotto NZ mobile application collectively made up 16% of all sales in the 2017 financial year (New Zealand Lotteries Commission, 2017a), while over 63% of TAB customers used online channels in 2016 (Fairfax New Zealand, 2016).

2.4.2 Access to other types of venues and their impact on population behaviour

Although studies linking accessibility to gambling venues and their impact on gambling behaviour are fairly limited, numerous studies linking accessibility of other venues on certain health outcomes have been carried out which offer fruitful insight on how accessibility plays a role in determining health outcomes.

Pearce, Witten, and Bartie (2006) investigated the geographic distribution of a range of community resources including shopping, education, recreation and health facilities that have been linked to health, on a national scale. In a similar manner to the study conducted by Pearce et al. (2008), accessibility was approximated by the distance

to each population-weighted centroids of each meshblock in New Zealand to each facility. The study found clear regional variations in accessibility to community resources, especially between urban and rural areas of the country, with greater levels of accessibility to the mentioned facilities in major urban areas and lower levels of accessibility in rural areas, suggesting that certain health outcomes such as physical exercise, consumption of fresh fruit and vegetable and educational attainment may be potentially compromised in rural areas as a result of poorer accessibility to these facilities in rural areas.

Brabyn and Barnett (2004) took a more detailed approach, measuring accessibility to general practitioners (GPs) in New Zealand by using three different measures of accessibility; population to GP ratios on a territorial authority level, least cost path analysis whereby the distance between each meshblock centroid to the nearest GP was mapped using the road network, and an allocation method which took into account the capacity constraint of GPs. The authors found that there existed major variations in geographical accessibility to GPs depending on the method used to calculate accessibility, where areas with similar ratios had wide variations in the distance to their nearest GP as well as in the proportion of neighbourhoods living more than 30 minutes of driving time to their nearest GP, which were highest in rural and remote areas with higher levels of deprivation. As people residing in rural areas were less likely to access primary health care services due to the extra travel costs associated with longer travel distances, Brabyn and Barnett suggested that a distance-based or time-based approach is vital to measuring accessibility in order to identify these at-risk groups.

Badland, Mavoa, Livingston, David, and Giles-Corti (2016) and Ayuka, Barnett, and Pearce (2014) both investigated the relationship between alcohol availability, represented by venues with alcohol licences and alcohol consumption. In particular, Badland et al. (2016) explored spatial measures that involved alcohol outlets which were related to long-term health outcomes. Using logistic regression analysis to examine the associations between self-rated health, area-level disadvantage and alcohol outlet density in neighbourhoods of metropolitan Melbourne, the study found that for people living in more socioeconomically-deprived areas, the absence of venues with off-licences within 800 metres or venues with on-licenses within 400 metres were found to be protective factors of self-rated health. The study concluded that that alcohol outlet

density has a more detrimental effect on more disadvantaged neighbourhoods, suggesting a need for spatial alcohol policies in order to reduce harm.

In contrast, Ayuka et al. (2014) looked at the availability of alcohol products and incidence of excessive alcohol consumption by examining the distance between the population-weighted centroid of each participant's meshblock of residence to their closest alcohol outlet location, finding no evidence of correlation between hazardous consumption and access to alcohol outlets. However, the study did find evidence of a correlation between hazardous consumption and access with certain demographic groups, namely younger Māori and Pacific males, younger European females, middle-aged European men and older men of all ethnicities.

Day, Breetzke, Kingham, and Campbell (2012) studied the association between geographic access to licenced alcohol outlets and serious violent crime in New Zealand, finding significant negative associations between distance to the nearest licenced alcohol outlet and the incidence of serious violent offences. In particular, greater levels of violent offences were recorded in areas with close access to licenced premises when compared to those with less access.

Garrett (2013) investigated the effect of accessibility to the coast, physical activity facilities and recreational facilities on physical activity of individuals in the former North Shore City of Auckland. The study found that there was significant association of achieving sufficient physical activity and coastal access, highlighting the importance of outdoor and aquatic activities for the population. However, the study did not find associations with physical activity and facilities pertaining to physical or recreational activities, suggesting that proximity to work or study may have a greater impact on using these venues rather than ones closer to their place of residence.

2.5 The New Zealand gambling industry in an international context

Participation rates in gambling activities in New Zealand have been found to be relatively similar when compared to those in other developed nations. Various surveys have found rates of past year gambling by the adult population to vary from 58% in Canada (Institute of Health Economics, 2013), 64% in Australia (Armstrong & Carroll, 2017), 72% in the United Kingdom (Orford, Erens, Mitchell, Sproston, & White, 2003)

to 82% in the United States (Welte, Barnes, Wieczorek, Tidwell, & Parker, 2002), compared to 75% in New Zealand as reported in the 2015 NGS (Abbott, Bellringer, & Garrett, 2015). In line with surveys conducted in New Zealand, participation in lotteries have been consistently found to be the most popular form of gambling in most countries where lotteries are available.

In an effort to control the adverse impacts of gambling addiction brought about by the introduction of casinos, certain nations have, while allowing the establishment of casinos within their territory, restricted or completely prohibited their own citizens from entering these casinos. The governments of Cambodia (Stradbroke, 2014) and Monaco (Sood, 2013) have enacted laws banning their respective citizens from entering casinos in their territories, while the governments of Singapore and Vietnam require its citizens and permanent residents to pay entry as well as membership fees for those intending to gamble at casinos (Lim, 2012; Nikkei Asian Review, 2018). Additionally, in 2012 Singaporean citizens and permanent residents who are unemployed, on a low income or who are public housing tenants in arrears of six months or more with their rent payments were completely banned from entering casinos (J. Grant, 2012). In direct contrast New Zealand legislation, whilst prohibiting the establishment of new casinos under the Gambling Act 2003, sets no restrictions on its own citizens with regards to entering casinos in New Zealand.

New Zealand legislation, as well as legislation pertaining to the majority of provinces in Canada that permit the use of EGMs, mandate a minimum age of 18 years for gambling on EGMs in the country (CanadaWest Foundation, 2001), and therefore such machines are found primarily in licensed premises that are age-restricted. Internationally however, differing legislation has resulted in EGMs being available in a wide variety of locations. In the United States and Britain for example, EGMs can be found in bars, restaurants, takeaway stores, convenience stores and arcades (United States General Accounting Office, 2000; Wardle et al., 2014), where they can be accessed more easily compared to those in New Zealand, although British law severely restricts the maximum amount that can be wagered in unlicensed premises (Rajan, 2018).

Lotteries in New Zealand operate in a similar fashion to many other countries in the sense that they are operated by their respective governments. In Australia, Canada and the United States, each province or state has their own lottery board (Smith, 2013)

except for a handful of states in the United States, although national lotteries also do exist in these countries. Additionally in Europe, transnational lotteries such as EuroMillions, Eurojackpot and Vikinglotto, whereby money wagered is pooled by participants from a large number of participating countries also exist (Marionneau, 2015).

Sports and track betting is provided for by TAB in New Zealand, which provides betting services on a wide range of both New Zealand and international sport and racing events (D. Grant, 2003). Internationally, very few other government-run monopolies provides such a regulated and comprehensive service, the exception being the Australian TAB (Heagney, 2017). In direct contrast, Canadian provincial sports lotteries have long complained of increasing competition from offshore websites due the lack of betting options available on local websites (Strashin, 2016). Due to the competitive products available by the TAB in New Zealand and the country's ban on remote interactive gambling apart from the Lotto and TAB websites, it is therefore unsurprising that participation rates in internet gambling have been found to be relatively lower in New Zealand when compared to other countries (18% in the United Kingdom compared to less than one percent in New Zealand) (Abbott et al., 2014b; Gambling Commission, 2018), where gamblers wishing to bet on sporting events are forced to do so online with private betting agencies rather than with a government-run totalisator.

Chapter 3 Methodology

This chapter presents the methodology associated with the examination of gambling behaviour with respect to accessibility to gambling venues, namely casino venues and non-casino venues that host EGMs.

In particular, the following tasks will be explored:

- Data collection
- Geocoding of address data
- Measuring accessibility to EGM venues
- Statistical analyses
- Cartographic display

In order to study the effect of placement of EGM venues on individuals' gambling habits, a quantitative approach was taken where the effect of both the distance to the nearest EGM gambling facility and the density of such facilities were evaluated.

3.1 Data collection

3.1.1 Participant survey data

For the purpose of this study, data from phase one of the National Gambling Study (NGS) will be used. The NGS was a comprehensive longitudinal study carried out by the Gambling and Addictions Research Centre within the Faculty of Health and Environmental Sciences, Auckland University of Technology. Data was collected from a randomly selected sample of people aged 18 and over who lived in private households at the time of the survey using a complex survey design (Abbott et al., 2014b). Phase one of the survey was carried out in 2012 where a total of 6,251 people were surveyed face-to-face from March to October, with a selection of these participants being re-interviewed in 2013, 2014 and 2015.

The survey questionnaires included questions on a wide variety of topics, including those on gambling participation in various activities, mental health, substance use, leisure activities, social connectedness and attitudes towards gambling in addition to sociodemographic information (National Research Bureau, 2012). Questions relating

to the PGSI were also included as part of the survey in order to measure participants' severity of problem gambling.

Ethics approval was granted for the NGS on 26 May 2011 by the Northern Y Regional Ethics Committee of the Health and Disability Ethics Committee (Reference: NTY/11/04/040). Due to ethical concerns, each participant was allocated a six-digit numeric code as an identifier and no information was used which could personally identify participants of the survey.

3.1.2 Electronic gaming machine venue location data

As discussed, a substantial proportion of gambling harm has been caused by gambling on EGMs, with gambling on EGMs at non-casino venues and casino venues together accounting for a majority of problem gambling interventions. Therefore, for the purpose of this study, only casino venues and non-casino venues with EGMs were included. While the effect of TAB venues, including standalone TAB venues and other venues with TAB facilities would have been useful to analyse, data on TAB venues and terminals were not easily obtainable as opposed to those on casino venues and non-casino EGM venues. Although locations of current TAB venues can be found on the TAB's website, locations of venues at past points in time were not available, and missing locations of previously operating and relocated venues could potentially compromise the results of this study. Similarly, although facilities with Lotto terminals are commonly found at most supermarkets, dairies and bookstores, an exhaustive list of such facilities was not available. Additionally, as discussed, the introduction of online betting, betting through phones using keypads and betting through mobile phone applications has resulted in physical TAB stores and Lotto outlets becoming increasingly irrelevant in terms of geographic accessibility.

A list of each of the six casinos in New Zealand were obtained from the New Zealand Gambling Commission's Annual Report (Gambling Commission, 2013), while their individual addresses were obtained from their respective websites (Christchurch Casino, 2018; Dunedin Casino, 2018; SkyCity Auckland, 2018; SkyCity Hamilton, 2018; SkyCity Queenstown, 2018).

As the Department of Internal Affairs has been responsible for licencing of EGM venues, address data for non-casino venues with EGMs including the number of machines per location and the physical address of these locations have been collected by

the Department of Internal Affairs since March 2004 and were obtained from the Department's website (Department of Internal Affairs, 2017b). These data have been published on a quarterly basis in spreadsheet format, except those for the quarter ending June 2015 which were not published. For the purpose of this study, data on venues from the four quarters of 2012 were obtained and a venue was included in the analysis only if it was listed as operating by the Department of Internal Affairs (2017b) in at least one of the four quarters of the 2012 year.

3.1.3 Geographic shapefiles

Land boundaries

In order to cartographically represent areas of New Zealand during this study, shapefiles containing polygons pertaining to land boundaries at various geographic levels were used. These were available from the Statistics New Zealand Geographic Boundary Files website (Statistics New Zealand, 2017). For the purposes of geospatial analyses carried out in this study, the high-definition version of the New Zealand 2012 Annual Boundary Files was used.

In this study, the New Zealand Standard Areas Classification 1992 (NZSAC92) was used, which divided New Zealand land areas into meshblocks, census area units (CAUs), community boards, wards, territorial authorities and regions, among other levels of geographic organisations. Meshblocks are the smallest geographic units for which data is collected by Statistics New Zealand, while CAUs are aggregations of meshblocks, which in turn define or aggregate to define entire urban areas, territorial authorities or regional councils.

Although the Statistical Standard for Geographic Areas 2018 replaced NZSAC92 from 1st January 2018, for the purposes of this study NZSAC92 was still used as census data which was used as a basis for calculations and estimations, as well as the latest available New Zealand Index of Deprivation measures were only available using NZSAC92 geographic levels.

Lakes

In order to accurately represent areas that are inhabited by people when cartographically displaying New Zealand's land area, it was decided not to include areas that were

covered by large bodies of water such as lakes. Shapefiles containing polygons representing New Zealand lakes were obtained from the Land Information New Zealand Data Service website (Land Information New Zealand, 2018b).

Transport network data

Shapefiles containing polylines representing transport network data were obtained from the Land Information New Zealand (LINZ) Data Service website (Land Information New Zealand, 2018a) and Auckland Transport's Open GIS Data website (Auckland Transport, 2018). Shapefiles obtained from LINZ included datasets containing:

- Road centrelines, including motorways, highways, major arterial roads, minor arterial roads and residential roads
- Railway centrelines
- Walking track centrelines and
- Ferry crossing centrelines

As this dataset was not updated to include ferry services which had been operating in the Auckland region during 2012, shapefiles containing polylines representing these ferry services were obtained from the Auckland Council's website.

Transport network data was only available for the two major island groups of New Zealand, i.e. the North Island (including Waiheke and Great Barrier Islands) and the South Island (including Stewart Island).

Besides the two aforementioned island groups, the only other inhabited island group with a substantial population was the Chatham Islands with a population of 600 people based on the 2013 Census (Statistics New Zealand, 2013). However, as the road network was not available for these Islands, the Chatham Islands have been excluded from this study. Additionally, other offshore islands such as the Kermadec Islands as well as the New Zealand Subantarctic islands consisting of the Snares, Bounty, Antipodes, Auckland and Campbell Island groups, had been excluded.

3.1.4 Socioeconomic deprivation data

For the purposes of this study, both neighbourhood deprivation, representing socioeconomic deprivation on an aggregate level based on the area where an individual

resided, as well as individual deprivation, based on that individual's personal circumstances, was used.

Neighbourhood deprivation

In this study, neighbourhood deprivation was represented by the New Zealand Index of Deprivation 2013 (NZDep2013), an area-based measure of the level of deprivation for the inhabitants of that particular area. The index is based on nine census variables and is updated using data released after each population census has taken place. NZDep2013 is based on the results of the 2013 Census of Population and Dwellings developed by Atkinson et al. (2014). The metrics used to calculate this measure include nine census variables (Atkinson et al., 2014), namely the proportion of people:

- aged under 65 years without access to the internet at home
- aged 18-64 years receiving a means-tested benefit
- living in equivalised households with income below an income threshold
- aged 18-64 who are unemployed
- aged 18-64 years without any qualifications
- aged who are not living in their own home
- aged under 65 years living in a single-parent family
- living in equivalised households below a bedroom occupancy threshold
- without access to a car.

For this study, neighbourhood deprivation on a meshblock-level will be used as this provides greater accuracy than values available at a CAU level, where large variations in deprivation scores may exist within the same CAU. For example, the least-deprived meshblock in New Zealand is located in the CAU of Mangawhai Heads in Northland, with a score of 833 while the least-deprived census area unit is that of Resolution, corresponding to the Eastern portion of the suburb of Whitby in Porirua with a score of 850. Similarly, the most-deprived meshblock is located in the CAU of Raumanga West, a suburb of Whangarei, with a score of 1488, while the most-deprived census area unit is the Fordlands in the Rotorua urban area with a score of 1356.

The NZDep2013 groups deprivation scores into 10 deciles, where a decile score of 1 represents areas with the least-deprived scores and where a value of 10 represents areas with the most-deprived scores. Deprivation indices were not calculated for 1059

meshblocks in New Zealand due to these meshblocks being either sparsely populated at the time of the 2013 Census or due to being classified as lakes, estuaries or waterways. NZDep2013 values were therefore unavailable for these meshblocks.

Individual deprivation

While neighbourhood deprivation is an efficient measure of area-based deprivation of an individual's neighbourhood, it fails to take into account the characteristics of an individual's circumstances. The New Zealand Index of Socioeconomic Deprivation for Individuals (NZiDep), a measure developed by Salmond, Crampton, King, and Waldegrave (2006) has been found to be an appropriate indicator of an individual's socioeconomic conditions and was therefore used in this study to measure individual deprivation.

The NZiDep is based on the answers of eight questions which are asked of participants, namely if a participant, in the preceding 12 months:

- has been forced to buy cheaper food in order to pay for other things that are needed
- has been out of paid work for a period of more than one month
- has received payments in the form of Jobseeker Support, Sole Parent Support and Supported Living Payment
- has personally put up with feeling cold in order to save on heating costs
- has personally made use of special food grants or food banks due to insufficient money for food
- has personally continued wearing shoes with holes due to not being able to afford replacements
- has personally gone without fresh fruit or vegetables often in order to pay for other things that are needed and
- has personally received help in the form of clothes or money from a community organisation (Salmond et al., 2006).

3.2 Software used

ArcMap 10.5, developed by ESRI was used for geospatial analyses during the course of this project. In particular, the Network Analyst extension was used to measure distances from point to point using the road network.

R Studio version 1.1.453 was used in order to perform statistical analyses during this study.

3.3 Data preparation

3.3.1 Preparation of address data

The addresses of the 6,251 participants, six casinos and 1,429 non-casino venues with EGMs were tabulated into a spreadsheet. Out of the 6,251 participants surveyed, 6,249 had valid street numbers which allowed their full physical addresses to be properly geocoded. As address data on non-casino EGM locations were available on a quarterly basis for all four quarters of the 2012 year, each unique address was given a unique identification number and addresses from all the four quarters were matched up in order to prevent duplication while counting. Addresses which appeared at least once during the course of the 2012 calendar year were counted in the spreadsheet.

Each participant and venue address was then manually fragmented into their respective unit number, street number, street name, suburb (if applicable), rural delivery number (if applicable) and town or place name. Figure 3 illustrates a screenshot of the spreadsheet containing addresses of non-casino EGM venues in the Auckland suburb of Papakura.

	A	B	C	D	E	F	G
1	CODE	VENUE NAME	UNIT NUMBER	STREET NUMBER	STREET NAME	SUBURB	CITY
2	PAP008	PAPAKURA TAVERN		159	GREAT SOUTH ROAD	PAPAKURA	AUCKLAND
3	PAP003	COYOTE BAR		163-165	GREAT SOUTH ROAD	PAPAKURA	AUCKLAND
4	PAP002	BOODLES LICENSED CAFE		182-188	GREAT SOUTH ROAD	PAPAKURA	AUCKLAND
5	PAP009	STAMPEDE BAR AND GRILL		238-246	GREAT SOUTH ROAD	PAPAKURA	AUCKLAND
6	PAP004	FORGE2		26	EAST STREET	PAPAKURA	AUCKLAND
7	PAP015	PAPAKURA BOWLING CLUB		29	WOOD STREET	PAPAKURA	AUCKLAND
8	PAP010	TAB PAPAKURA	2A	6	AVERILL STREET	PAPAKURA	AUCKLAND
9	PAP011	THE COPPER LOUNGE		37	O'SHANNESSEY STREET	PAPAKURA	AUCKLAND
10	PAP007	PAPAKURA RSA CLUB INC		40	ELLIOTT STREET	PAPAKURA	AUCKLAND
11	PAP006	PAPAKURA CLUB		5	CROSKERY ROAD	PAPAKURA	AUCKLAND
12	PAP013	WHITEHOUSE TAVERN		5	DUMAS PLACE	PAPAKURA	AUCKLAND

Figure 3. Spreadsheet showing addresses of non-casino EGM venue locations in the suburb of Papakura fragmented into their various components.

3.3.2 Geocoding of addresses

Geocoding refers to the process of converting physical addresses into geographic coordinates, including latitude and longitude data, which can be used to place markers on a map for visualisation and subsequent analysis (ArcGIS, 2018; Verbyla, 2002). Geocoding of addresses was carried out by Kim Ollivier of Ollivier & Co. Addresses were matched using a composite address locator consisting of individual address locators, namely GeoPaf, AIMS1, Nickel, DIME in descending order of reliability of position. Of the combined 8,582 participant addresses, casino addresses and non-casino EGM venue addresses, 99% were successfully matched by the composite locator, with the remainder being manually allocated coordinates.

For each address, an x-coordinate value (representing longitude) and y-coordinate value (representing latitude) were obtained. Using the New Zealand Geodetic Datum 2000, these coordinates were used to create point locations which could be plotted in a geographic information system in order to represent addresses of participants, casino venues and non-casino EGM venues for future geospatial analysis to be performed. Figure 4 illustrates a selection of the addresses in the spreadsheet in Figure 3 that have been geocoded and converted to point locations in order to be visually represented on parcel boundaries. Land blocks are denoted in yellow, roads in grey and participant locations by red dots.



Figure 4. Map showing a selection of addresses in Figure 3 as geocoded and displayed as point locations.

3.3.3 Calculation of derived variables

In order to study the effect of participants' age, ethnicity and individual deprivation on various types of gambling behaviour, participants were categorised into mutually exclusive groups on the basis of their age group, prioritised ethnicity and individual deprivation class respectively.

Age groups

Participants were divided into six age groups depending on their age in years on their last birthday. Participants were grouped into those of 18-19 years, 20-29 years, 30-39 years, 40-49 years, 50-65 years and 65 years or older. The 18-19-year-old age group was created as the legal age of entry into casinos in New Zealand is 20 years ("Gambling Act 2003," 2003) and this group would therefore be expected to exhibit limited casino gambling behaviour. Similarly, participants aged 65 years and above were grouped into a single group as 65 years of age is a common age to retire from employment and individuals start being eligible for superannuation payments at this age (New Zealand Government, 2018).

Prioritised ethnicity

In the questions pertaining to ethnicity in the NGS Questionnaire, participants were given the opportunity to select more than one ethnic group that they identified with (National Research Bureau, 2012), resulting in the total sum of responses exceeding the total number of respondents. In order to overcome this problem and therefore prevent the over counting of participants, prioritised ethnicity was used so to measure the ethnicity of participants in the order; Māori, Pacific, Asian and European/Other. As an example, while a person who has stated their ethnic responses as Māori and Asian would be counted as Māori, a person who has stated their ethnic response as Pacific, Asian and European would be counted as Pacific. A person would only be counted as European/Other should they not select a Māori, Pacific and Asian response in addition to their European and/or Other response. Prioritisation of ethnicity therefore overcomes the issues related to dealing with multiple ethnic responses and there has been shown to be very little difference in results while using prioritised ethnicities when compared to total response ethnic groups (Ministry of Health, 2008b).

Individual deprivation

Based on participants' responses to questions relating to the NZiDep, participants were given a score depending on the number of deprivation characteristics they were affected by and were categorised into groups recommended by Salmond et al. (2006). Group 1 contained participants with no deprivation characteristics, Group 2 included those with one characteristic, Group 3 included participants with two characteristics, Group 4 included those with three or four characteristics and Group 5 included participants with five or more deprivation characteristics.

3.3.4 Allocation of neighbourhood deprivation

In order to calculate neighbourhood deprivation of participants, shapefiles containing meshblocks which contained unique meshblock numbers was imported into ArcMap. A text file containing NZDep2013 values created by Atkinson et al. (2014) for each meshblock was obtained from the University of Otago's website. These deprivation values were then joined to their appropriate meshblocks using their meshblock code as their unique identifier.

A layer consisting of geocoded point locations representing participant addresses were then overlaid onto the meshblock layer. By performing a spatial join whereby each participant's point location was allocated properties of the meshblock where that point was located in, each participant was allocated a neighbourhood deprivation value which corresponded to the NZDep2013 decile value of that participant's meshblock of residence.

3.3.5 Preparation of response variable data

Three binary variables were created in order to measure the extent of participation in gambling activities and the level of risk of problem gambling that they were exposed to. Each of these three variables were given one of two values; that of one or zero to represent whether a participant fulfilled that criteria or whether they had not respectively.

The three variables were:

- Whether a participant had gambled (on any activity) in the past year
- Whether a participant had gambled on an EGM (at either a casino or non-casino venue) in the past year
- Whether a participant who has gambled during the past year is at risk of problem gambling

Gambling in the past year

Question 1.02 from the questionnaire of the first phase of the NGS asked participants to indicate whether they had participated in at least one gambling activity from a broad list during the past year, while question 1.03 asked participants to choose from a more detailed list of gambling activities if they had participated in each activity during the past year (National Research Bureau, 2012). From participants' responses to questions 1.02 and 1.03, the number of gambling activities that a participant had taken part in was obtained. If a participant had participated in one or more activities in the past year, they were allocated a value of one. Participants that did not take part in any of the activities mentioned were allocated a value of zero.

Gambling on an EGM (in a casino or non-casino EGM venue) in the past year

Option (i) from Question 1.03 gave participants the option of indicating whether they had played on a casino EGM or had participated in a table game or other type of game at one of the six casinos in New Zealand (National Research Bureau, 2012). If a participant had selected this option, they were asked in question 1.109 if this included playing on an EGM. Question 1.03 also gave participants the option of indicating whether they had played on an EGM in a pub location which was not a casino or club (Option (j)), or whether they had played on an EGM in a club location which was not a casino or club (Option (k)) (National Research Bureau, 2012). If a participant responded to either of these three options with a ‘yes’ answer, they were assigned with a value of one, while participants who responded with a ‘no’ answer to all three questions were assigned a value of zero.

Risk of problem gambling having gambled in the past year

The questionnaire for phase one of the NGS included questions relating to the PGSI, which calculated risk of problem gambling (National Research Bureau, 2012) based on the answers to nine questions (see Section 1.1.1). The risk of problem gambling was measured by assigning a value of one to participants who had a non-zero PGSI score, therefore indicating that they had at least some risk of problem gambling participants. This included participants in the low-risk, moderate-risk and problem gambler categories. Participants with a PGSI score of zero were assigned a score of zero. For this outcome, participants that did not gamble during the past year were removed from the dataset, thereby measuring risk for past-year gamblers only.

3.4 Measuring accessibility

Accessibility to EGM venues was measured by calculating distance to the nearest casino venue, distance to the nearest non-casino EGM venue and the density of EGM venues within certain predefined distances from participants’ residential addresses. All distances were calculated taking into using the travel network.

In order to test for the effect of distance to EGM venues on participants’ gambling behaviour, distances from each participant’s location to the closest casino venue and the distance to the nearest non-casino EGM venue were calculated using the

‘Closest Facility’ tool from the Network Analysis extension. For the sake of simplicity, each segment of the street network was given the same amount of impedance in terms of the time taken to travel, i.e. it was assumed that the same amount of time would be taken to traverse a given length of road, regardless of that road’s status as a motorway or a residential road. In the case of casino venues, distances were calculated from each participant’s location to each of the six casinos. For non-casino EGM venues, distances were only calculated for each participant to each venue in that participant’s major island group, i.e. for North Island participants, distances were calculated only to each non-casino EGM venue in the North Island, while for South Island participants, distances were only calculated to each non-casino EGM venue in the South Island.

In order to test for the effect of the density of EGM venues that each participant had access to, the total number of EGM venues that were accessible within four travel distances was investigated, namely those within 500 metres, one kilometre, five kilometres and 10 kilometres. Distances of 500 metres and one kilometre were chosen as these distances were commonly used as acceptable short and long walking distances for commuting respectively (Marshall & Baker, 2001; Wakenshaw & Bunn, 2015). Similarly, distances of five kilometres and 10 kilometres have been used to approximate short and long driving distances depending on various levels of convenience (Ahmad, 2012; Austin et al., 2005). In a similar manner to investigating distances to the closest casino and non-casino EGM facility, the ‘Closest Facility’ tool was used, but distance to all venues in each participant’s island group, including casino and non-casino EGM venues alike, were calculated from each participant’s point location. Using R Studio, the number of locations that each participant could travel to within 500 metres, one kilometre, five kilometres and 10 kilometres was calculated.

3.5 Statistical analyses

As mentioned, three outcome variables were considered for this study, namely:

- gambling on any activity during the past year
- gambling on an EGM during the past year (at either a casino or a non-casino EGM venue)
- the risk of problem gambling having gambled on any activity during the past year

Due to the relatively small number of participants classified as problem gamblers, the probability of participants being classified as problem gamblers was not investigated. Rather, the combined risk of being problem gambling, including the risk of low-risk gambling and moderate-risk gambling as defined by the PGSI (Section 1.1.1) was used instead.

To take into account the potential non-linear nature of gambling behaviour with respect to variation in the two distance variables, distances to the nearest casino venue and the distances to the nearest non-casino EGM venue for each participant were divided into four quartiles ranked in terms of their proximity to the nearest venue. Similarly, each of the four density measures were categorised into three to five groups in order to test for the effect of increasing EGM venue locations within a certain distance.

For each outcome variable, logistic regression analyses were carried out to investigate the effect of the two distance variables and four density variables, assigning a certain weighting to each participant in order to represent the sex, age group and ethnicity proportions of the general population. These logistic regression analyses were then repeated to control for five demographic variables; sex, age group, prioritised ethnicity, neighbourhood deprivation and individual deprivation. When correcting for demographics, all five variables were included as they were important overall, even though some did not turn out to be significant in predicting one or two outcome variables.

In order to compare the behaviour of various demographic groups, a reference group was created for each variable that was being measured. Males were set as the reference group in terms of sex, the 20-29 years old group was set as the reference groups in terms of age group, the European/Other group was set as the reference group in terms of prioritised ethnicity, the least deprived decile (Decile 1) was set as the reference group in terms of neighbourhood deprivation while the least socioeconomically deprived group (Group 1) was set as the reference group in terms of individual deprivation.

In terms of distance to the nearest casino and distance to the nearest non-casino venue, the quartile of participants furthest away from the venue in question was chosen as the reference group in order to compare the effects of living close to a venue. In terms of the four density venues, the group of participants that lived with no venues

within each of the distance measured was set as the reference group in order to test for the effects of having EGM venues within this distance.

For each of the three outcome variables, the outcome variable was set as the independent variable while each of the two distance measures and four density measures of accessibility to EGMs were set as the independent variables. For each outcome, odds ratios were calculated along with 95% percent confidence intervals. Chi-squared tests were used to test for the significance of each of the distance and density variables. These logistic regression tests were then repeated with the five demographic variables in order to control for these factors.

3.5.1 Modelling each of the outcome variables

Logistic regression models were then built for each of the three outcome variables using the five socioeconomic variables, along with the distance and density variables that were found to be statistically significant. Using the results of the logistic regression tests, in cases where the p-value of the Chi-square test was found to be less than or equal to 0.2, that particular density or distance variable was used as a candidate for being included in as input variable in the final logistic regression model.

A base model was created for each of the three outcome variables, where the outcome was predicted using the five demographic variables of age, sex, ethnicity, neighbourhood deprivation and individual deprivation, as all of these variables were associated with demographic behaviour. Starting from the base model, each of the distance and density variables were individually examined for associations with the outcome models. After eliminating variables with p-values greater than 0.2, a final multiple variable model was developed using the best subset model building process.

3.6 Cartographic display

Maps were created using ArcMap to visually illustrate the location of EGMs, the number of venues within five kilometres and the results of the multiple variable models in various parts of the country. In order to more accurately display areas of the country which could be inhabited by people, shapefiles displaying land areas were clipped in

order to remove areas consisting of lakes and water bodies with a surface area of 100,000 square kilometres or more.

In the case of maps where classes of quantitative data were to be displayed, a diverging colour scheme ranging from blue to red was used, with blue signifying lower quantities and red signifying higher quantities. A red-green diverging colour scheme was avoided due to the difficulty in distinguishing red from green by colour-blind individuals. In order to display the extent of urban areas, a layer of polylines representing the travel network was displayed. As it is known that the street network tends to be much denser in urban areas compared to rural areas (Borruso, 2003), the layer representing the travel network was displayed to give the reader a sense of the extent of an area's level of urbanisation.

Distinct colours were used to symbolise both casino and non-casino venues with EGMs. As casinos were often found in locations with high concentrations of non-casino EGM venues, symbols representing casinos were placed on top of those representing non-casino EGM venues but made slightly transparent so that the clustering of non-casino venues could still be visible underneath this layer.

Maps showing distances to the nearest casino and to the nearest non-casino venue were calculated using the Network Analyst extension's 'Service Area' tool in ArcMap. For distances to the nearest casino, service areas of five kilometres, 10 kilometres, 50 kilometres, 100 kilometres, 250 kilometres, 500 kilometres and 1000 kilometres from each of the six casinos were created while in the case of distances to the nearest non-casino EGM venue, service areas of 500 metres, one kilometre, five kilometres, 10 kilometres, 50 kilometres and 1000 kilometres from each of the 1,429 non-casino EGM venues were created.

In order to create maps showing the number of EGM venues at various distances of 500 metres, one kilometre, five kilometres and 10 kilometres, service areas from each venue (both casino and non-casino EGM venues) were created for each of these distances. The 'Union' tool was then used to count the number of overlapping service areas for each area, with the total number of overlapping service areas at each distance corresponding to the number of venues being accessible at that distance.

For the purposes of visualising the results of statistical analyses carried out, service areas representing quartiles of participants in terms of their proximity to the nearest casino and non-casino venue were created. Similarly, for the number of venues

within each of the four distances, polygons representing the number of venues within each distance were merged to represent the various categories used in the statistical analyses.

For maps displaying the relative risk of past-year gambling, gambling on an EGM during the past year and the risk of problem gambling for past-year gamblers, relative risk was calculated by using the 'Union' tool to create overlapping polygons from layers representing the various distance and density categories that were significant in determining each outcome and then multiplying the likelihood of each category.

Chapter 4 Results

This chapter provides an overview of the results of this study, detailing information on the demographic characteristics of the participants from the first phase of the NGS study as well as presenting the results of the geospatial and statistical analyses performed. In particular, the physical locations and distribution of casino and non-casino EGM venues as well as the spread and distribution of the two distance and four density measures discussed in Chapter 3 will be presented. Results of the logistic regression tests for each of the distance and density variables on each outcome variable will also be presented, as well as results of the multiple variable logistic regression models for each of the three outcome variables.

For illustration purposes, maps showing distances to the nearest casino venue, distances to the nearest non-casino EGM venue and the number of EGM venues within five kilometres are provided. Maps showing the results of the multiple variable logistic regression models for each of the three outcome variables are also provided.

Participant demographics Table 3 shows the composition of study participants by sex. Female participants had been oversampled in the study, and weighting had the impact of reducing the percentage of participants that were female and increasing the percentage of participants that were male.

Table 3. Composition of participants by sex.

Sex	Number of participants	Percent of total (before weighting)	Percent of total (after weighting)
Male	2641	42.3%	47.8%
Female	3608	57.7%	52.2%
Total	6249	100.0%	100.0%

The composition of participants by age groups is show in Table 4. In terms of age groups, only relatively minor changes were made after weighting was applied. The 18-19-years, 20-29-years and 50-64 years old age groups were the only age groups whose percentages had increased after weighting, while the proportion of other groups slightly declined.

Table 4. Composition of participants by age group.

Age group	Number of participants	Percent of total (before weighting)	Percent of total (after weighting)
18-19	143	2.3%	3.2%
20-29	934	15.0%	16.7%
30-39	1146	18.4%	17.2%
40-49	1283	20.6%	19.2%
50-64	1490	23.9%	24.4%
65 and over	1220	19.6%	19.1%
Total	6216	100.0%	100.0%

Note: Thirty-three respondents did not report their date of birth, their age at their last birthday or their age group, and were therefore not placed in one of these age groups

Table 5 shows the composition of participants in the first phase of the NGS survey in terms of their reported ethnicity. The majority of respondents identified as being European and/or of another ethnicity, with those of Māori, Asian and Pacific ethnicities accounting for the remainder. As participants of Māori, Pacific and Asian ethnicities were oversampled relative to the general population, all three of these groups saw a reduction in percentages after weighting had been applied, while the European/other group saw an increase in terms of proportion.

Table 5. Composition of participants by reported ethnicity.

Reported ethnicity	Number of responses	Percent of total (before weighting)	Percent of total (after weighting)
European/other	4033	64.5%	78.1%
Māori	1164	18.6%	10.4%
Pacific	830	13.3%	5.3%
Asian	827	13.2%	10.4%
Total	6854	109.7%	104.3%

Note: Sixty-three respondents did not report an ethnicity.

Table 6 shows the composition of participants by prioritised ethnicity. After prioritisation, the number and proportion of participants who identified with the Māori ethnic group had remained relatively similar compared to that before prioritisation. In contrast, the number and proportions of participants identifying with the other three broad ethnic groups all saw a decline in their numbers and proportion of the population.

Table 6. Composition of participants by prioritised ethnicity.

Prioritised ethnicity	Number of participants	Percent of total (before weighting)	Percent of total (after weighting)
European and/or other	3446	55.2%	74.1%
Māori	1164	18.6%	10.6%
Pacific Island	778	12.5%	5.1%
Asian	798	12.8%	10.4%
Total	6186	100.0%	100.0%

Note: Sixty-three respondents did not report an ethnicity, resulting in their ethnicity being unable to be prioritised.

Table 7 shows the composition of participants by neighbourhood deprivation decile. It can be seen in general, participants that lived in more deprived deciles were oversampled compared to those living in less deprived areas. After weighting had been applied, the proportion of each decile more or less approximated the 10% mark.

Table 7. Composition of participants by neighbourhood deprivation decile.

Neighbourhood deprivation	Number of participants	Percent of total (before weighting)	Percent of total (after weighting)
Decile 1 (least-deprived)	471	7.5%	9.6%
Decile 2	547	8.6%	10.4%
Decile 3	616	9.9%	11.2%
Decile 4	559	9.9%	10.5%
Decile 5	556	8.9%	9.6%
Decile 6	540	8.6%	9.2%
Decile 7	675	10.8%	10.9%
Decile 8	718	11.5%	10.3%
Decile 9	730	11.7%	9.2%
Decile 10 (most-deprived)	822	13.2%	9.0%
Total	6234	100.0%	100.0%

Note: Fifteen participants lived in meshblocks where neighbourhood deprivation data was not available.

Composition of participants by individual deprivation categories are shown in Table 8. It can be seen that categories representing the number of participants becomes smaller with increasing deprivation characteristics. As participants with higher

individual deprivation scores were oversampled, their relative proportions decline after weighting was applied.

Table 8. Composition of participants by individual deprivation category.

Individual Deprivation	Number of participants	Percent of total (before weighting)	Percent of total (after weighting)
Group 1 (least-deprived)	3284	52.6%	56.6%
Group 2	1322	21.1%	21.6%
Group 3	712	11.4%	10.9%
Group 4	611	9.8%	7.6%
Group 5 (most-deprived)	320	5.1%	3.3%
Total	6249	100.0%	100.0%

4.1 Geospatial analysis

4.1.1 Location of participants

Table 9 displays the number of participants and the number of non-casino EGM venues in each region in New Zealand, while Table 10 shows the number of participants and the number of non-casino EGM venues in each local board area in the Auckland Region. Table 20 in Appendix A shows the number of participants in each territorial authority in New Zealand.

Participants were selected from every territorial authority in the country, except from the Mackenzie District. No participants were surveyed from the Chatham Islands or from areas outside the 74 territorial authorities. Due to privacy concerns, physical locations of participants' residential locations are not visually illustrated.

Table 9. Number of survey participants and number of non-casino EGM venues in 2012 by Region.

Region	Number of participants	Number of non-casino EGM venues
Northland	272	66
Auckland	2322	306
Waikato	649	155
Bay of Plenty	480	107
Gisborne	135	14
Hawke's Bay	261	56
Taranaki	145	46
Manawatu-Wanganui	326	99
Wellington	682	146
West Coast	20	33
Canterbury	522	202
Otago	193	90
Southland	107	52
Tasman	49	16
Nelson	53	20
Marlborough	33	21
Area Outside Region	0	0
Total	6249	1429

Table 10. Number of survey participants and number of non-casino EGM venues in 2012 by Auckland Local Board Area.

Local Board Area	Number of participants	Number of non-casino EGM venues
Rodney	57	14
Hibiscus and Bays	117	19
Upper Harbour	45	13
Kaipatiki	124	19
Devonport-Takapuna	48	10
Henderson-Massey	146	16
Waitakere Ranges	91	10
Great Barrier	0	0
Waiheke	11	3
Waitemata	73	31
Whau	139	14
Albert-Eden	133	16
Puketapapa	117	4
Orakei	116	8
Maungakiekie-Tamaki	138	23
Howick	211	23
Mangere-Otahuhu	166	18
Otara-Papatoetoe	217	22
Manurewa	167	14
Papakura	86	14
Franklin	120	15
Total	2322	306

4.1.2 Location of electronic gaming machine venues

Figure 5 shows the physical locations of EGM venues in the North Island, while Figure 6 shows the locations of EGM venues in the South Island. Locations of EGM venues in the Auckland (Figure 7), Wellington (Figure 8) and Christchurch (Figure 9) urban areas are also displayed. Maps for other cities in New Zealand with populations of 50,000 or greater as at the 2013 Census of Population and Dwellings (Statistics New Zealand, 2013) can be found in Appendix B.

It can be seen that four of the six casino venues in New Zealand are located in the CBDs of major urban areas, namely those of Auckland (Figure 7), Christchurch (Figure 9), Hamilton (Figure 38) and Dunedin (Figure 40), with the two remaining venues located in the city centre of Queenstown (Figure 47).

On the other hand, locations of non-casino EGMs are spread throughout the country. It can be seen from Table 20 and Table 9 that non-casino EGM venues are present in every territorial authority and region in New Zealand respectively. In the Auckland Region, these venues are present in every local board area, except in the sparsely-populated Great Barrier Local Board Area (Table 10). Figure 5 and Figure 6 show that in terms of the geographical distribution of such venues, these are located throughout the country in every sizable city and town, with most towns that host these venues having multiple venues. The distribution of non-casino EGM venues is seen to mirror that of the general population, with especially high concentrations in main urban areas such as Auckland (Figure 7), Wellington (Figure 8), Christchurch (Figure 9), Hamilton (Figure 38), Tauranga (Figure 39), Napier-Hastings (Figure 43) and Dunedin (Figure 40), with sizable concentrations in the remainder of the regional cities. Additionally, in Auckland, Wellington, Christchurch, Hamilton, Tauranga and Dunedin, non-casino EGMs are found to be located throughout the urban area of the city. There are clear clusters of non-casino EGM venues located in the main CBD, on major arterial roads as well as commercial areas of suburban areas.

In Auckland, concentrations of non-casino EGM venues are highest in the CBD, but also around the inner-city area including the suburbs of Ponsonby, Newton and Grafton (Figure 7). Clusters can also be seen in suburban centres away at sizeable distances away from the city centre, particularly in the suburbs of Otahuhu, Papatoetoe, Manurewa, Papakura and New Lynn areas. In Wellington, concentrations are found to be the highest in the CBD area and the Brooklyn area, with sizable concentrations in the

business areas in the cities of Porirua, Lower and Upper Hutt (Figure 8). In Christchurch, concentrations of non-casino EGM venues are highest in the CBD area but also on arterial roads leading away from the city (Figure 9). The suburbs of Hornby, Phillipstown, Lyttleton and New Brighton are also seen to have sizable clusters of non-casino EGM venues.

Outside the three largest metropolitan cities, it is seen that the majority of non-casino EGM venues are located primarily in the city centres of such places. However, similarly to the case with the three metropolitan cities, there are also clusters of non-casino EGM venues found in more socially deprived suburbs of such cities. This is especially the case with the suburbs of Gate Pa and Greerton in Tauranga (Figure 39) and Ngongotaha in Rotorua (Figure 42).

In smaller cities, such as Whangarei (Figure 41), New Plymouth (Figure 44) and Invercargill (Figure 48), the majority of non-casino EGM locations are found to be located in their city centres, with the few locations that are not located in the city centre being located on major arterial roads.

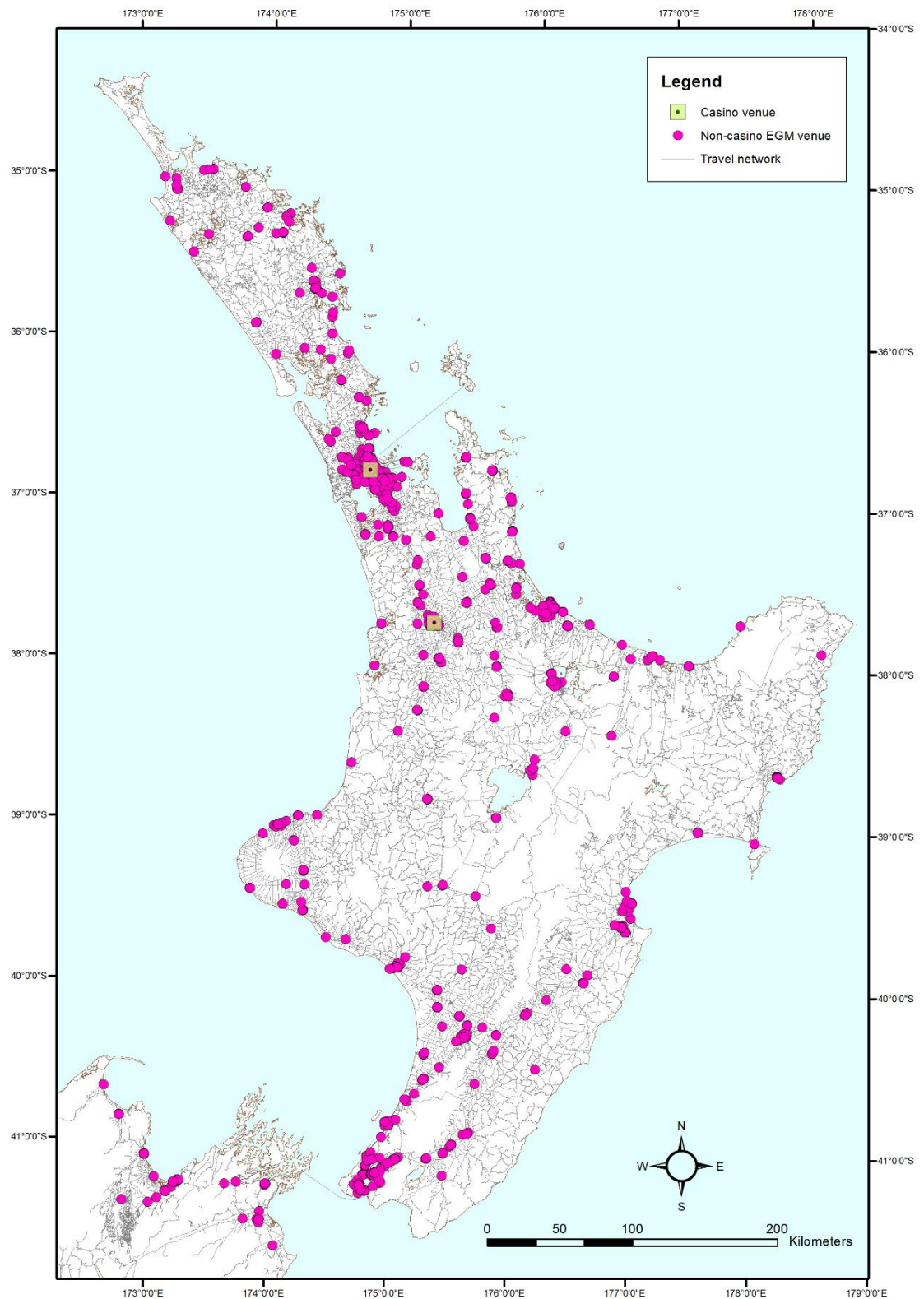


Figure 5. Map of EGM venue locations in the North Island.

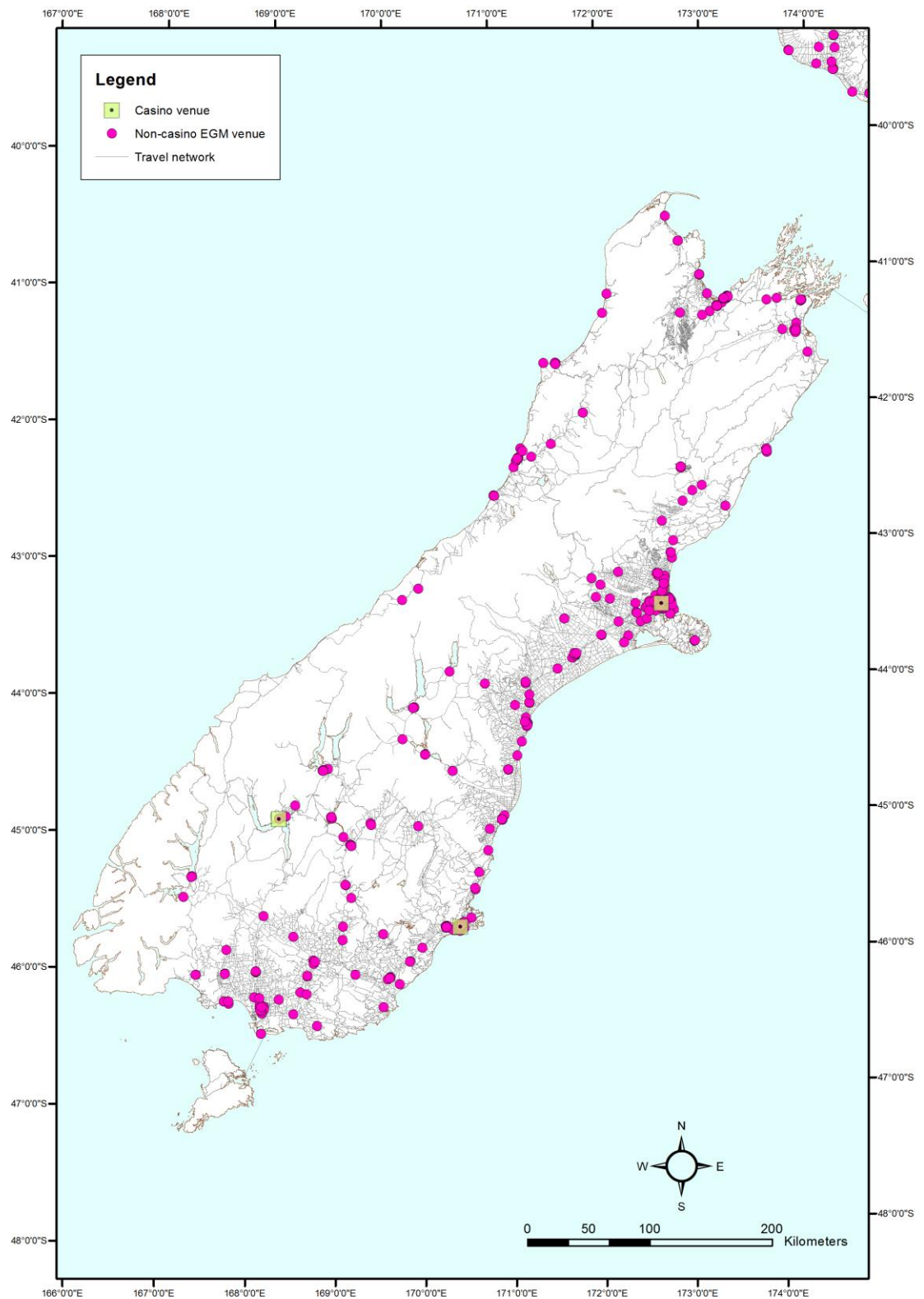


Figure 6. Map of EGM venue locations in the South Island.

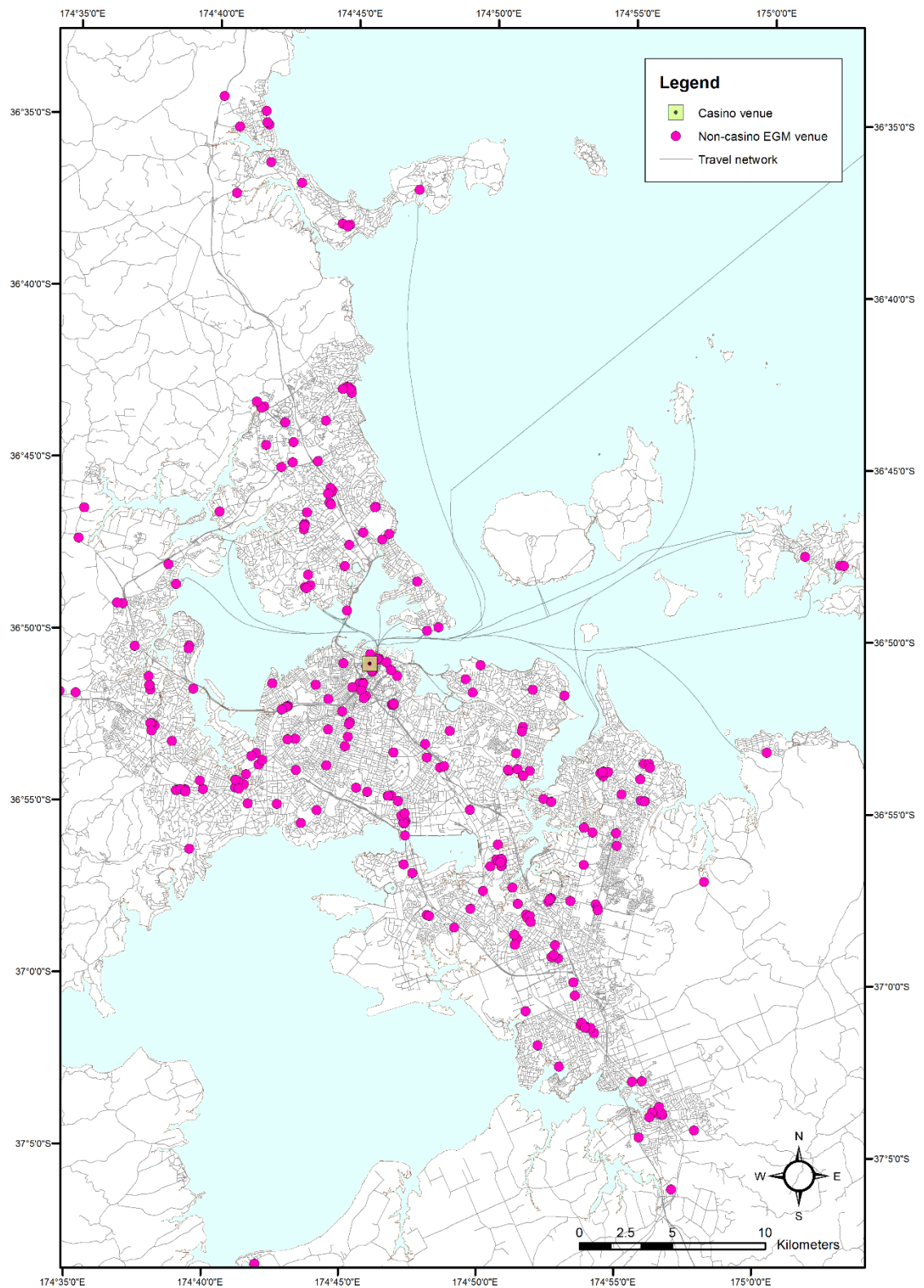


Figure 7. Map of EGM venue locations in the Auckland urban area.

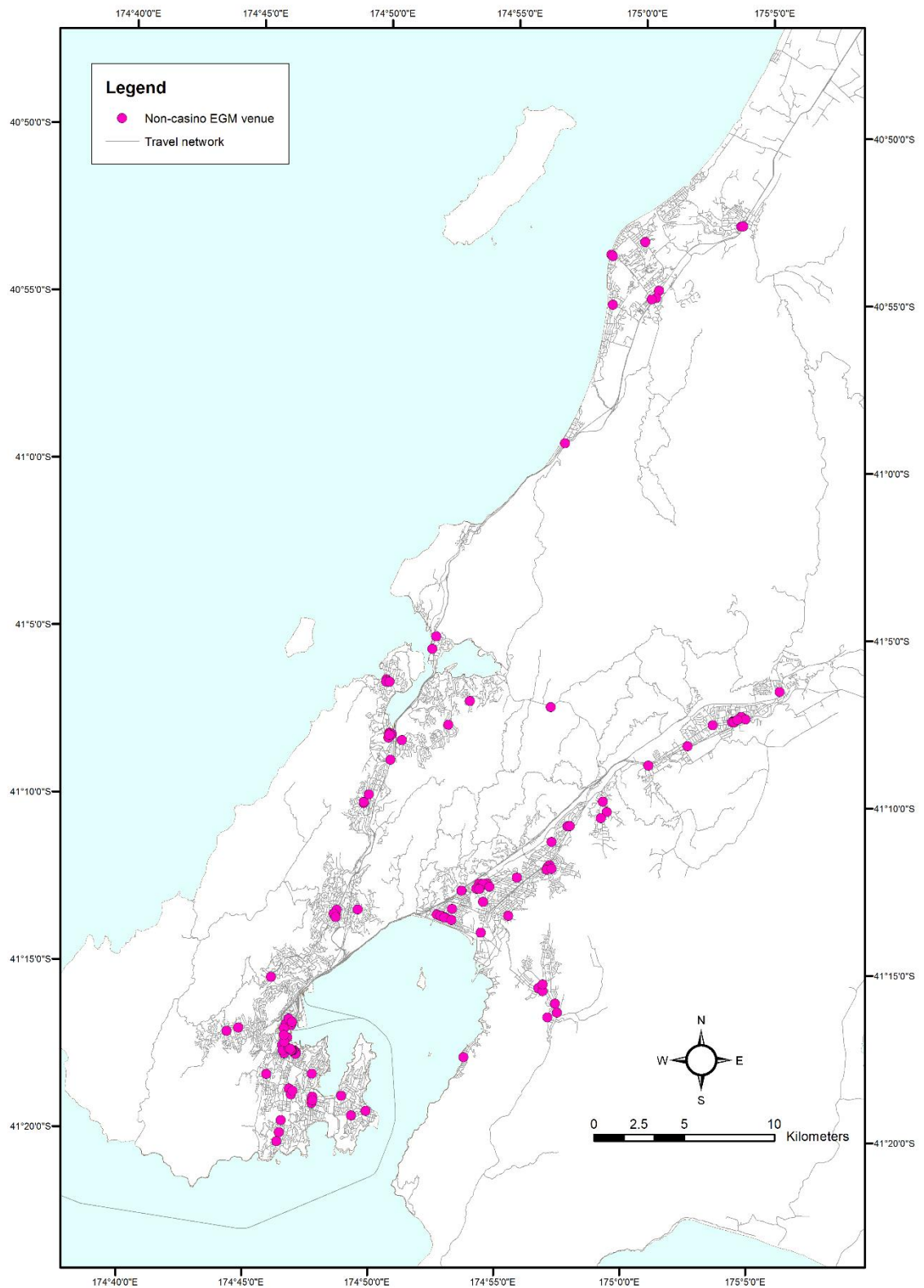


Figure 8. Map of EGM venue locations in the Wellington urban area.

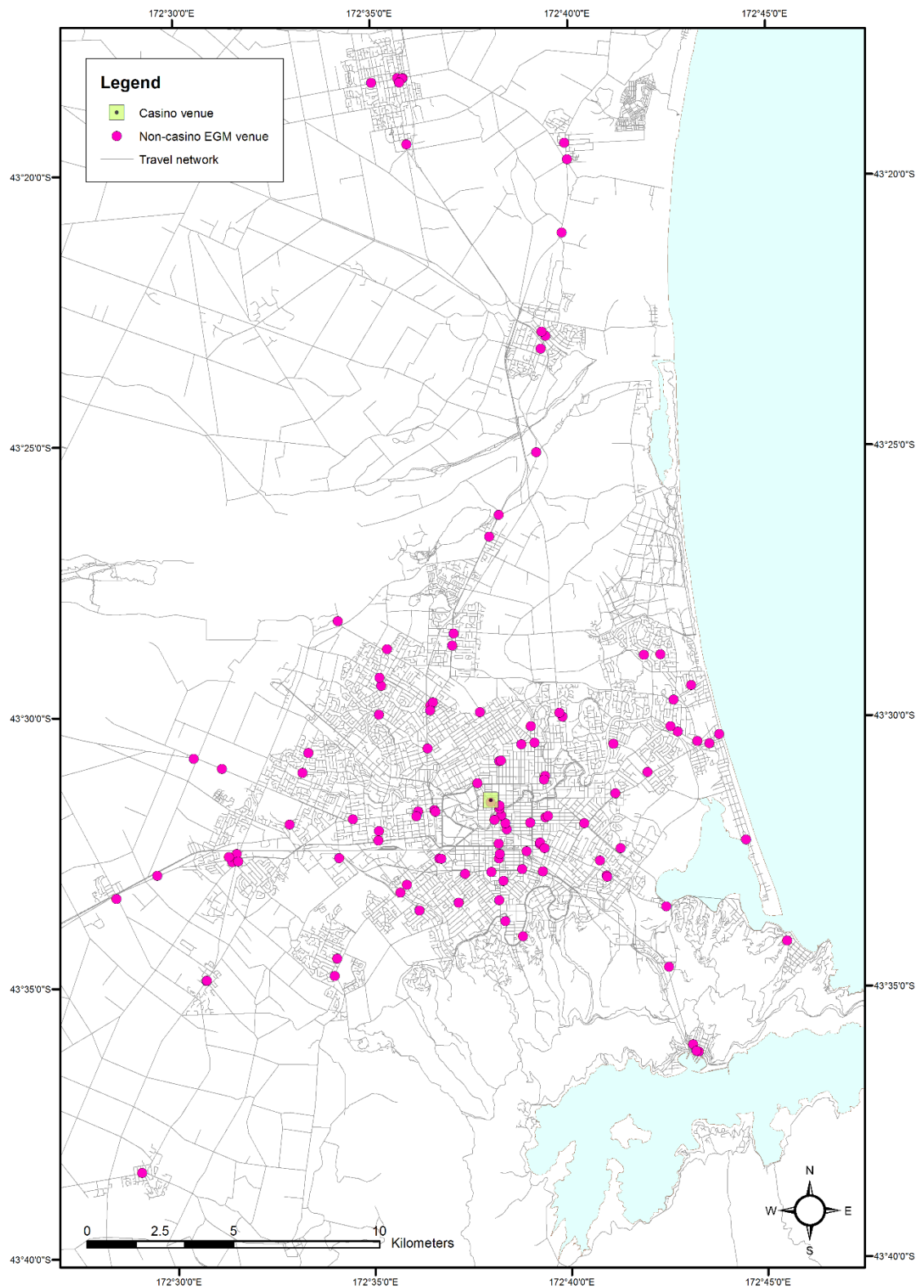


Figure 9. Map of EGM venue locations in the Christchurch urban area.

4.1.1 Measures of accessibility

Distance to the nearest casino venue

Figure 10 below displays a histogram of distances to the nearest casino venue by number of participants. More than half (51.6%) of participants lived less than or equal to 50 km away from a casino venue, while 19.2% lived more than 50 km but less than or including 200 km away. Only 29.4% of participants lived more than 200 kilometres away from a casino.

The minimum distance from a participant's address to the nearest casino was 23 metres, while the maximum distance was 506.7 km. The lower quartile distance was 13.0 km, the median distance was 45.2 km and the upper quartile was 287.0 km.

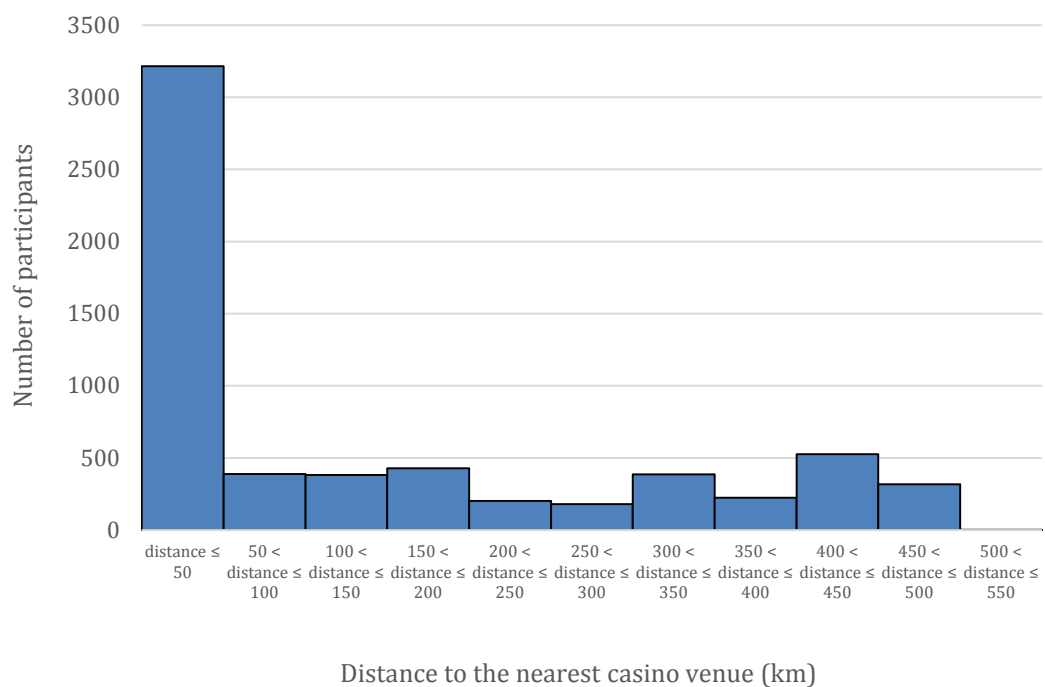


Figure 10. Histogram of distances to the nearest casino by number of participants.

Figure 11 and Figure 12 show distances to the nearest casino venue for areas in the North Island and South Island respectively. Distances to the nearest casino venue for each of the five cities that host casinos are shown in Appendix C.

It is evident that the shortest distances to casinos are located immediately around the five urban areas that contain casino venues. Due to the relatively short distance between the cities of Auckland and Hamilton, no part of the area between these two

cities was found to be more than 100 km from a casino (Figure 11). A large part of the upper North Island extending from the Bay of Islands to New Plymouth on the west coast and Opotiki on the east coast was found to be within 250 km of a casino. Similarly, a large of part of the eastern South Island extending from Kaikoura to the Southland Plains, encompassing the cities of Christchurch, Timaru, Dunedin and Invercargill, was found to be less than 250 km of a casino (Figure 12). In contrast, parts of the lower North Island, namely the Manawatu, Horowhenua and southern Wairarapa areas were found to be more than 500 km from a casino (Figure 11).

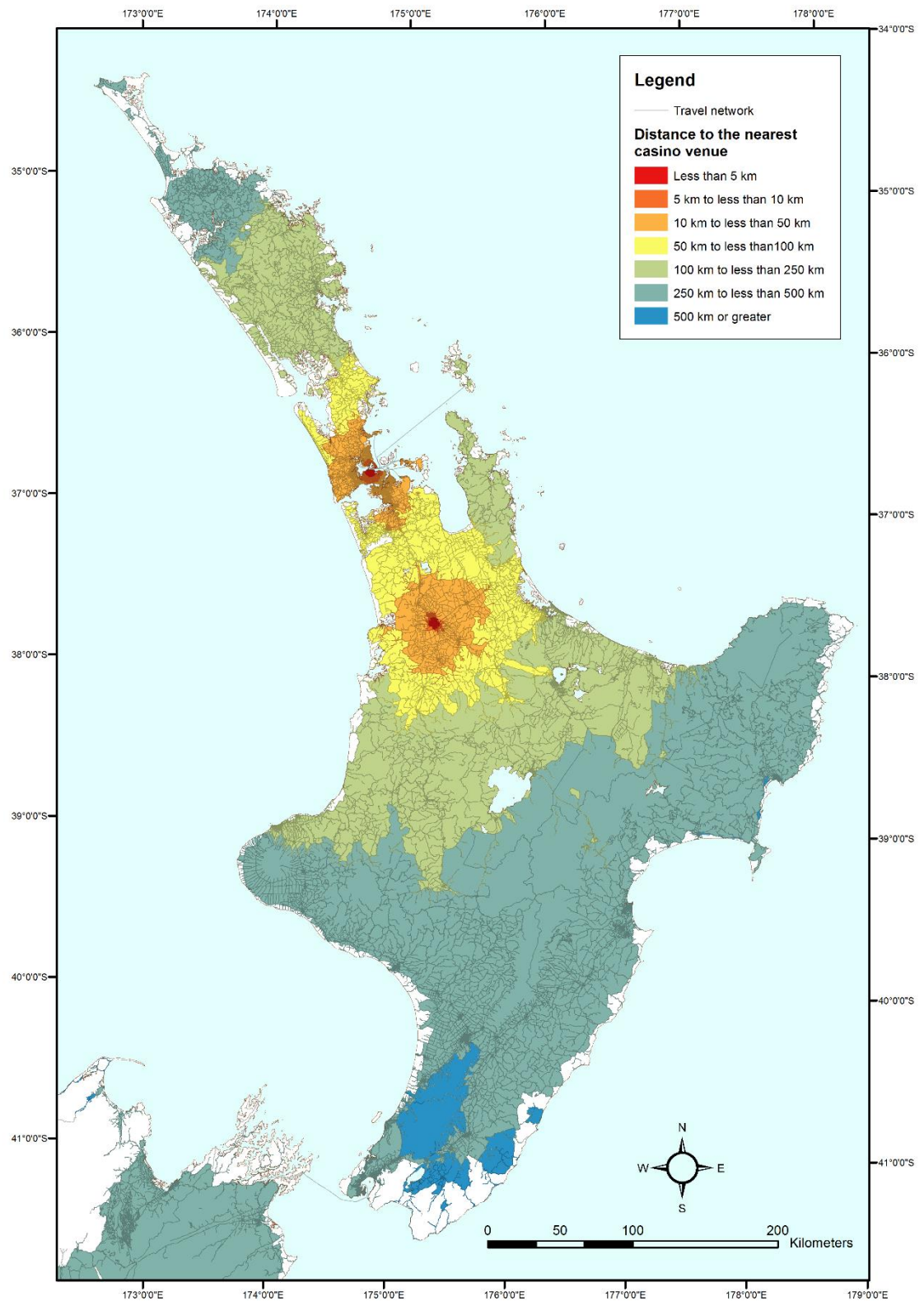


Figure 11. Map of distance to the nearest casino venue in the North Island.

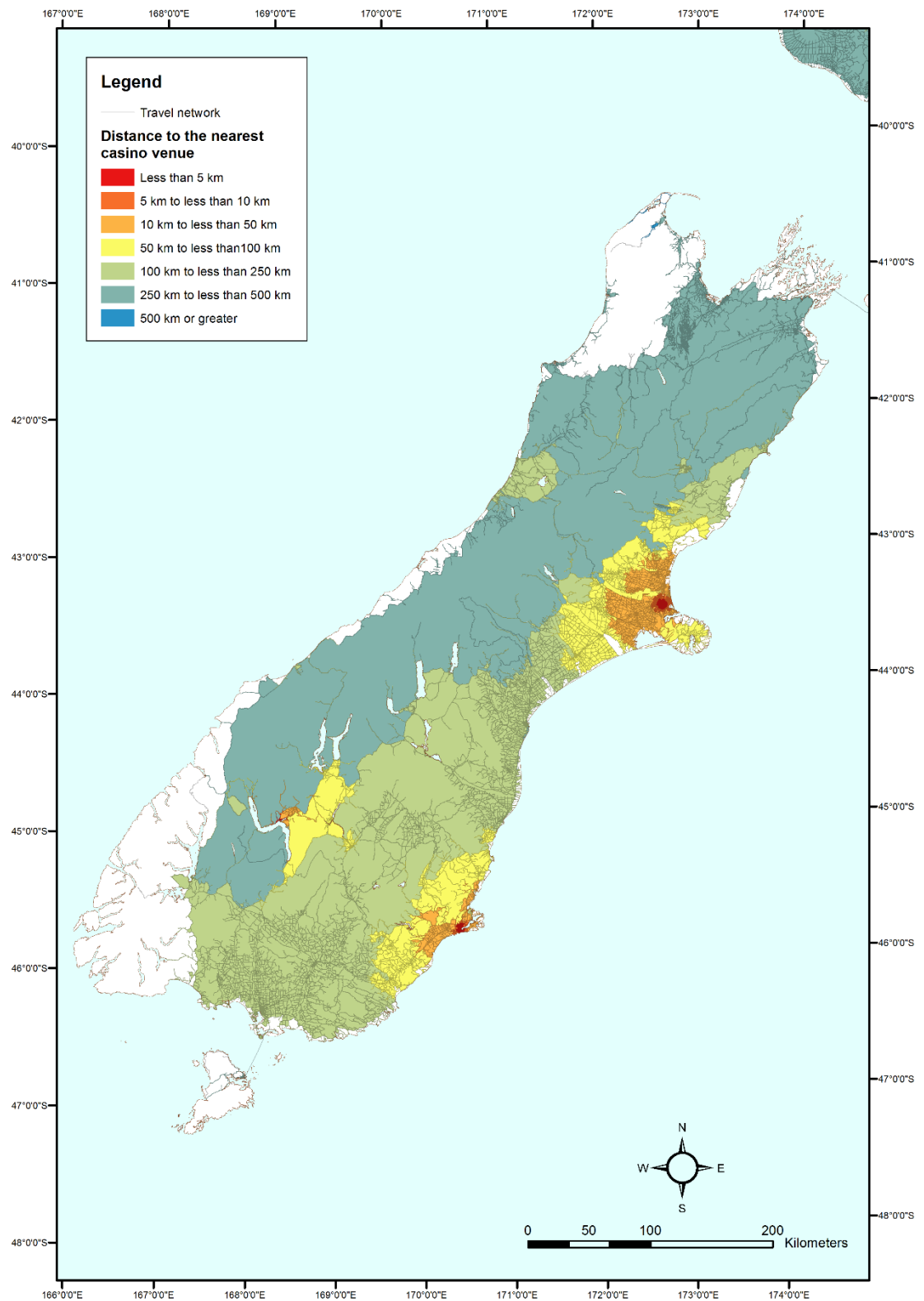


Figure 12. Map of distance to the nearest casino venue in the South Island.

Distance to the nearest non-casino EGM venue

Figure 13 displays a histogram with the number of participants for various distances to the nearest non-casino EGM venue. It was found that 37.7% of respondents lived up to one kilometre of a non-casino EGM venue, 35.2% lived between one and up to two kilometres and 10.7% lived between two and up to three kilometres of a non-casino EGM venue. Only 16.4% of participants lived more than three kilometres away from a venue. Due to the widespread distribution of non-casino venues in New Zealand, distances to the nearest non-casino venue in New Zealand are relatively small compared to those to the nearest casino (Figure 10).

The minimum distance from a participant's address to the nearest non-casino EGM was found to be 1.1 metre, while the maximum distance was 126.0 kilometres. The lower quartile distance was 780 metres, the median distance was 1.28 kilometres while the upper quartile distance was 2.14 kilometres. A full 95% of participants lived within 10 kilometres of an EGM venue, while 99.9% lived within 50 kilometres of a venue.

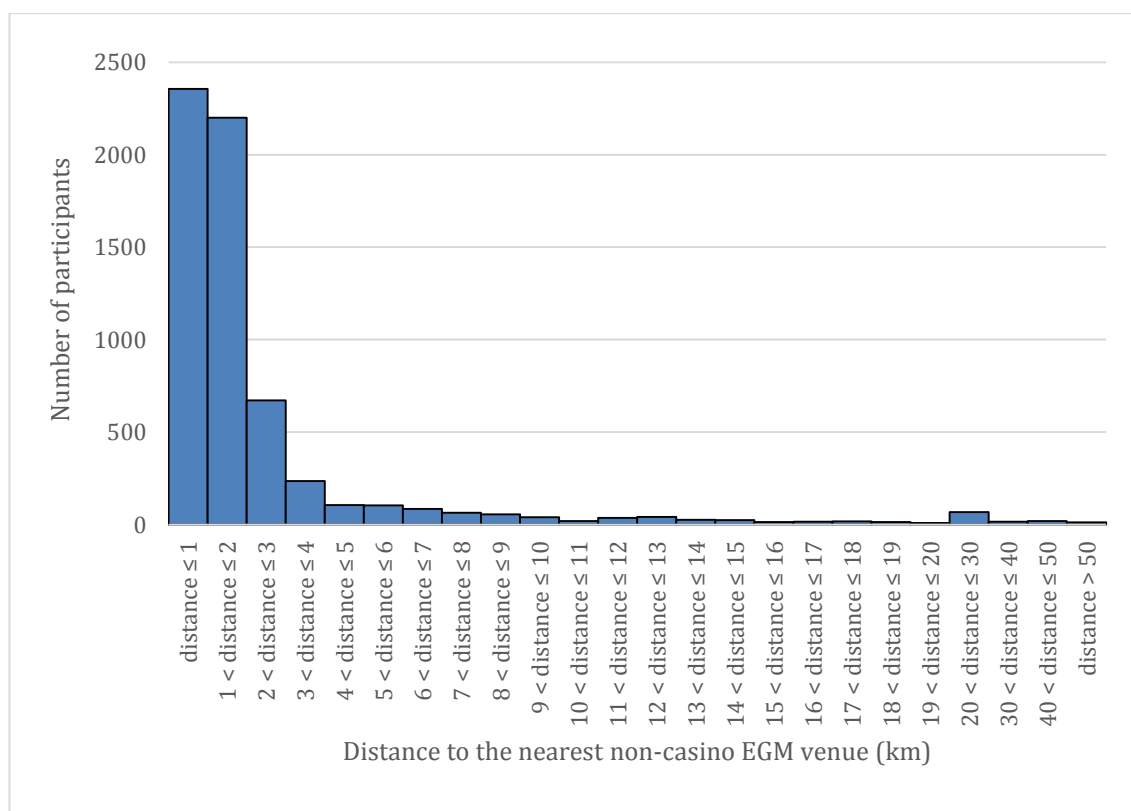


Figure 13. Histogram of distances to the nearest non-casino EGM venue by number of participants.

Figure 14 and Figure 15 show maps of distances to the nearest non-casino venues in the North Island and South Island respectively. Distances to the nearest non-casino EGM venues in the Auckland (Figure 16), Wellington (Figure 17) and Christchurch (Figure 18) urban areas are also shown. Maps showing distances to the nearest non-casino EGM venues for other cities with populations greater than 50,000 are shown in Appendix D.

From Figure 14 and Figure 15, it can be seen that the majority of rural areas, except for the most remote areas, are seen to be within 50 km from a non-casino EGM venue. Only in the most remote areas of the country, including the mountainous areas of the North Island that extend from the Ruahine Ranges northwards to the Raukumara Ranges, the King Country area and the alpine areas of the South Island, are distances to the nearest non-casino EGM venue greater than 50 km. It is also evident that the overwhelming majority of urban areas are less than five kilometres from a non-casino EGM venue (Figure 16, Figure 17, Figure 18 and maps in Appendix D).

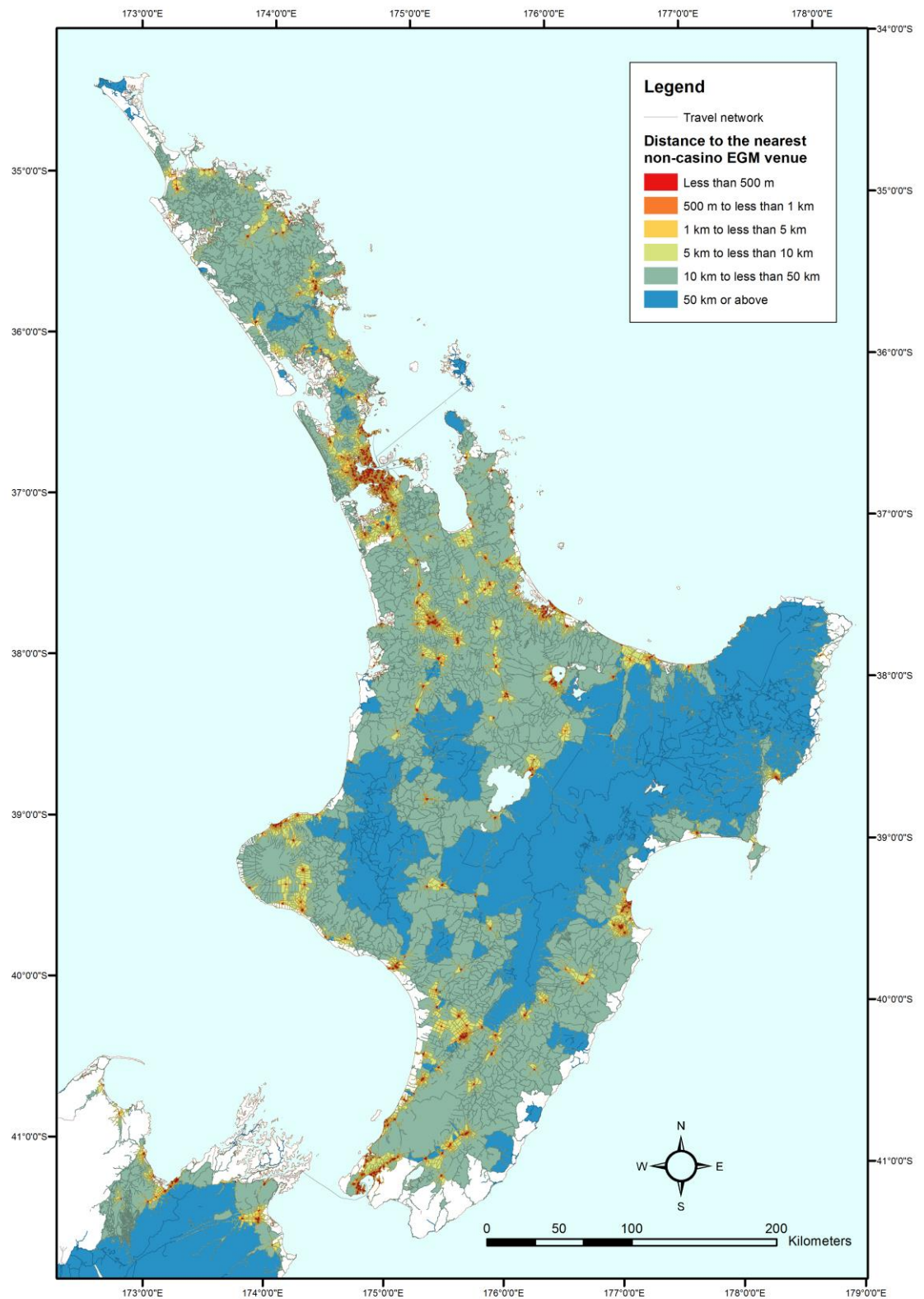


Figure 14. Map of distance to the nearest non-casino EGM venue in the North Island.

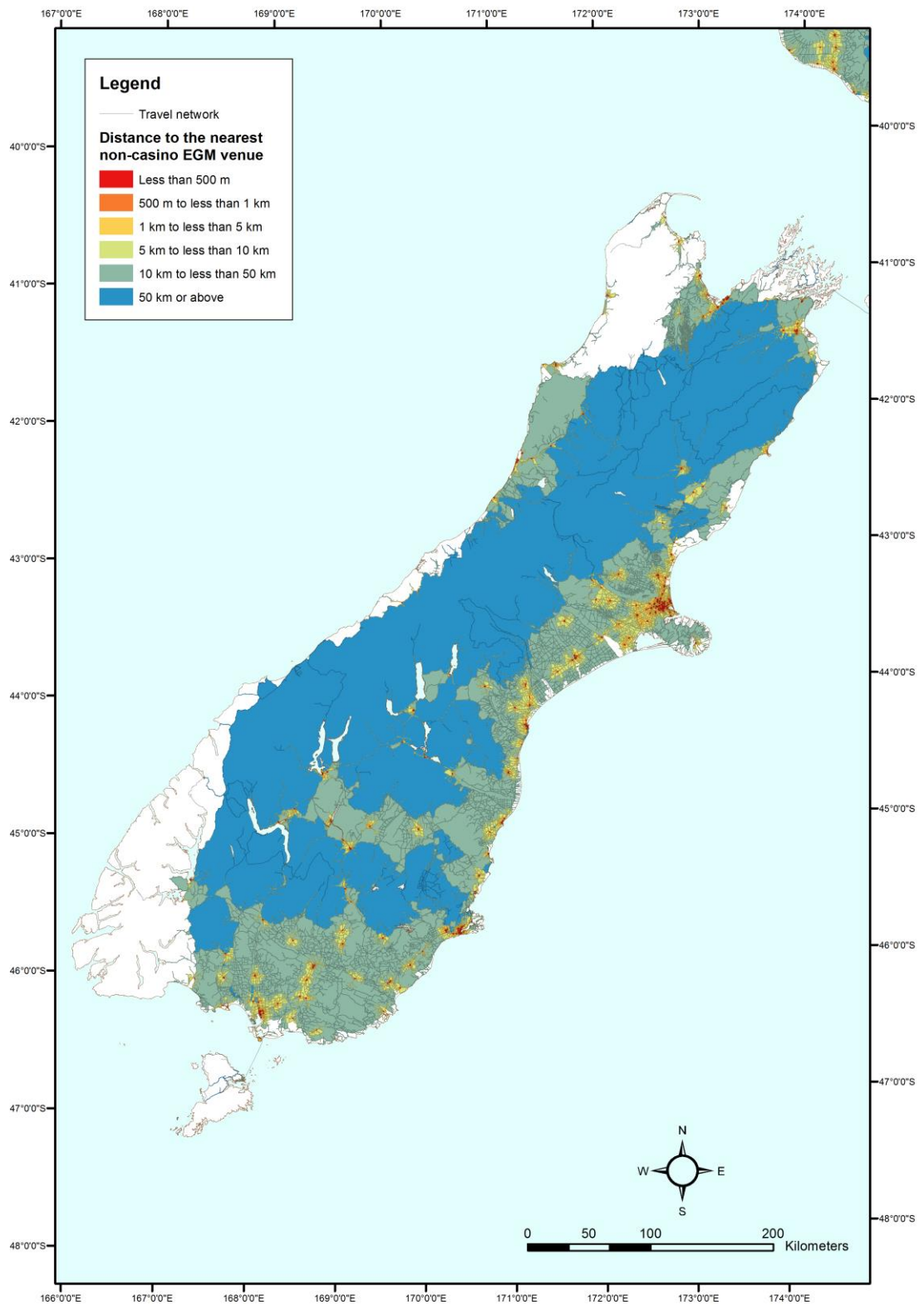


Figure 15. Map of distance to the nearest non-casino EGM venue in the South Island.

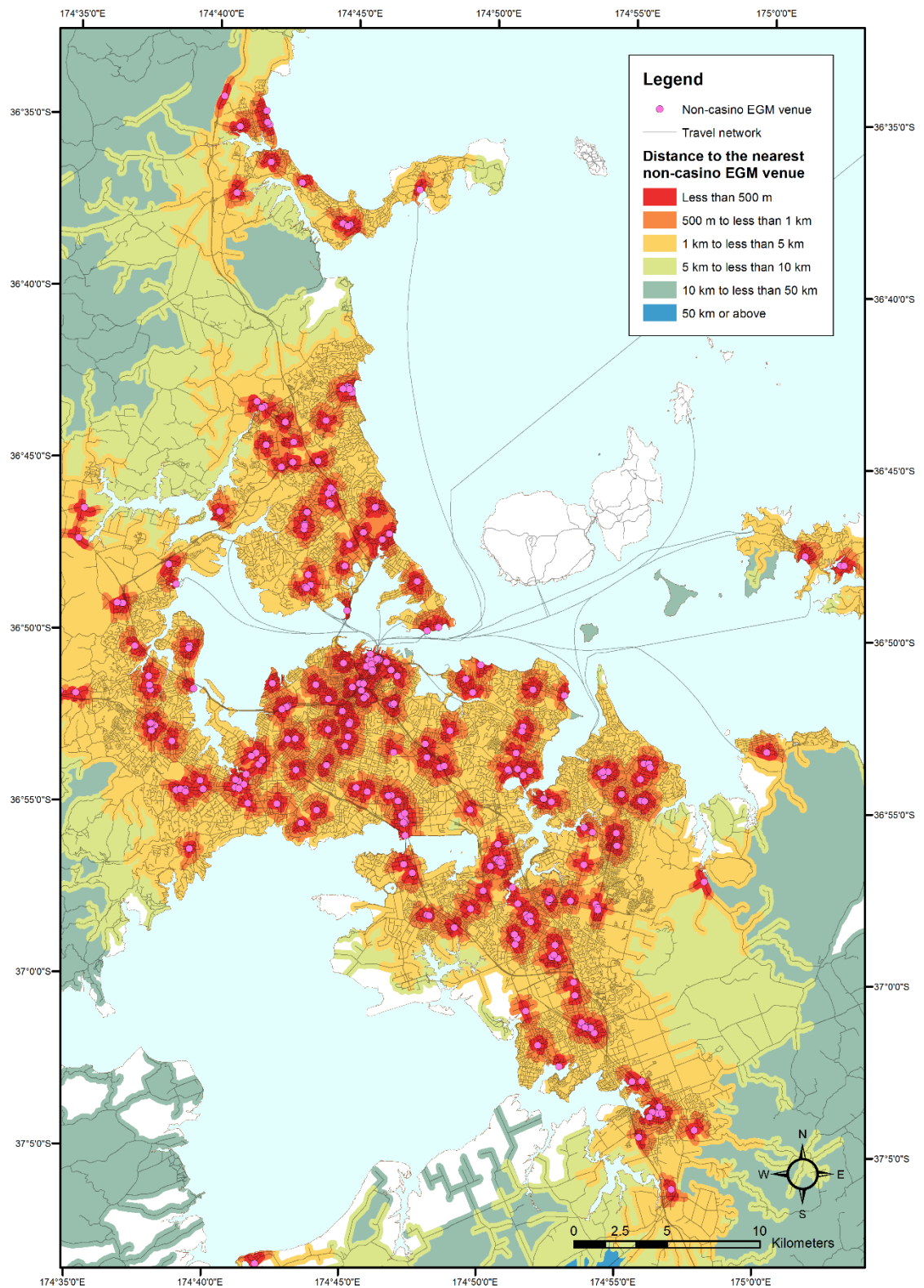


Figure 16. Map of distance to the nearest non-casino EGM venue in the Auckland urban area.

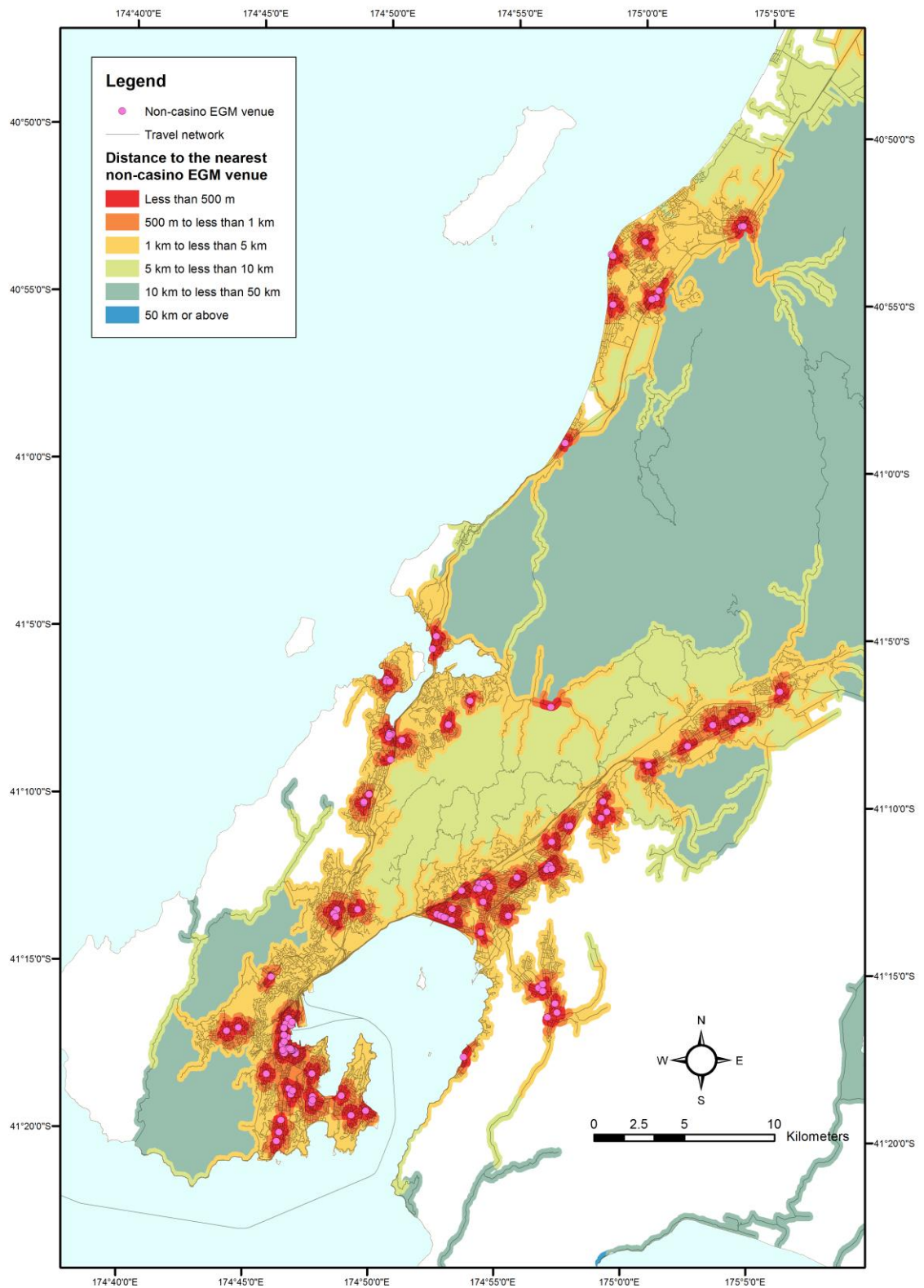


Figure 17. Map of distance to the nearest non-casino EGM venue in the Wellington urban area.

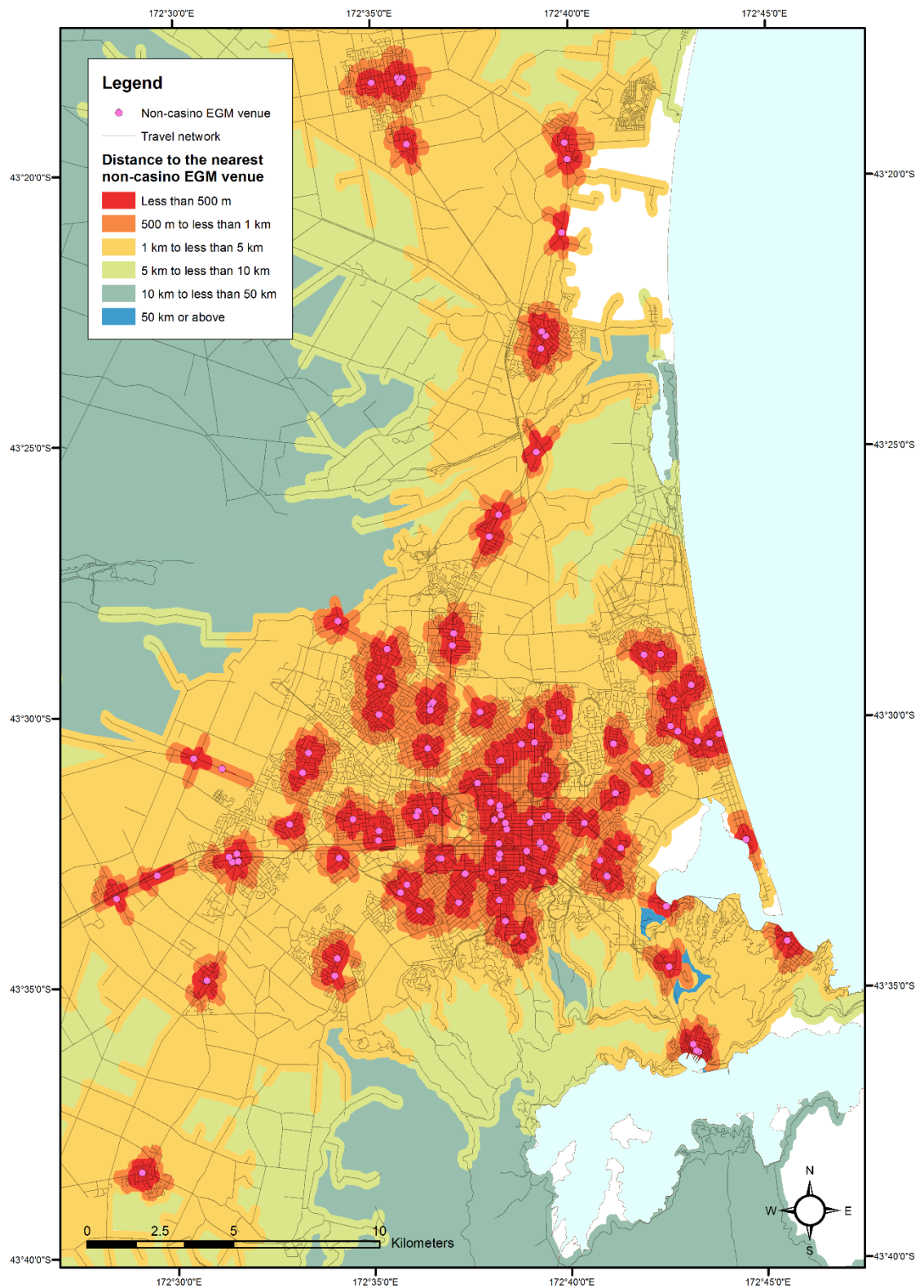


Figure 18. Map of distance to the nearest non-casino EGM venue in the Christchurch urban area.

Number of EGM venues within 500 metres of participants' addresses.

Figure 19 shows the number of EGM locations within 500 metres by number of participants. It can be seen that the overwhelming majority of participants (88.2%) did not live within 500 metres of an EGM venue, while 8.2% of participants lived within 500 metres of one venue and 1.2% of participants lived within of two venues, with the remaining 1.5% living within 500 metres of three or more venues. The maximum number of EGM venues within 500 metres for participants from the survey was found to be seven.

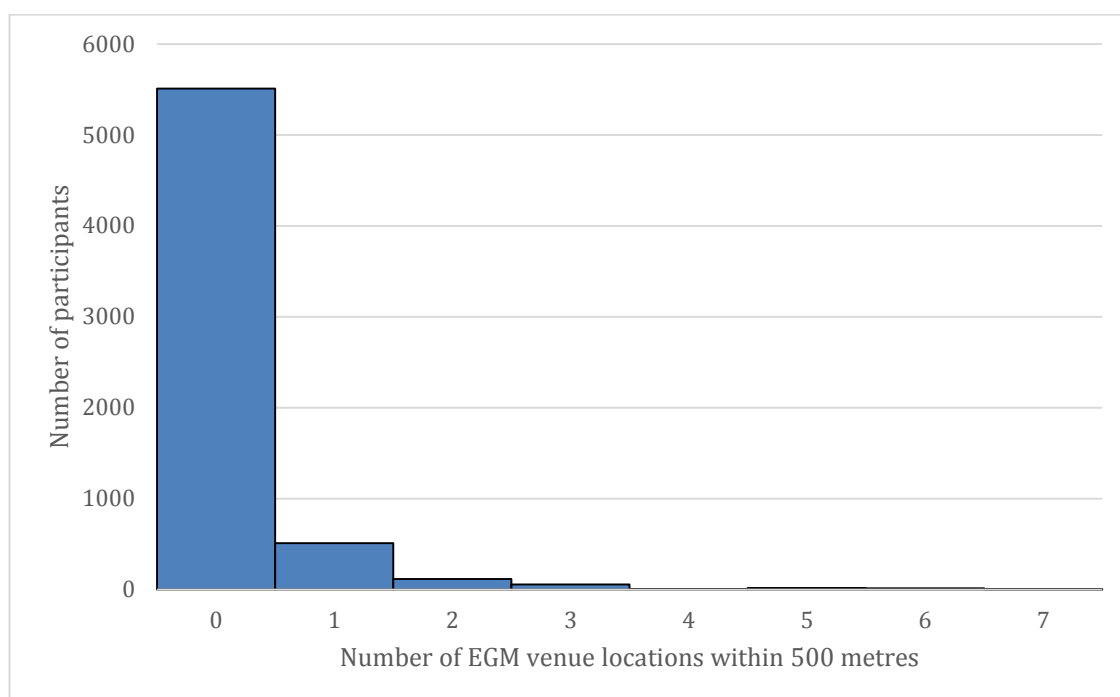


Figure 19. Histogram of the number of EGM locations within 500 metres by number of participants.

The majority of urban areas within cities were not found to be within 500 metres of any non-casino EGM venue. In the major metropolitan areas of Auckland, Wellington and Christchurch, the CBD areas were all found to contain areas with five or more venues, with numerous additional clusters of five or more venues situated in throughout the urban area of these cities. In the case of Auckland, the cluster of five or more venues in the city centre extended to include parts of Newton and Ponsonby. High concentrations of EGM venues are also seen in certain suburbs, including Onehunga, Otahuhu, Manukau, Manurewa and Papakura. In the Wellington urban area, there were relatively few areas of higher concentration outside the city centre, including Petone,

Lower Hutt, Upper Hutt and Porirua. In Christchurch, Riccarton, Hornby and Rangiora were also found to have high concentrations of EGM venues within 500 metres apart from the city centre.

In the cities of Hamilton, Tauranga and Dunedin, concentrations of EGM venues were found to be highest in their respective city centres in addition to high concentrations being seen in the suburbs of Frankton in Hamilton, Tauranga South and Mount Maunganui in Tauranga and South Dunedin in Dunedin.

In the case of regional cities, such as Palmerston North, Rotorua, Nelson, Whangarei, New Plymouth and Invercargill, areas with the highest concentrations of EGM venues within 500 metres, i.e. areas with five or more venues, were found exclusively in their city centres. In the case of Nelson, the adjoining town of Richmond was also found to contain a relatively high concentration of EGM venues.

Number of EGM venues within one kilometre of participants' addresses.

Figure 20 shows the number of EGM venue locations within one kilometre by number of participants. In terms of the spread of the number of EGM venues within one kilometre, a majority (62.1%) of participants did not have any venues within one kilometre of their residential locations. A fifth (20.0%) of participants lived within a kilometre of one EGM location, 7.6% of participants lived within a kilometre of two locations and 4.2% of participants lived within a kilometre of three locations. Only 5.7% lived within a kilometre of four or more venues. It can be seen that the number of participants decreases in an exponential manner with an increase in numbers of EGM locations within one kilometre, similarly to the case for the number of venues within 500 metres of an EGM venue.

Because the majority of participants did not live within a kilometre of an EGM venue, the minimum, lower quartile and median number of venues within a kilometre were all found to be zero. The upper quartile was found to be one venue, while the maximum number of venues that any participant lived within a kilometre from in the survey was found to be 15 venues.

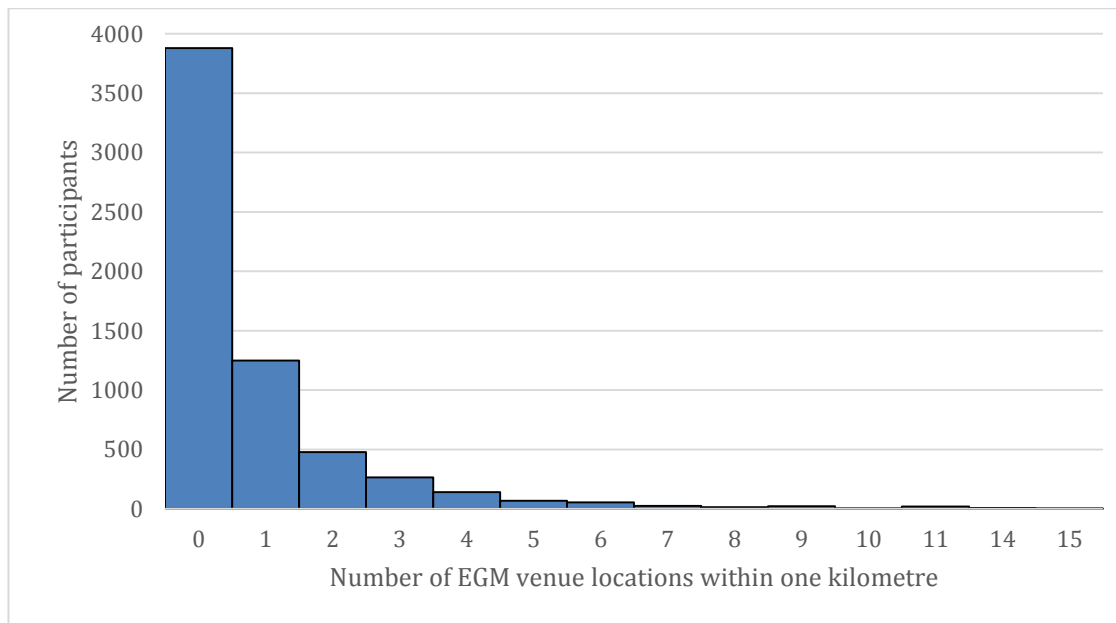


Figure 20. Histogram of the number of EGM locations within one kilometre by number of participants.

Areas with access to EGM venues within one kilometre were found to be larger and contained higher concentrations of EGMs compared to those with access to venues within 500 metres. Similar to the case with the number of EGM venues within 500 metres, the CBD areas of all major urban areas were found to have the highest concentrations of EGM venues within one kilometre.

In the Auckland urban area, a large area extending from the city centre southwards towards Newton, Grafton and Ponsonby was found to contain concentrations of six or more EGM venues within a kilometre, but in addition to the areas containing high concentrations of venues within 500 metres, the suburbs of Glenfield, Highland Park, Henderson, Massey and Somerville were also found to have high concentrations of EGMs within a kilometre. In the Wellington urban area, apart from the CBD, Petone, Lower Hutt, Upper Hutt and Porirua, the suburbs of Newton and Naenae were also found to have relatively high concentrations of EGM venues within a kilometre. In Christchurch, a larger area of the city centre was found to have high concentrations of EGM venues and in addition to the suburbs of Riccarton, Hornby and Rangiora, high concentrations of EGM venues within a kilometre were found in parts of Woolston, New Brighton, Shirley and Edgware.

Similarly, in Hamilton, Tauranga and Dunedin, more areas in addition to the city centre were found with higher concentrations of EGMs within a kilometre when

compared to those within 500 metres, with the suburbs of Greerton and Bayfair in Tauranga and Mosgiel in Dunedin also containing large concentrations of EGM venues.

In the cases of smaller regional cities, high concentrations of EGM venues were still exclusively found only in city centres, with few exceptions. In the case of Napier high concentrations were also found in the suburb of Taradale and in the case of Nelson, high concentrations were also found in the neighbouring urban centre of Richmond.

Number of EGM venues within five kilometres of participants' addresses

Figure 21 shows a graph of the number of EGM venue locations within five kilometres by number of participants. A large proportion of participants (31.9%) were found to have lived within five kilometres of five or fewer EGM venues, 15.2% had more than five but up to 10 venues, 15.9% had more than 10 but up to 15 and 13.6% had more than 15 but up to 20 venues. The remaining 23.4% of participants had more than 20 venues within five kilometres. The maximum number of venues within five kilometres from a participant was found to be 50 venues. The lower quartile was four venues, the median was 11 venues and the upper quartile was 20 venues.

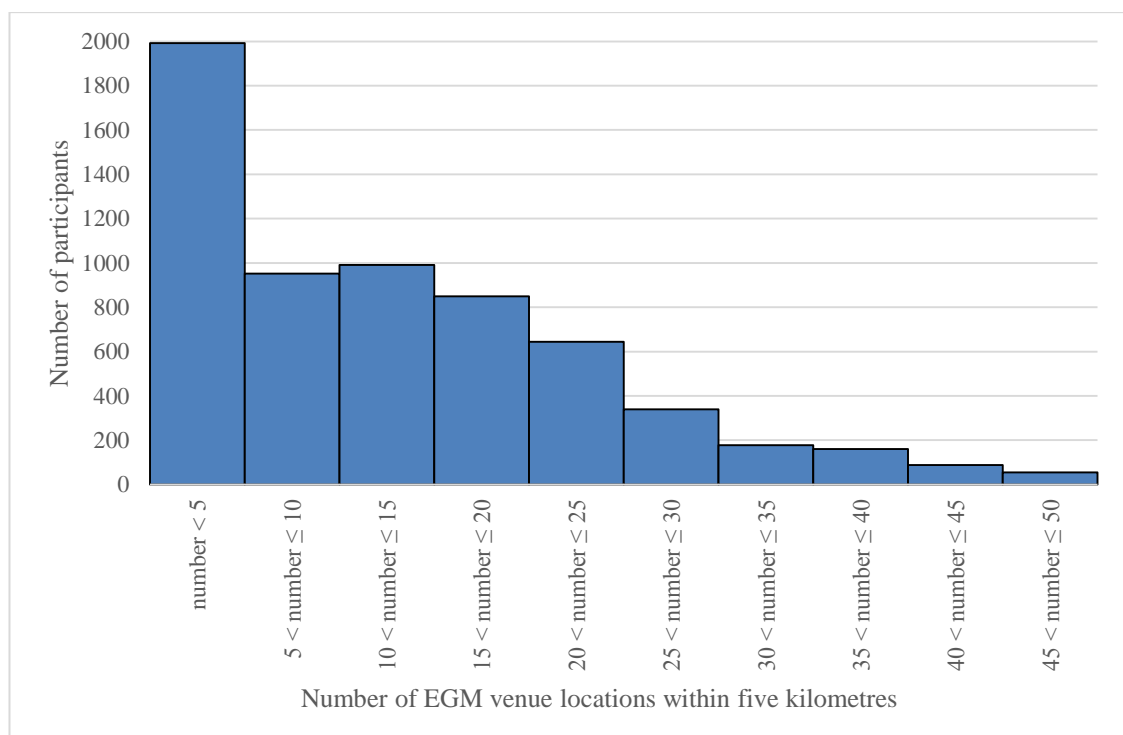


Figure 21. Histogram of the number of EGM locations within five kilometres by number of participants.

Maps showing the number of venues within five kilometres in the Auckland, Wellington and Christchurch urban areas are shown in Figure 22, Figure 23 and Figure 24 respectively. Maps showing the number of venues within five kilometres for urban areas with populations of 50,000 or greater are shown in Appendix E.

Strong urban-rural contrasts were found in terms of the geography of the number of venues within five kilometres. The highest densities of venues within this distance were found in areas containing large populations. Areas with 21 or more venues were found in the urban areas of Auckland, Wellington and Christchurch, Hamilton, Tauranga, Dunedin, Palmerston North, Rotorua, and Napier. Areas having between 11 and up to 20 venues were found in the cities mentioned above, as well as in the urban areas of Whangarei, Taupo, Gisborne, Napier, Hastings, New Plymouth, Whanganui, Nelson, Timaru and Invercargill. The majority of the remaining smaller urban areas not mentioned above were found to have between six to up to ten venues, with most rural service centres having between one and up to five venues.

It can be seen that the almost the entire urban area in Auckland (Figure 22) and Christchurch (Figure 24) were found to have at least six venues within reach of five kilometres.

In Auckland, most of the western part of the Auckland isthmus, the eastern part of West Auckland, the central part of the North Shore and the northern part of South Auckland were found to contain 21 or more venues within five kilometres. In Wellington (Figure 23), only areas around the CBD and parts of Lower Hutt extending from Petone to Lower Hutt central were found to have these concentrations, while the majority of areas in Porirua and the remaining areas of Lower Hutt were found to have between 11 and 20 EGMs within five kilometres. The highest concentrations of venues in Upper Hutt and the Kapiti Coast area within this distance were found to be between six and ten venues, while the suburbs of Johnsonville, Tawa and Whitby, as well as Raumati and Waikanae in the Kapiti Coast were found to have between two to five EGM venues within five kilometres. In Christchurch, areas with 21 or more venues within five kilometres were found in an approximately circular area radiating from the CBD, extending from Papanui in the north to Spreydon in the south and from Upper Riccarton in the west to Linwood in the east. Densities of venues were generally found to decrease with increasing distance away from the Christchurch CBD area.

In the cities of Hamilton (Figure 65), Tauranga (Figure 66) and Dunedin (Figure 67), concentrations of 21 or more venues within five kilometres were found in their respective city centres only. The cities of Palmerston North (Figure 71), Rotorua (Figure 69) and Napier (Figure 70) were also found to contain concentrations of 21 or more venues. Napier was found to be an anomaly in comparison to other cities where 21 or more venues were found primarily in their city centres, where this density of high concentration was found to be centred on the suburb of Pirimai due to having access to large numbers of venues in both the Napier's city centre and the suburb of Taradale.

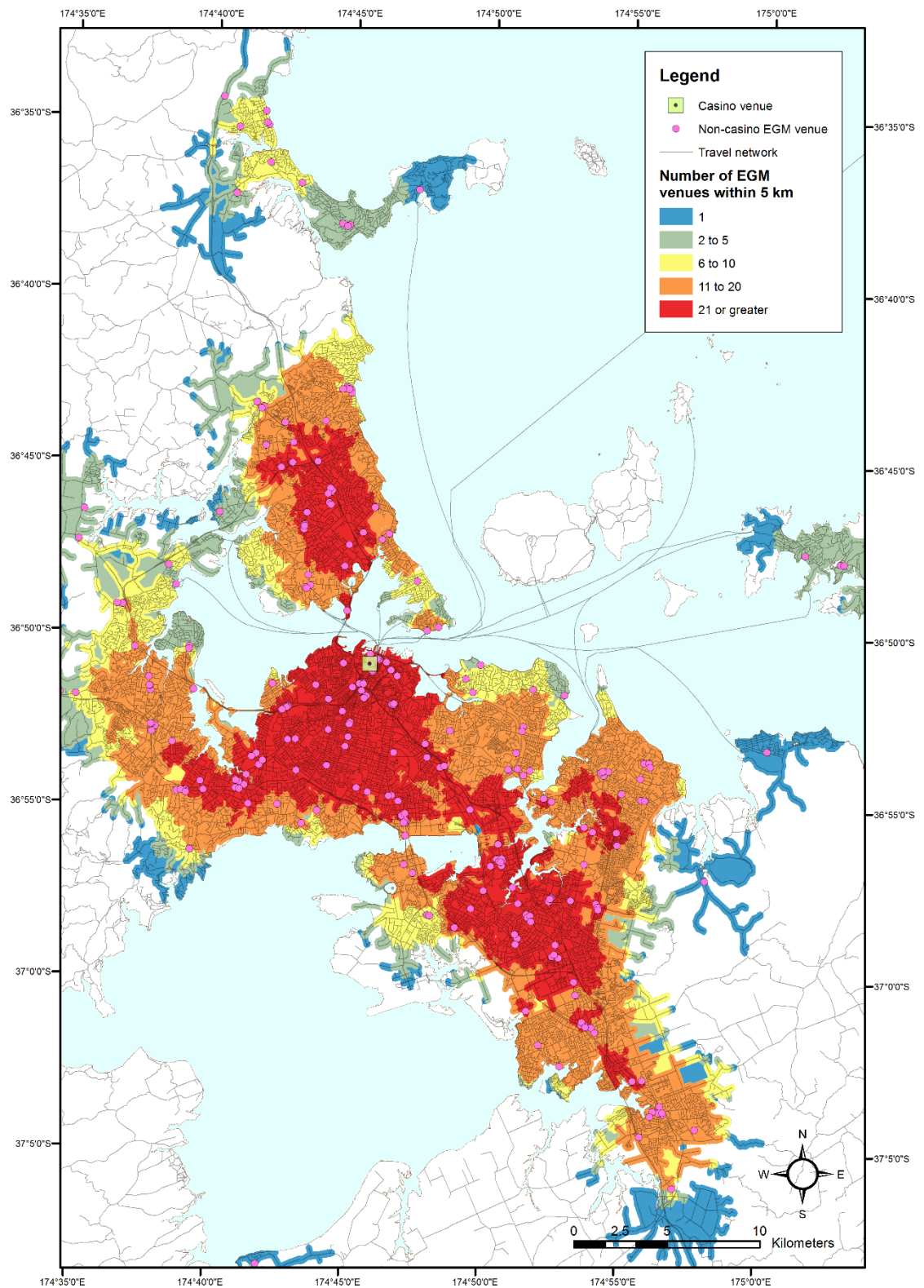


Figure 22. Map of the number of EGM venues within five kilometres in the Auckland urban area.

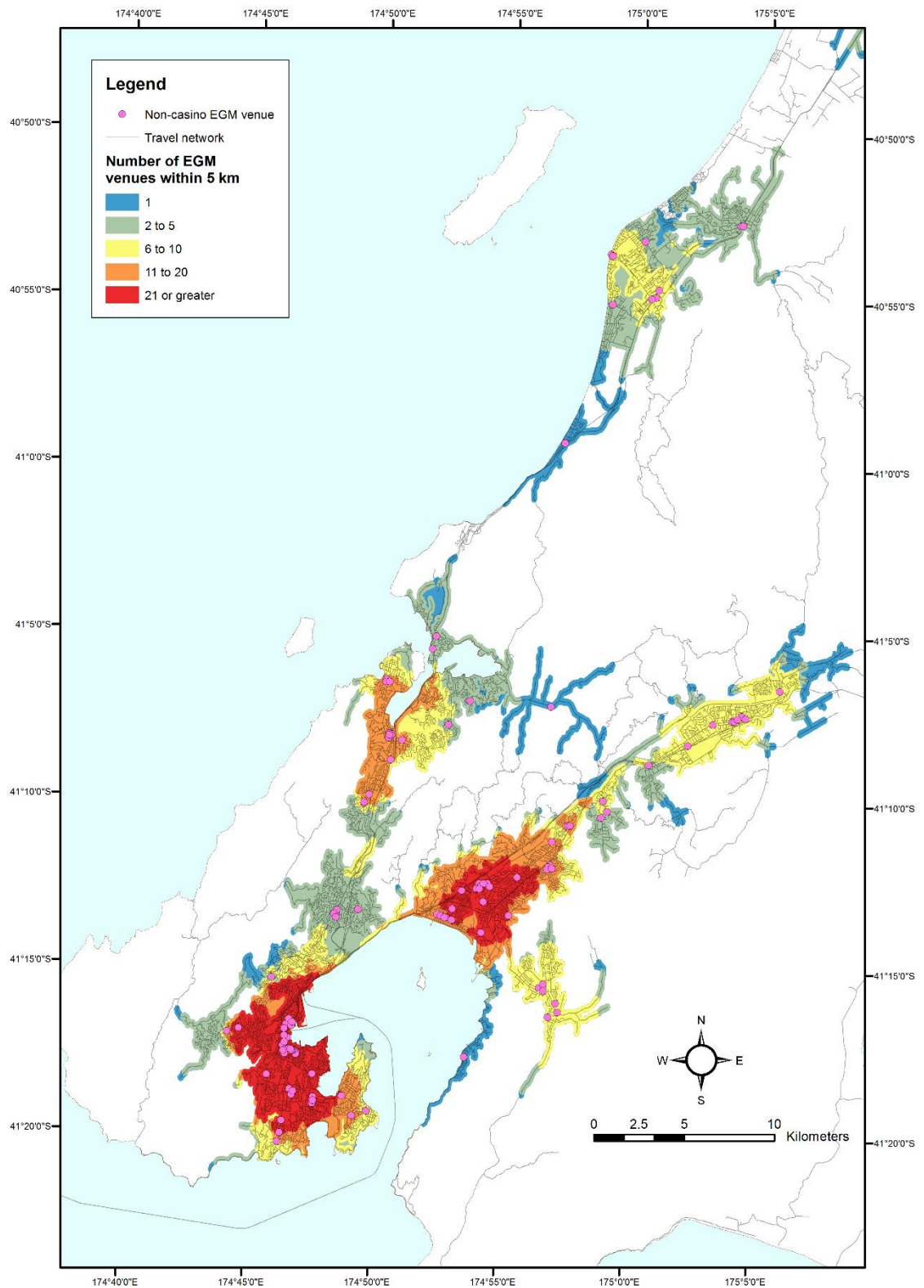


Figure 23. Map of the number of EGM venues within five kilometres in the Wellington urban area.

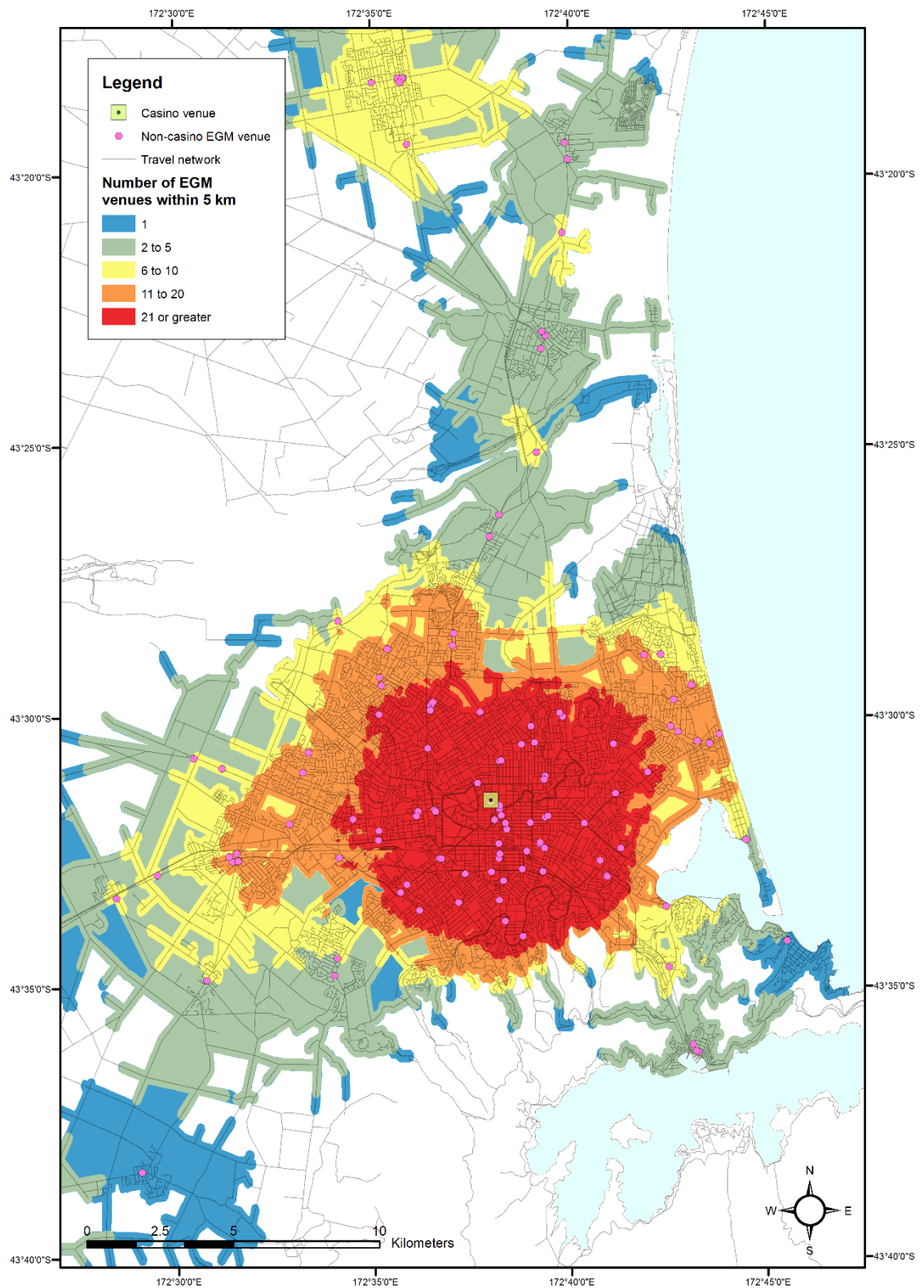


Figure 24. Map of the number of EGM venues within five kilometres in the Christchurch urban area.

Number of EGM venues within 10 kilometres of participants' addresses

Figure 25 shows the number of EGM venues within 10 kilometres by number of participants. There was a much greater spread for the number of EGM venues within 10 kilometres when compared to the number of venues of other distances. A large proportion of participants lived with 10 or fewer venues within this distance (29.7%), while 14.0% of participants had more than 10 but up to 20 venues, 10.5% had more than 20 but up to 30 venues, 14.4% had more than 30 but up to 40 venues and 6.1% had more than 40 but up to 50 venues. The remaining 25.3% had more than 50 venues. The lower quartile was 8 venues, the median was 27 venues and the upper quartile was 51 venues. The maximum number of venues for a participant in the study was 111 venues.

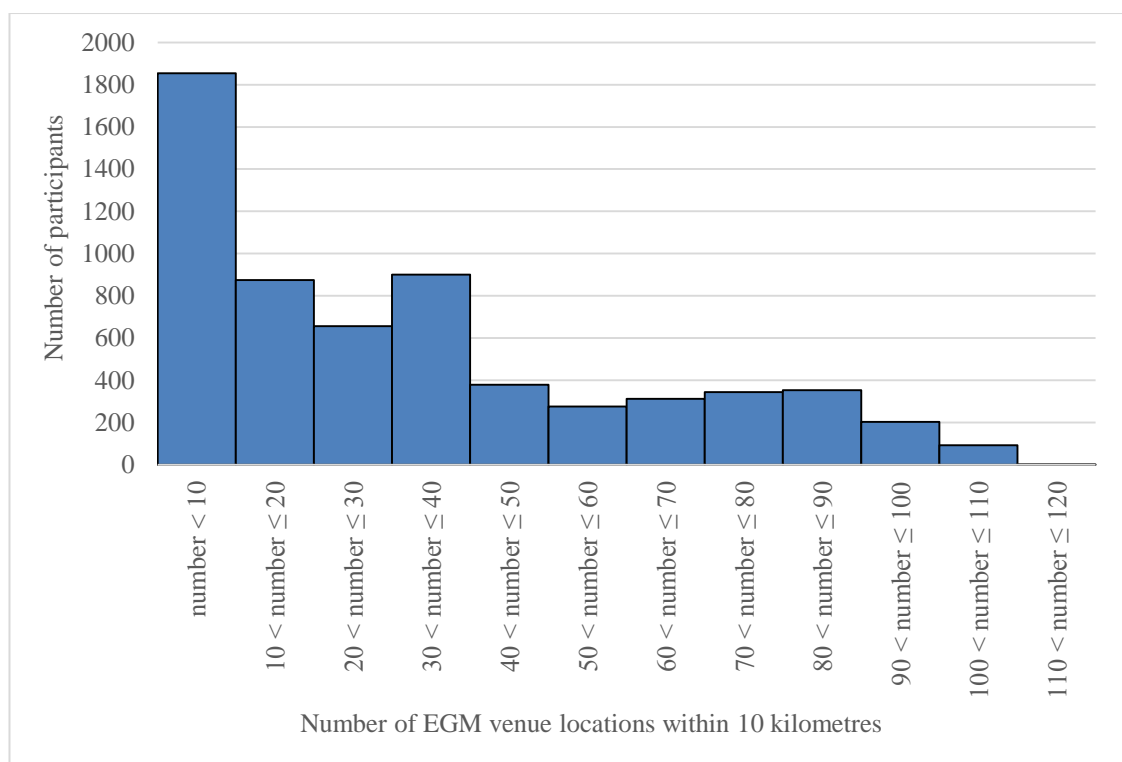


Figure 25. Histogram of the number of EGM locations within 10 kilometres by number of participants.

Strong urban-rural contrasts were found in terms of the geography of the number of venues within 10 kilometres, with the highest densities of venues within this distance found in areas containing large populations. Areas with more than 50 venues were found only in the Auckland, Wellington and Christchurch urban areas. Areas having between 26 and up to 50 venues were found in the three largest cities as well as Hamilton, Tauranga, Dunedin, Palmerston North, Rotorua, Nelson and a section of rural

land between Napier and Hastings. Areas between six and up to 25 venues were found in the cities mentioned above, and also in the smaller towns of Kaitia, Kerikeri, Whangarei, Pukekohe, Thames, Ngaruawahia, Cambridge, Te Awamutu, Tokoroa, Taupo, Te Puke, Whakatane, Gisborne, Napier, Hastings, New Plymouth, Stratford, Hawera, Levin, Feilding, Masterton, Carterton, Blenheim, Greymouth, Westport, Ashburton, Temuka, Timaru, Oamaru, Gore and Invercargill. The majority of smaller towns contained five or fewer venues, with most rural service centres having one or two venues.

Only the Auckland and Christchurch urban areas along with a small part of the Wellington urban area contain concentrations of 51 or greater EGM venues within 10 kilometres. In Auckland, a majority of the isthmus and upper South Auckland, along with the adjoining part of West Auckland and the lower North Shore were found to have access to 51 or more venues, as did the majority of the Christchurch urban area. In Wellington, only a small stretch of the Ngauranga Gorge has access to 51 or more venues within 10 kilometres.

The majority of the remainder of the urban areas of Auckland and Christchurch were found to have between 26 and up to 50 venues within 10 kilometres. In contrast, in the Wellington urban area, only the urban parts of Wellington City and Lower Hutt City were found to have these concentrations, while a majority of urban areas in Upper Hutt and Porirua Cities and the Kapiti urban area were found to have between six and 25 venues within 10 kilometres.

Almost the entirety of the urban areas of Hamilton, Dunedin and Palmerston North were found to have between 26 and up to 50 venues within 10 kilometres, while the majority of the Tauranga urban area except for suburbs in the southern fringes, were found to contain this concentration. Apart from these cities, the urban area of Nelson, a small area extending from the city centre of Rotorua to the suburb of Ngongotaha and a stretch of area between Napier and Hastings were the only other places found to contain between 26 and up to 50 venues within 10 kilometres. The remainder of other urban areas were found to have between six and up to 25 EGM venues within 10 kilometres.

4.2 Statistical analysis

4.2.1 Past-year gambling on any activity

Logistic regression tests

Table 11 shows the results of the logistics regression test examining the effect of the five demographic variables on past-year gambling status on any activity. Participants' age group and prioritised ethnicity were found to be significantly associated with past-year gambling status, while sex, neighbourhood deprivation and individual deprivation were found to be not important for general gambling. In particular, people in the 40 to 49 years old and 50 to 65 years old age groups were found to be 45% and 35% respectively more likely to have gambled compared to the reference 20 to 29 years old age group, while the 18-19 years old age group was found to be only half as likely (49% less likely) to have gambled in the past year compared to this group. Compared to the European ethnic group, those identifying as Māori were more 25% more likely to have gambled in the past year and those identifying as Asian or Pacific were less 68% and 38% respectively less likely to have gambled during the past year.

Table 11. Logistic regression test result examining the effect of various demographic variables on past-year gambling.

Variable	Category	OR	95% confidence intervals		p-value
			2.50%	97.50%	
Sex	Males	1.00			0.73
	Females	0.98	0.86	1.11	
Age group	18 to 19	0.51	0.37	0.70	< 0.0001*
	20 to 29	1.00			
	30 to 39	1.20	0.97	1.48	
	40 to 49	1.45	1.18	1.80	
	50 to 64	1.35	1.11	1.65	
	65 and above	0.96	0.79	1.17	
Prioritised ethnicity	European/other	1.00			< 0.0001*
	Asian	0.32	0.27	0.39	
	Māori	1.25	1.00	1.58	
	Pacific Island	0.62	0.48	0.81	
Neighbourhood deprivation	Decile 1	1.00			0.058
	Decile 2	0.84	0.62	1.14	
	Decile 3	0.63	0.47	0.84	
	Decile 4	0.72	0.53	0.97	
	Decile 5	0.73	0.53	0.98	
	Decile 6	0.71	0.52	0.97	
	Decile 7	0.76	0.56	1.02	
	Decile 8	0.74	0.54	1.0	
	Decile 9	0.99	0.72	1.38	
	Decile 10	0.77	0.56	1.06	
Individual deprivation	Group 1	1.00			0.13
	Group 2	0.93	0.79	1.09	
	Group 3	0.82	0.68	1.01	
	Group 4	0.84	0.67	1.06	
	Group 5	0.75	0.54	1.05	

Table 12 shows results of logistic regression tests examining the effect of the two distance and four density variables on past-year gambling status on any gambling activity, after each test was corrected for the demographic variables in Table 11. In terms of geospatial variables, it can be seen that after correcting for the five demographic variables, only distance to the nearest casino was found to be a significant factor in predicting past-year gambling, while distance to the nearest non-casino EGM venue and the four density variables were not found to be significant. Compared to the

quartile of participants living furthest away from a casino, participants living in the quartile closest to a casino were found to be 10% less likely to have gambled on any activity in the past year, while those living in the second-closest quartile were found to be 19% less likely to have gambled in any activity during the past year. Those in the third-closest quartile were found to be 10% more likely to have gambled in the past year compared to participants in the quartile furthest away from a casino.

Table 12. Logistic regression test examining the effects of various distance and density variables on past-year gambling.

Explanatory variable		OR	95% confidence intervals		Type III test p-value
			2.50%	97.50%	
Distance to the nearest casino (km)	< 13.0 km	0.90	0.75	1.08	0.011*
	13.0 to 45.3 km	0.81	0.80	0.82	
	45.3 to 287.0 km	1.10	1.11	1.10	
	287.0 to 507 km	1.00			
Distance to the nearest non-casino EGM venue (km)	< 0.784 km	1.18	0.98	1.43	0.20
	0.784 to 1.28 km	1.00	1.00	1.01	
	1.28 to 2.14 km	0.99	0.99	1.00	
	2.14 to 127.0 km	1.00			
Number of EGMs within 500 m	0	1.00			0.29
	1	1.20	0.95	1.55	
	2 or above	1.12	0.77	1.69	
Number of EGMs within 1 km	0	1.00			0.92
	1	1.04	0.88	1.23	
	2	0.99	0.77	1.28	
	3 or above	1.07	0.85	1.35	
Number of EGMs within 5 km	0	1.00			0.78
	1 to 5	0.94	0.74	1.19	
	6 to 10	1.08	0.84	1.39	
	11 to 20	1.02	0.81	1.28	
	21 or above	0.98	0.77	1.25	
Number of EGMs within 10 km	0	1.00			0.098
	1 to 5	0.94	0.68	1.29	
	6 to 25	1.15	0.84	1.54	
	26 to 50	1.07	0.78	1.44	
	51 or above	0.91	0.66	1.23	

Note: Each test is adjusted for sex, age group, prioritised ethnicity, neighbourhood deprivation and individual deprivation only.

Logistic regression model

Table 13 shows the results of the stepwise logistic regression model predicting past-year gambling status after correcting for individuals' sex, age group, ethnicity, neighbourhood deprivation and individual deprivation. The model with the best fit was found to have distance to the nearest casino as the only significant variable in predicting past-year gambling status. The odds ratios, confidence intervals and p-value associated with this variable are therefore the same as those in Table 12 since only this variable was found to be significantly correlated with past-year gambling.

Table 13. Logistic regression model predicting past-year gambling.

Explanatory variable	Category	OR	95% confidence intervals		p-value
			2.50%	97.50%	
Distance to the nearest casino (km)	< 13.0 km	0.90	0.75	1.08	0.011
	13.0 to 45.3 km	0.81	0.80	0.82	
	45.3 to 287.0 km	1.10	1.11	1.10	
	287.0 to 507 km	1.00			

Note: Results have been corrected for participants' sex, age group, prioritised ethnicity, neighbourhood deprivation and individual deprivation.

Maps of the results of the best-fit logistic regression model in Table 13 showing relative risk of gambling on any activity during the past year applied to areas in the North Island and the South Island are shown in Figure 26 and Figure 27 respectively.

Both Figure 26 and Figure 27 show that areas immediately surrounding the six casinos in Auckland, Hamilton, Christchurch, Dunedin and Queenstown which represent the quartile of participants closest to a casino (coloured in light green) and areas representing the quartile of participants living between 13.0 km to 45.3 km from a casino (coloured in blue) have a slightly lower risk of having gambled in any gambling activity compared to the quartile of participants living furthest away from a casino (coloured in orange). In contrast, areas represented by the quartile of participants living between 45.3 km to 287.0 km from a casino (coloured in red) were found to have a highest risk of having gambled in any form compared to the quartile of participants living furthest away.

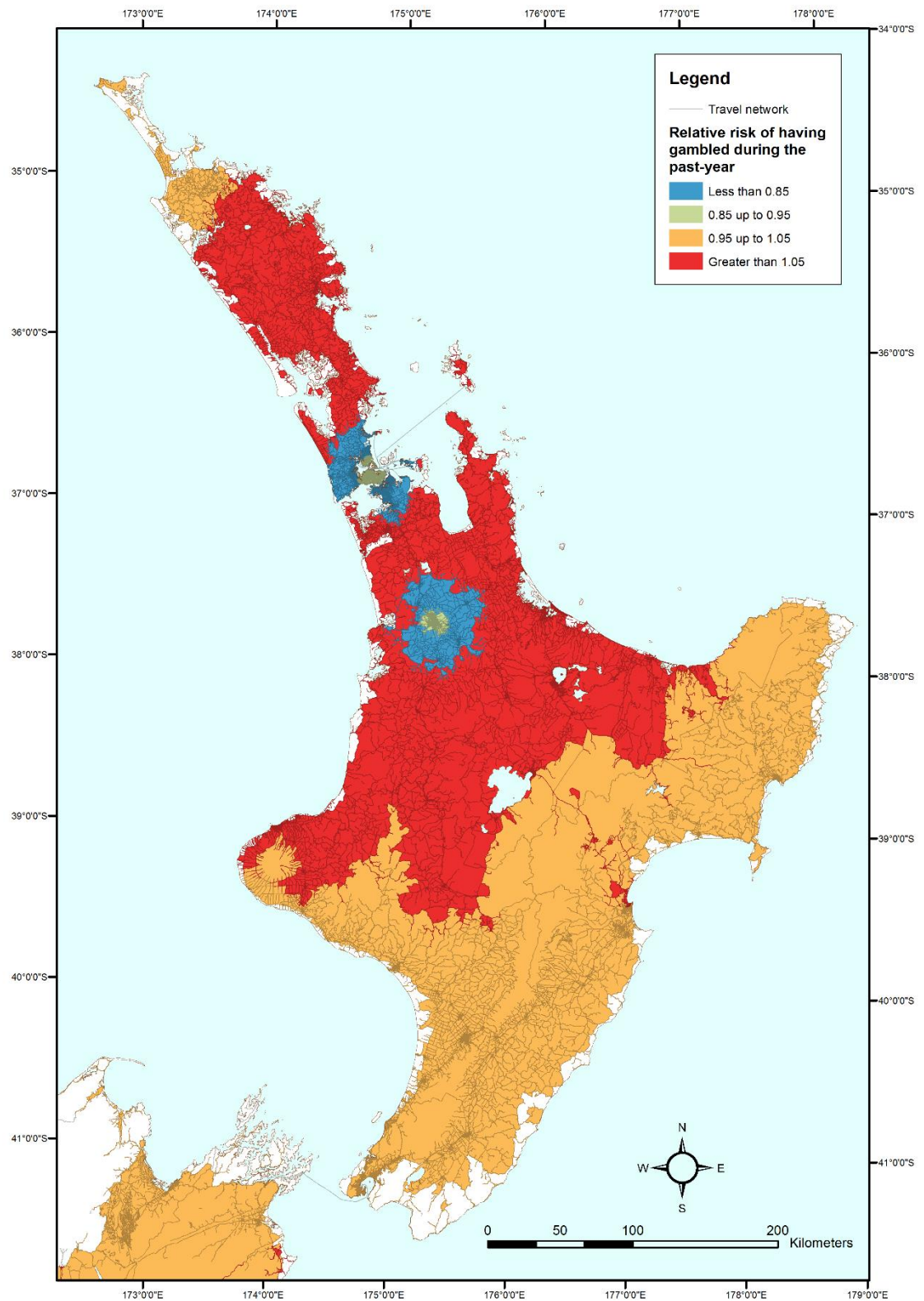


Figure 26. Map of relative risk of past-year gambling in the North Island.

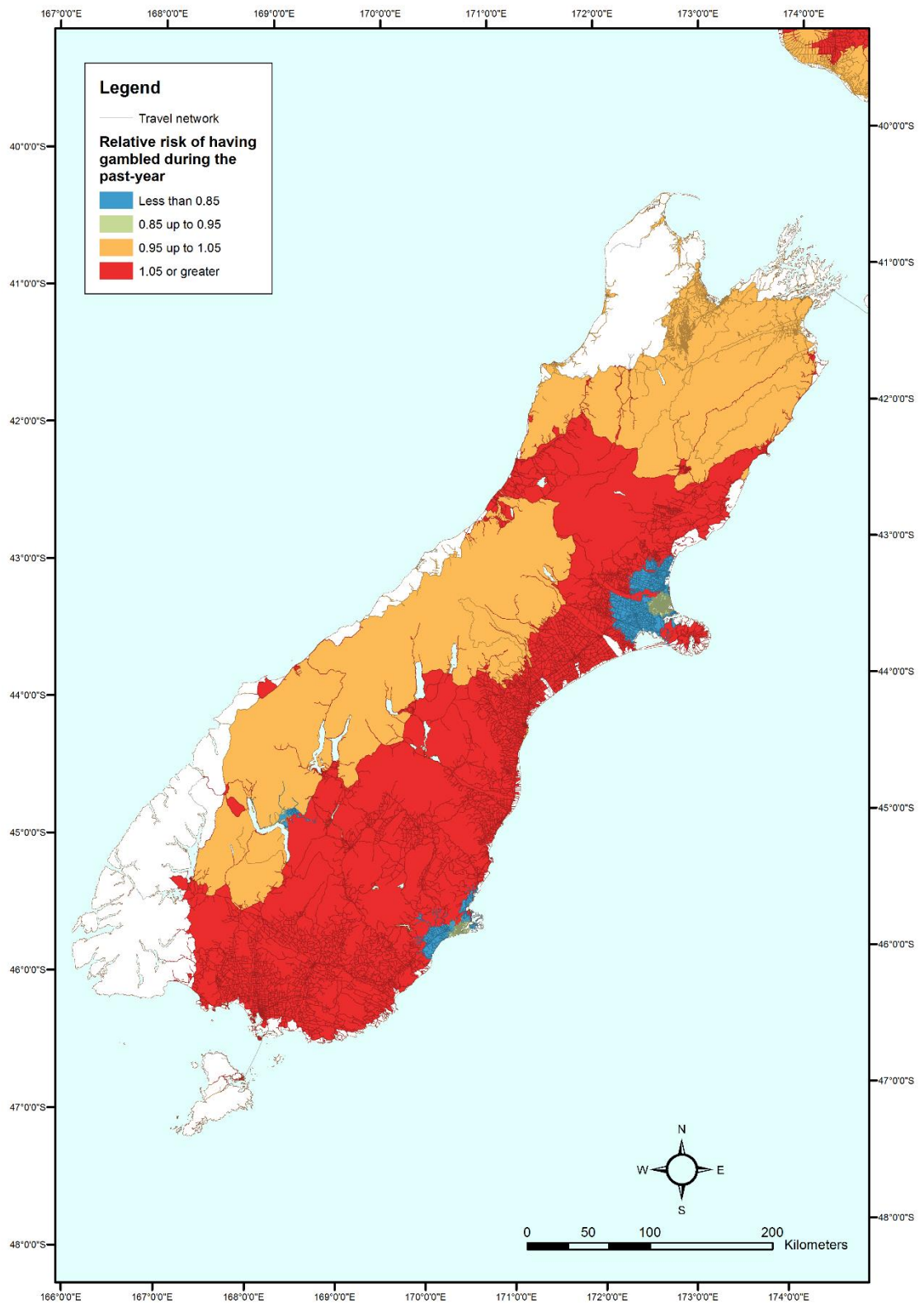


Figure 27. Map of relative risk of past-year gambling in the South Island.

4.2.2 Played on an electronic gaming machine in the past year

Logistic regression tests

Table 14 shows the results of the logistic regression test examining the effect of the five demographic variables on gambling on an EGM during the past year. Of all the demographic explanatory variables, it can be seen that only participant's sex was not significantly associated with having played on an EGM during the past year. Participants' age group, prioritised ethnicity, neighbourhood deprivation and individual deprivation groups were all significant in terms of having played on an EGM during the past year.

Compared to the 20 to 29 years old reference group, all other age groups were less likely to have played on an EGM during the past year, with likelihood decreasing with increasing age. Compared to participants identifying with the European/other ethnic group, those identifying as Māori were 87% more likely, those identifying with the Pacific ethnic group were 18% more likely and those identifying as Asian were 37% less likely to have played on an EGM in the past year. In terms of neighbourhood deprivation, compared to individuals living in the least-deprived decile, those living in the four most-deprived deciles were found to have significantly higher rates of past-year gambling, with those living in deciles 7, 8, 9 and 10 being 57%, 62%, 68% and 91% more likely to have gambled on an EGM respectively. Similarly, likelihood of having played on an EGM during the past year is seen to increase with increasing individual deprivation, with the group with the highest individual deprivation being at least twice (OR 2.03) as likely to have gambled on an EGM compared to the least-deprived group.

Table 14. Logistic regression test results examining the effect of various demographic variables on gambling on an EGM during the past year.

Variable	Category	OR	95% confidence intervals		p-value
			2.50%	97.50%	
Sex	Males	1.00			0.12
	Females	0.90	0.79	1.03	
Age group	18 to 19	0.57	0.39	0.80	< 0.0001*
	20 to 29	1.00			
	30 to 39	0.48	0.39	0.59	
	40 to 49	0.34	0.27	0.41	
	50 to 64	0.32	0.27	0.39	
	65 and above	0.27	0.21	0.33	
Prioritised ethnicity	European/other	1.00			< 0.0001*
	Asian	0.63	0.48	0.80	
	Māori	1.87	1.55	2.25	
	Pacific Island	1.18	0.87	1.57	
Neighbourhood deprivation	Decile 1	1.00			< 0.0001*
	Decile 2	1.00	0.73	1.38	
	Decile 3	1.12	0.82	1.53	
	Decile 4	1.21	0.89	1.66	
	Decile 5	1.09	0.79	1.50	
	Decile 6	1.16	0.84	1.60	
	Decile 7	1.57	1.17	2.12	
	Decile 8	1.62	1.20	2.19	
	Decile 9	1.68	1.24	2.29	
	Decile 10	1.91	1.42	2.60	
Individual deprivation	Group 1	1.00			< 0.0001*
	Group 2	1.41	1.20	1.66	
	Group 3	1.44	1.16	1.77	
	Group 4	1.92	1.52	2.40	
	Group 5	2.03	1.45	2.79	

Table 15 shows results of the logistic regression tests examining the effects of the two distance and four density variables on gambling on an EGM during the past year, after correcting for demographic variables in Table 14. It can be seen that in terms of the distance variables, both distance to the nearest casino and distance to the nearest non-casino EGM venue were found to be significant in terms of predicting playing on an EGM. Additionally, all density variables, i.e. the number of EGM venues within 500

metres, one kilometre, five kilometres and ten kilometres were found to be statistically significant.

Participants in the three quartiles closest to a casino were all found to have higher rates of EGM participation compared to those in the quartile furthest away from a casino, with likelihood generally increasing with decreasing distance away from a casino. The likelihood of having played on an EGM during the past year was found to be the highest for the quartile of participants living closest to the casino, who were 43% more likely to have gambled on an EGM compared to those in the quartile furthest away from a casino. Participants living in the second-closest and third-closest quartiles to a casino were found to be 25% and 27% more likely to have played on an EGM compared with those in the quartile of participants living furthest away from a casino.

Similarly, likelihood of playing on an EGM during the past year was found to increase with decreasing distance away from a non-casino EGM venue. Compared with the quartile of participants living furthest away from a non-casino EGM, participants living in the second-closest quartile to a non-casino EGM venue were 32% more likely to have played on an EGM during the past year, while those living in the third-closest quartile to a non-casino EGM were 48% more likely. Participants in the quartile living closest to a non-casino EGM venue were found to be the most likely (OR 1.62) to have played on a non-casino EGM during the past year.

In terms of the number of venues within 500 metres, having at least one EGM venue within this distance has been found to increase the likelihood of playing on an EGM during the past year. Compared to participants with no venues, participants with one venue within 500 metres were found to be 49% more likely to have gambled on an EGM in the past year and those with two or more venues within 500 metres were found to be 25% more likely to have gambled in the past year compared to those with zero venues.

In terms of the number of venues within one kilometre, compared to participants with no venues within a kilometre, all other groups were found to be more likely to have gambled on at an EGM venue during the past year. Compared with participants living with no venues within one kilometre, participants living with one venue within a kilometre were 24% more likely, those living with two venues were 16% more likely and those living with three or more venues within a kilometre were the most likely (OR 1.36) to have played on an EGM during the past year.

In terms of the number of venues within five kilometres, a U-shaped relationship was found, where increasing number of venues within this distance was seen to increase likelihood up to a certain density, after which likelihood of having played on an EGM slightly decreased with increasing density further, although this was still higher than that for having no venues within five kilometres. Compared to participants living with no venues within five kilometres, those living between one to five venues within this distance were 50% more likely to have played on an EGM during the past year, while those living between six and 10 venues were 89% more likely, being the group most likely to have gambled during the past year. Those living with between 11 and 20 venues and those living with 21 or more venues were 63% and 61% respectively more likely to have gambled on an EGM during the past year.

In terms of the number of venues within 10 kilometres, a U-shaped relationship was found similar to the case with the number of venues within five kilometres. Compared to participants with no venues within 10 kilometres, all groups were at least 45% more likely to have gambled on a non-casino EGM during the past year, with those living with between 1 to 5 venues within this distance being 45% more likely, those living with between six to 25 venues within this distance being 82% more likely and those living with between 26 to 50 venues within this distance being 86% more likely to have gambled on an EGM during the past year. Those living with the highest density of venues (51 or more) within 10 kilometres were 71% more likely to have gambled on an EGM during the past year compared to those with no venues within this distance.

Table 15. Logistic regression test results examining the effect of various distance and density variables on gambling on an EGM during the past year.

Variable	Category	OR	95% confidence intervals		p-value
			2.50%	97.50%	
Distance to the nearest casino (km)	< 13.0 km	1.43	1.18	1.74	0.0035*
	13.0 to 45.3 km	1.25	1.24	1.25	
	45.3 to 287.0 km	1.27	1.26	1.28	
	287.0 to 507 km	1.00			
Distance to the nearest non-casino EGM venue (km)	< 0.784 km	1.62	1.33	1.98	< 0.0001*
	0.784 to 1.28 km	1.48	1.46	1.50	
	1.28 to 2.14 km	1.32	1.31	1.34	
	2.14 to 127.0 km	1.00			
Number of EGMs within 500 m	0	1.00			0.0022*
	1	1.49	1.19	1.87	
	2 or above	1.25	0.84	1.83	
Number of EGMs within 1 km	0	1.00			0.014*
	1	1.24	1.05	1.47	
	2	1.16	0.89	1.51	
	3 or above	1.36	1.07	1.71	
Number of EGMs within 5 km	0	1.00			0.0002*
	1 to 5	1.50	1.15	1.97	
	6 to 10	1.89	1.43	2.51	
	11 to 20	1.63	1.26	2.12	
Number of EGMs within 10 km	0	1.00			0.0018*
	1 to 5	1.45	1.00	2.13	
	6 to 25	1.82	1.29	2.63	
	26 to 50	1.86	1.31	2.70	
	51 or above	1.71	1.20	2.51	

Note: Each test is adjusted for sex, age group, prioritised ethnicity, neighbourhood deprivation and individual deprivation only.

Logistic regression model

Table 16 shows the results of the best-fit stepwise logistic regression model predicting whether an individual has played on an EGM during the past year after correcting for demographic variables. Distance to the nearest casino venue, distance to the nearest non-casino EGM venue and the number of EGM venues within 10 kilometres were found to be significant in predicting past-year status of playing on an EGM.

In terms of distance to the nearest casino EGM, an inversely proportional relationship exists, where decreasing distance away from a casino increases the

likelihood of playing on a casino venue. Compared to individuals living furthest away from a casino, those living in the second-closest quartile and third-closest quartile were predicted to be 25% and 27% respectively more likely to have gambled on an EGM during the past year, while those living in the quartile closest to a casino were predicted to be 67% more likely to have played on an EGM during the past year.

Similarly, distance to the nearest non-casino EGM venue was also found to be inversely proportional to the likelihood of playing on an EGM during the past year. Compared to individuals living in the quartile furthest away from a non-casino EGM venue, those living between closest to a non-casino EGM venue were predicted to be 55% more likely to have played on an EGM during the past year, while those living in the second-closest and third closest quartiles to a non-casino EGM venue were predicted to be 40% and 24% respectively more likely to have gambled on an EGM, during the past year.

In terms of the number of EGM venues within 10 kilometres, increasing the number of venues is seen to be associated with an increase in likelihood of having played on an EGM, up to a certain density, after which likelihood is predicted to decrease. Compared to individuals with no venues within 10 kilometres, those with one to five venues were predicted to be 15% more likely to gamble on a non-casino EGM, while those with six to 25 EGMs were 50% more likely. However, those with 26 to 50 EGMs were only predicted to be 30% less likely to have gambled on a non-casino EGM and those with 51 or more EGMs were predicted to be 1% less likely to have gambled.

Table 16. Logistic regression model predicting past-year gambling on an EGM.

Explanatory variable	Category	OR	95% confidence intervals		p-value
			2.50%	97.50%	
Distance to the nearest casino (km)	< 13.0 km	1.67	1.30	2.15	0.01
	13.0 to 45.3 km	1.25	1.34	1.45	
	45.3 to 287.0 km	1.27	1.41	1.39	
	287.0 to 507 km	1.00			
Distance to the nearest non-casino EGM venue (km)	< 0.784 km	1.55	1.24	1.93	< 0.0001
	0.784 to 1.28 km	1.40	1.36	1.45	
	1.28 to 2.14 km	1.24	1.20	1.28	
	2.14 to 127.0 km	1.00			
Number of EGMs within 10 km	0	1.00			0.0037
	1 to 5	1.15	0.78	1.72	
	6 to 25	1.50	1.03	2.22	
	26 to 50	1.30	0.87	1.97	
	51 and above	0.99	0.63	1.57	

Note: Results have been corrected for participants' sex, age group, prioritised ethnicity, neighbourhood deprivation and individual deprivation.

Figure 28 shows the results of the stepwise model applied to a map of the North Island, while Figure 29 shows these results applied to a map of the South Island. Maps of results of the model applied to the Auckland urban area are shown in Figure 30, of those applied to the Wellington urban area are shown in Figure 31 and of those applied to the Christchurch urban area are shown in Figure 32. Maps of these results applied to other urban areas with populations of 50,000 or greater are shown in Appendix F.

From Figure 28 and Figure 29, it is evident that the areas immediately surrounding the six casinos, as well as those with between six to 25 EGM venues within 10 kilometres in most urban areas, are found to have some of the areas with the highest relative risk of playing on an EGM during the past year. Similarly, areas furthest away from these casinos, including the parts of the Far North, the lower North Island and the upper and western South Island, were found to have some of the lowest relative risk of playing on an EGM during the past year. Figure 30, Figure 31 and Figure 30 show that disparities in risk exist even within urban areas, with areas closest to non-casino EGM venues having a higher relative risk, decreasing with increasing distance away from these venues. Additionally, even in areas closest to non-casino venues having similar densities of EGM venues, those in cities with casinos such as Auckland (Figure 30) and Christchurch (Figure 30) were found to have a lower relative risk than those in Wellington (Figure 31).

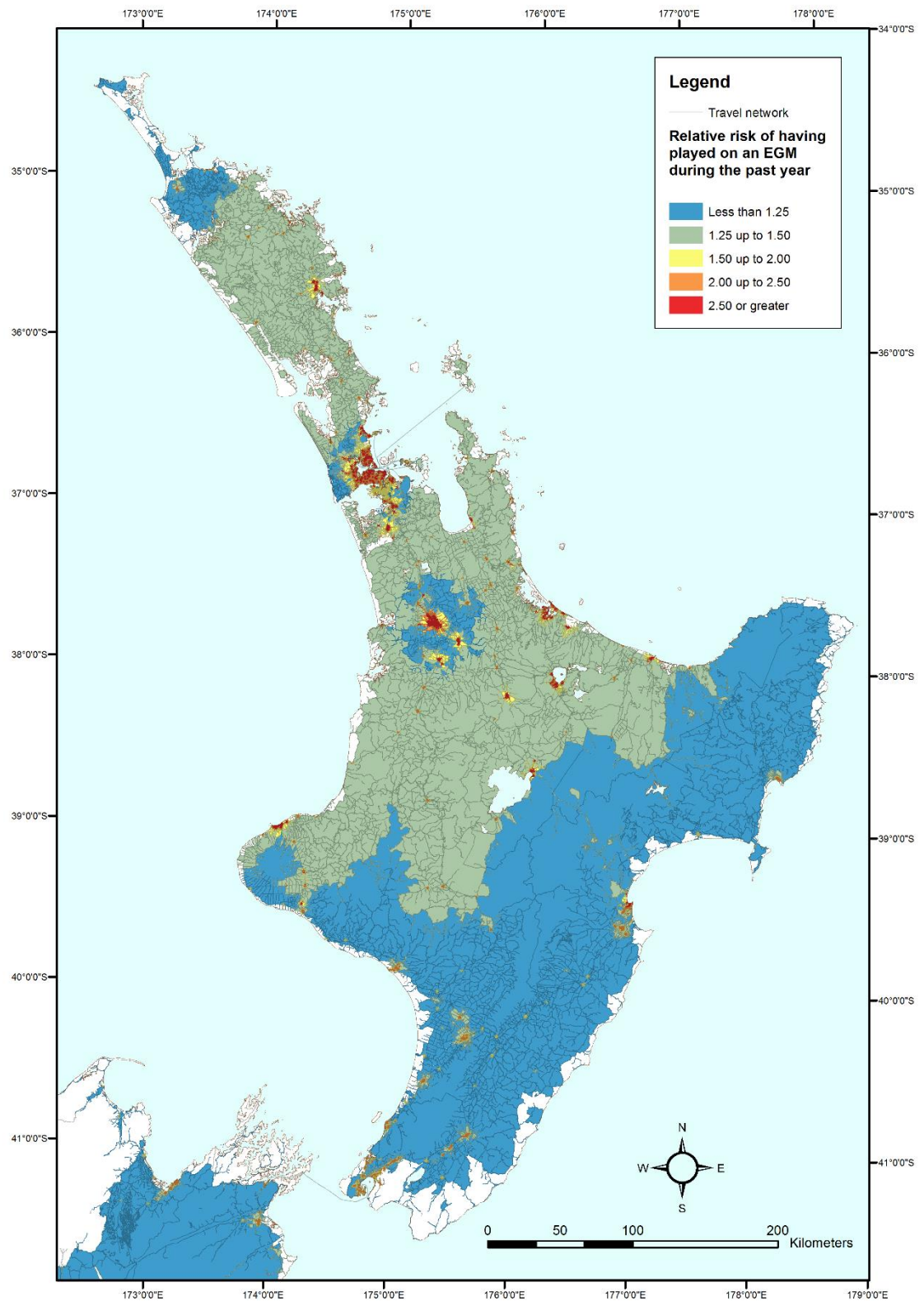


Figure 28. Map of relative risk of having played on an EGM during the past year in the North Island.

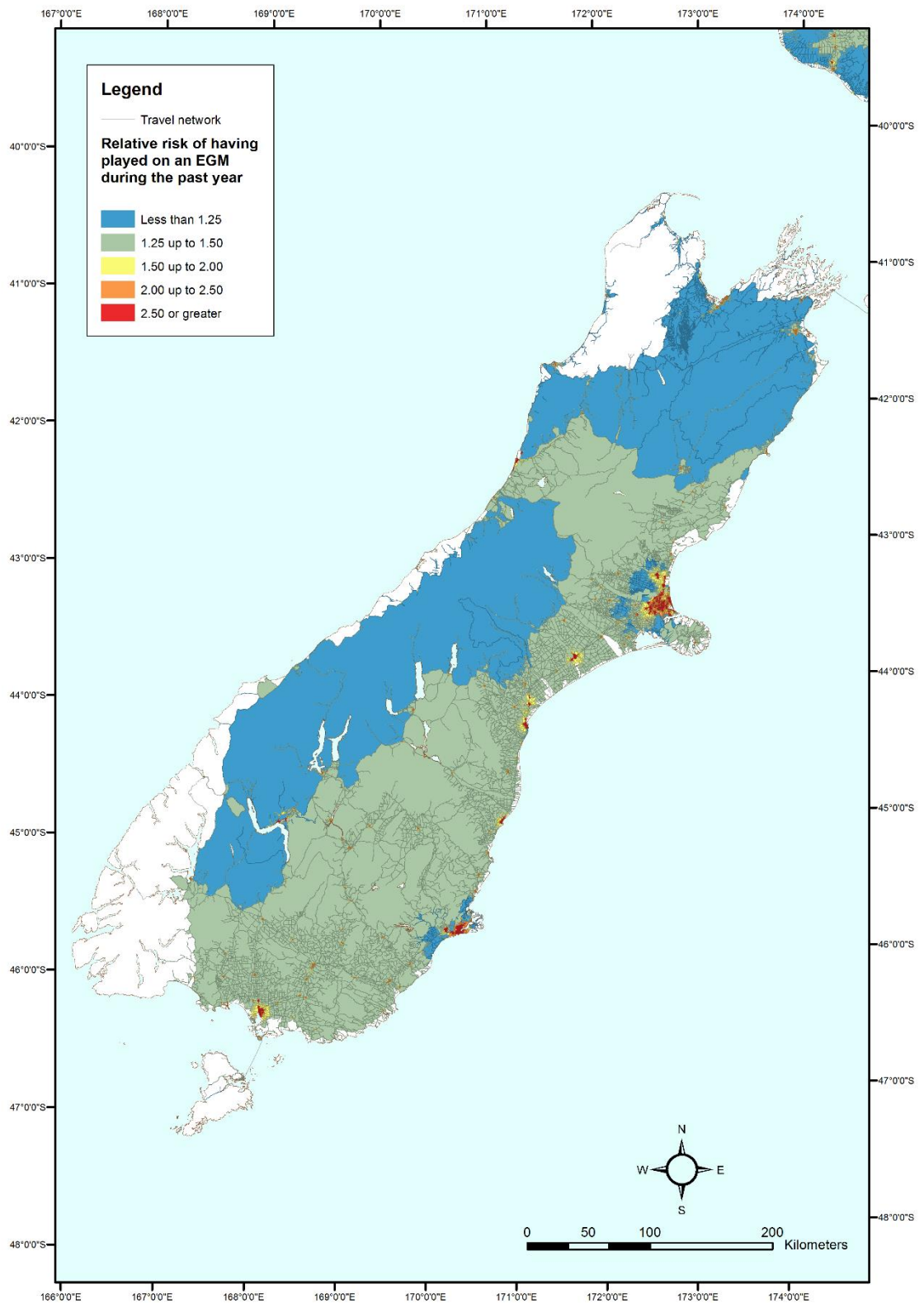


Figure 29. Map of relative risk of having played on an EGM during the past year in the South Island.

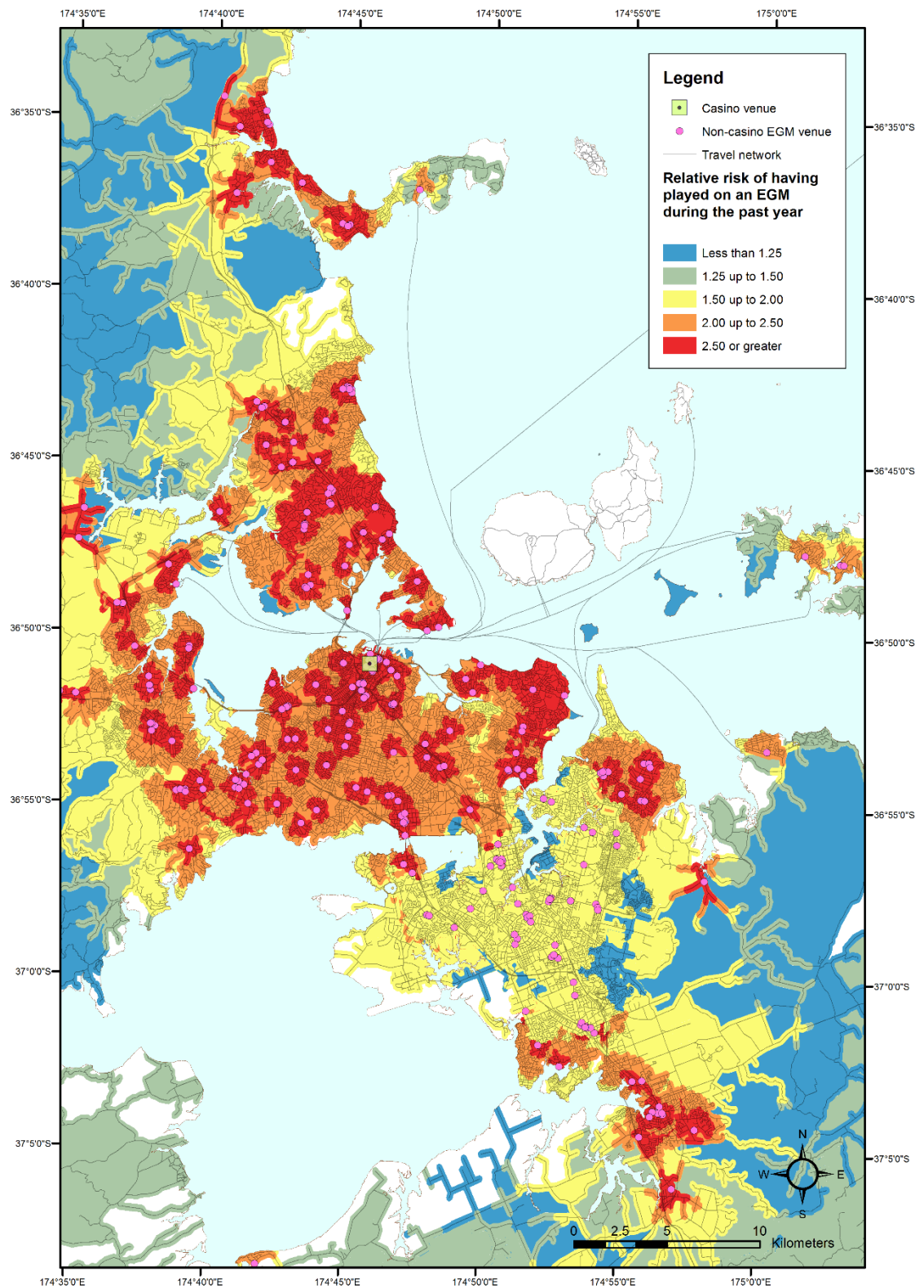


Figure 30. Map of relative risk of having played on an EGM during the past year in the Auckland urban area.

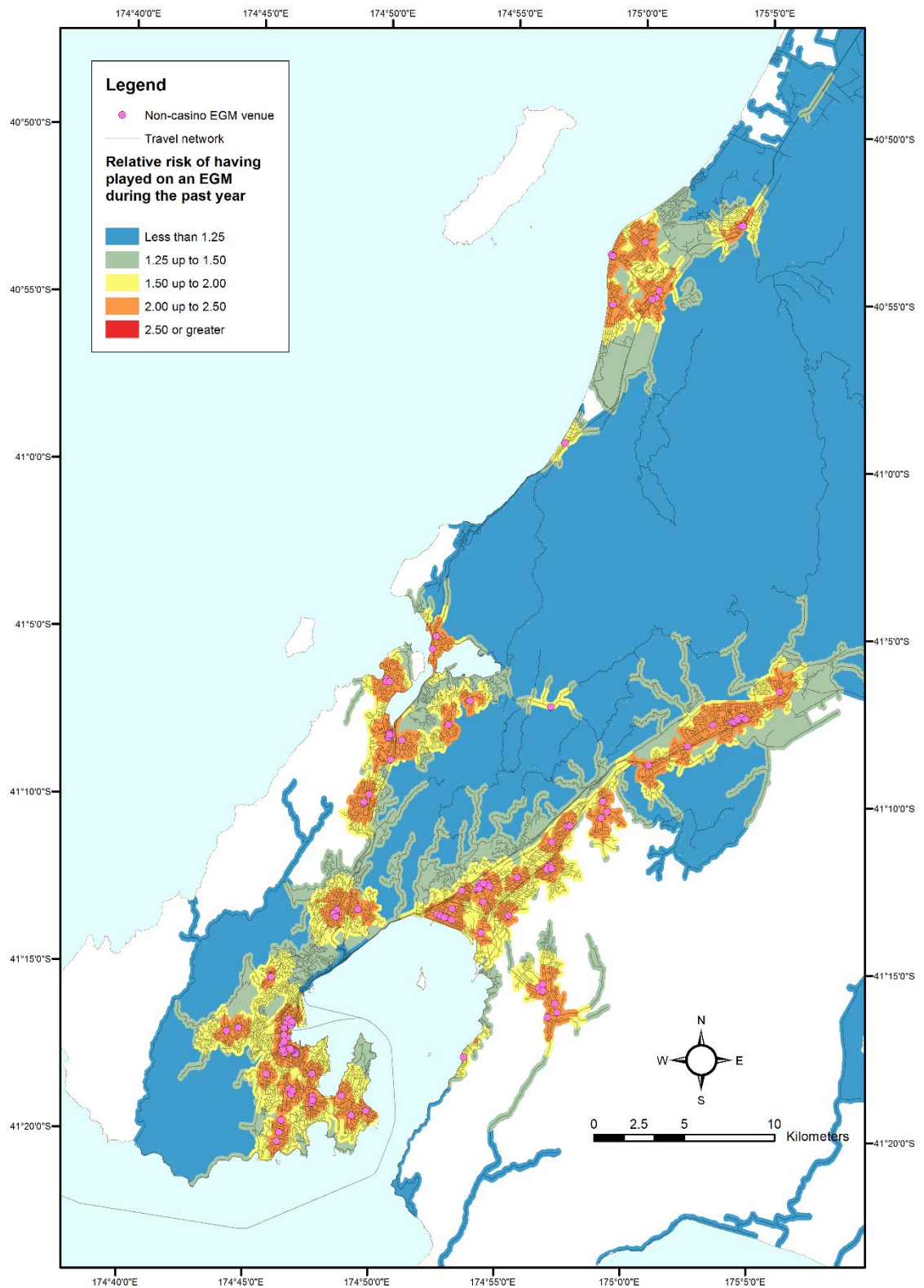


Figure 31. Map of relative risk of having played on an EGM during the past year in the Wellington urban area.

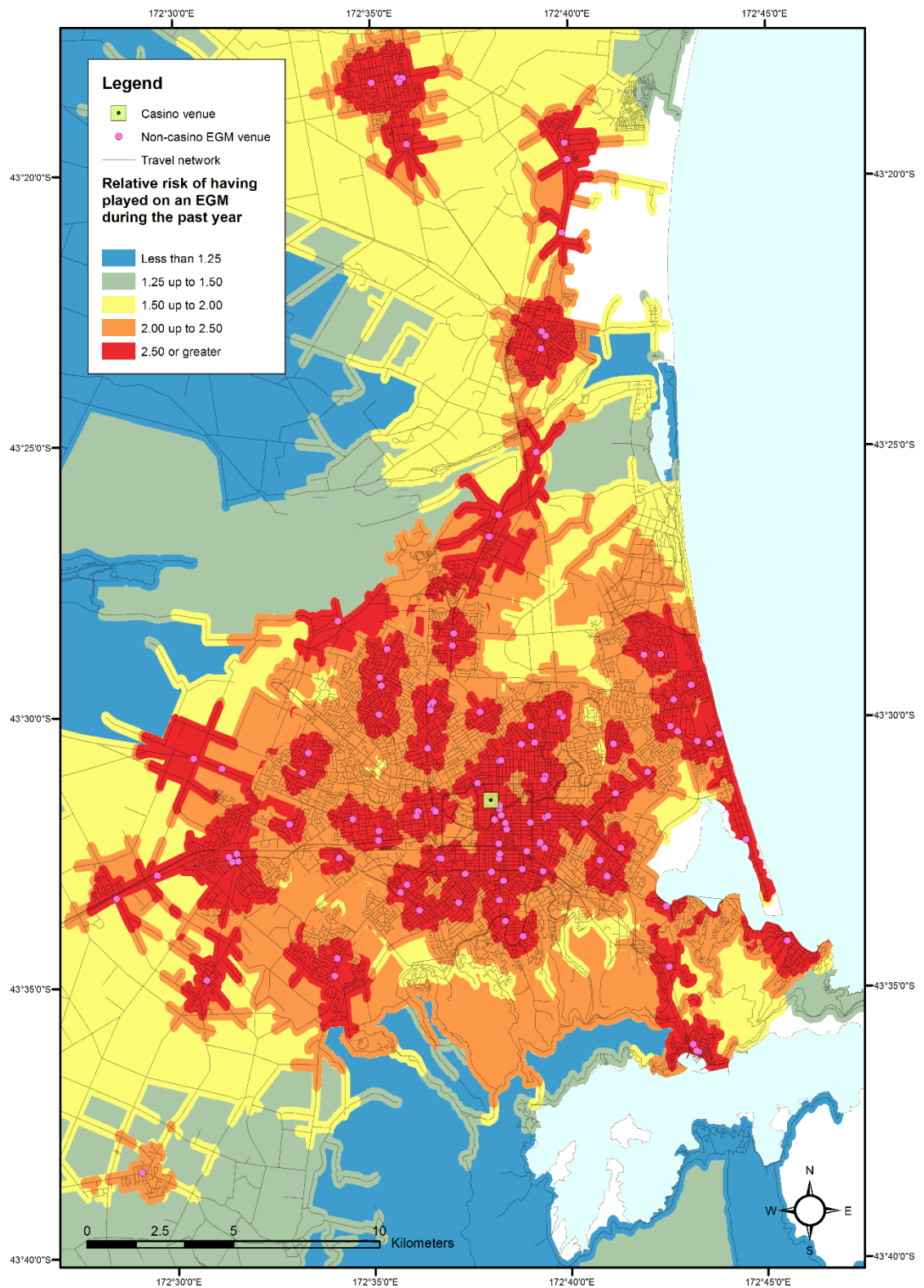


Figure 32. Map of relative risk of having played on an EGM during the past year in the Christchurch urban area.

4.2.3 Past-year gamblers being at risk of problem gambling

Logistic regression tests

Table 17 shows the logistic regression test result examining the effect of the five demographic variables on the risk of problem gambling for past-year gamblers. All five demographic variables were found to be statistically significant in predicting risk of problem gambling of past-year gamblers.

Compared to male gamblers, female gamblers were 26% less likely to be at risk of problem gambling. In terms of age group, there is a clear trend of decreasing risk with increasing age. Compared to the gamblers in the 20 to 29 years old age group, gamblers aged 28 to 19 years old were found to be 23% more likely to be at risk of problem gambling. Gamblers from all other age groups were found to have a lower risk of problem gambling than the reference group. Compared to past-year gamblers of European/other ethnicity, gamblers of the three main broad ethnic groups were found to be at least twice at risk of problem gambling, with elevated rates for gamblers of Asian (OR 2.27), Māori (2.62) and Pacific (3.96) ethnicity. In terms of neighbourhood deprivation, participants living the three most socioeconomically-deprived neighbourhood groups were significantly found to be at a significantly higher risk of problem gambling, with those living in deciles 8, 9 and 10 having a 37%, 57% and 146% higher risk respectively of problem gambling compared to those living in decile 1. More profound results were found for individual deprivation, where compared to the least deprived group, all other groups were at least twice as likely to be a higher risk of problem gambling. In particular, the most-deprived group and second-most deprived groups were found to be 4.18 and 4.04 times more likely to be at risk of problem gambling compared to the least-deprived group.

Table 17. Logistic regression test result examining the effect of various demographic variables on risk of problem gambling for past-year gamblers.

Variable	Category	OR	95% confidence intervals		p-value
			2.50%	97.50%	
Sex	Males	1.00			0.0024*
	Females	0.74	0.61	0.90	
Age group	18 to 19	1.23	0.74	1.98	< 0.0001*
	20 to 29	1.00			
	30 to 39	0.73	0.55	0.97	
	40 to 49	0.50	0.37	0.68	
	50 to 64	0.41	0.30	0.55	
	65 and above	0.31	0.22	0.44	
Prioritised ethnicity	European/other	1.00			< 0.0001*
	Asian	2.27	1.65	3.09	
	Māori	2.62	2.01	3.38	
	Pacific Island	3.96	2.81	5.50	
Neighbourhood deprivation	Decile 1	1.00			< 0.0001*
	Decile 2	0.68	0.42	1.08	
	Decile 3	0.63	0.39	1.01	
	Decile 4	0.61	0.37	0.98	
	Decile 5	0.73	0.45	1.17	
	Decile 6	0.79	0.49	1.26	
	Decile 7	0.93	0.60	1.44	
	Decile 8	1.37	0.91	2.08	
	Decile 9	1.57	1.05	2.37	
	Decile 10	2.46	1.68	3.64	
Individual deprivation	Group 1	1.00			< 0.0001*
	Group 2	2.18	1.70	2.78	
	Group 3	2.63	1.95	3.53	
	Group 4	4.18	3.08	5.64	
	Group 5	4.04	2.59	6.13	

Table 18 shows the results of logistic regression tests examining the effect of the two distance and four density variables on the risk of problem gambling for past-year gamblers after controlling for demographic variables. Distance to the nearest casino, the number of EGM venues within 500 metres and the number of EGM venues within 10 kilometres were found to be statistically significant.

Compared to the quartile of past-year gamblers living furthest away from a casino, those living in the quartile closest to a casino were found to be 69% more at risk

of problem gambling. Likelihood for participants living in the second-closest and third-closest quartiles were 13% more likely and 8% less likely respectively to be at risk of problem gambling.

Compared to individuals living with no venues within 500 metres, although those living with one venue within this distance were found to be 8% less likely to be at risk of problem gambling, those with two or more venues were 87% more likely to be at risk.

Compared to individuals with no venues within 10 kilometres, individuals living with between one to five venues and between six to 25 venues were 25% less likely and 34% less likely to be at risk of problem gambling. Individuals with 26 to 50 venues within 10 kilometres were 23% more likely to have gambled in the past year. Individuals with 51 or more venues within 10 kilometres were not significantly more likely to be at risk of problem gambling during the past year, being only three percent more likely to have gambled compared to those with no venues within 10 kilometres.

Table 18. Logistic regression test results examining the effect of various distance and density variables on risk of problem gambling for past-year gamblers.

Variable	Category	OR	95% confidence intervals		p-value
			2.50%	97.50%	
Distance to the nearest casino (km)	< 13.0 km	1.69	1.28	2.25	< 0.0001*
	13.0 to 45.3 km	1.13	1.12	1.13	
	45.3 to 287.0 km	0.92	0.93	0.91	
	287.0 to 507 km	1.00	1.00	1.00	
Distance to the nearest non-casino EGM venue (km)	< 0.784 km	1.18	0.89	1.59	0.54
	0.784 to 1.28 km	1.00	0.99	1.01	
	1.28 to 2.14 km	1.00	0.98	1.01	
	2.14 to 127.0 km	1.00	1.00	1.00	
Number of EGMs within 500 m	0	1.00			0.04*
	1	0.92	0.63	1.30	
	2 or above	1.87	1.14	2.98	
Number of EGMs within 1 km	0	1.00			0.25
	1	1.17	0.90	1.50	
	2	1.30	0.88	1.89	
	3 or above	1.30	0.93	1.80	
Number of EGMs within 5 km	0	1.00			0.21
	1 to 5	1.00	0.67	1.52	
	6 to 10	1.09	0.72	1.69	
	11 to 20	1.16	0.79	1.72	
	21 or above	1.41	0.95	2.12	
Number of EGMs within 10 km	0	1.00			0.0002*
	1 to 5	0.75	0.45	1.27	
	6 to 25	0.66	0.41	1.08	
	26 to 50	1.23	0.78	2.02	
	51 or above	1.03	0.65	1.71	

Note: Each test is adjusted for sex, age group, prioritised ethnicity, neighbourhood deprivation and individual deprivation only.

Logistic regression model

Table 19 shows the results of the best-fit stepwise regression model predicting risk of problem gambling for past-year gamblers. Distance to the nearest casino, the number of EGMs within 500 metres and the number of EGMs within 10 kilometres were all found to be significant in predicting risk for past-year gamblers.

Compared to gamblers living in the quartile furthest away from a casino venue, those living in the quartile closest to a casino were predicted to be 69% more likely to be at risk of problem gambling. Those living those living in the second-closest quartile

to a casino were predicted to be 10% more likely and those living in the third-closest quartile to a casino were predicted to be 7% less likely to be at risk of problem gambling.

In terms of the number of venues within 500 metres, there was a relatively small difference in the likelihood of being at risk of problem gambling for those living within 500 metres of one venue when compared to those that lived with no venues within this distance (OR 0.86). However, those living with two or more venues were predicted to be 83% more likely to be at risk of problem gambling compared to those that did not have any venues present within 500 metres.

In terms of the number of EGM venues within 10 kilometres, risk of problem gambling was found to be lower for all groups compared to those with no EGMs within 10 kilometres. Those with one to five venues were 28% less likely to be at risk, those with six to 25 were 37% less likely to be at risk while those with 51 or more venues were 34% less likely to be at risk of problem gambling. However, gamblers living with 26 to 50 venues within 10 kilometres were predicted to be only two percent less likely to be at risk of problem gambling compared to those with no venues present.

Table 19. Logistic regression model predicting risk of problem gambling for past-year gamblers.

Explanatory variable	Category	OR	95% confidence intervals		p-value
			2.50%	97.50%	
Distance to the nearest casino (km)	< 13.0 km	1.69	1.19	2.44	< 0.0001
	13.0 to 45.3 km	1.10	1.04	1.17	
	45.3 to 287.0 km	0.93	0.96	0.93	
	287.0 to 507 km	1.00			
Number of EGMs within 500 m	0	1.00			0.037
	1	0.86	0.59	1.23	
	2 and above	1.83	1.12	2.91	
Number of EGMs within 10 km	0	1.00			0.009
	1 to 5	0.72	0.43	1.24	
	6 to 25	0.63	0.39	1.04	
	26 to 50	0.98	0.60	1.65	
	>50	0.66	0.38	1.18	

Note: Results have been corrected for participants' sex, age group, prioritised ethnicity, neighbourhood deprivation and individual deprivation.

Maps showing the results of the model predicting total risk of problem gambling for past-year gamblers for the North Island and South Island are shown in Figure 33 and Figure 34 respectively, while those for the Auckland, Wellington and Christchurch urban areas are shown in Figure 35, Figure 36 and Figure 37 respectively. Maps showing results of this model applied to urban areas with populations of 50,000 or greater are shown in Appendix G.

From Figure 33 and Figure 34, it can be seen that many smaller urban areas, such as secondary and minor urban areas having between one and five EGM venues and between six and 25 EGM venues within five kilometres were predicted to have some of the lowest relative risk of problem gambling for past-year gamblers. Areas with no venues within 10 kilometres, such as many rural areas in the Far North and lower half of the North Island, as well as the northern and western South Island, were found to have a slightly higher risk than other rural areas. Areas with the highest risk of problem gambling for past-year gambling were found to be those in areas having access to two or more EGM venues in areas closest to casinos, such as those in Auckland (Figure 35) and Christchurch (Figure 37).

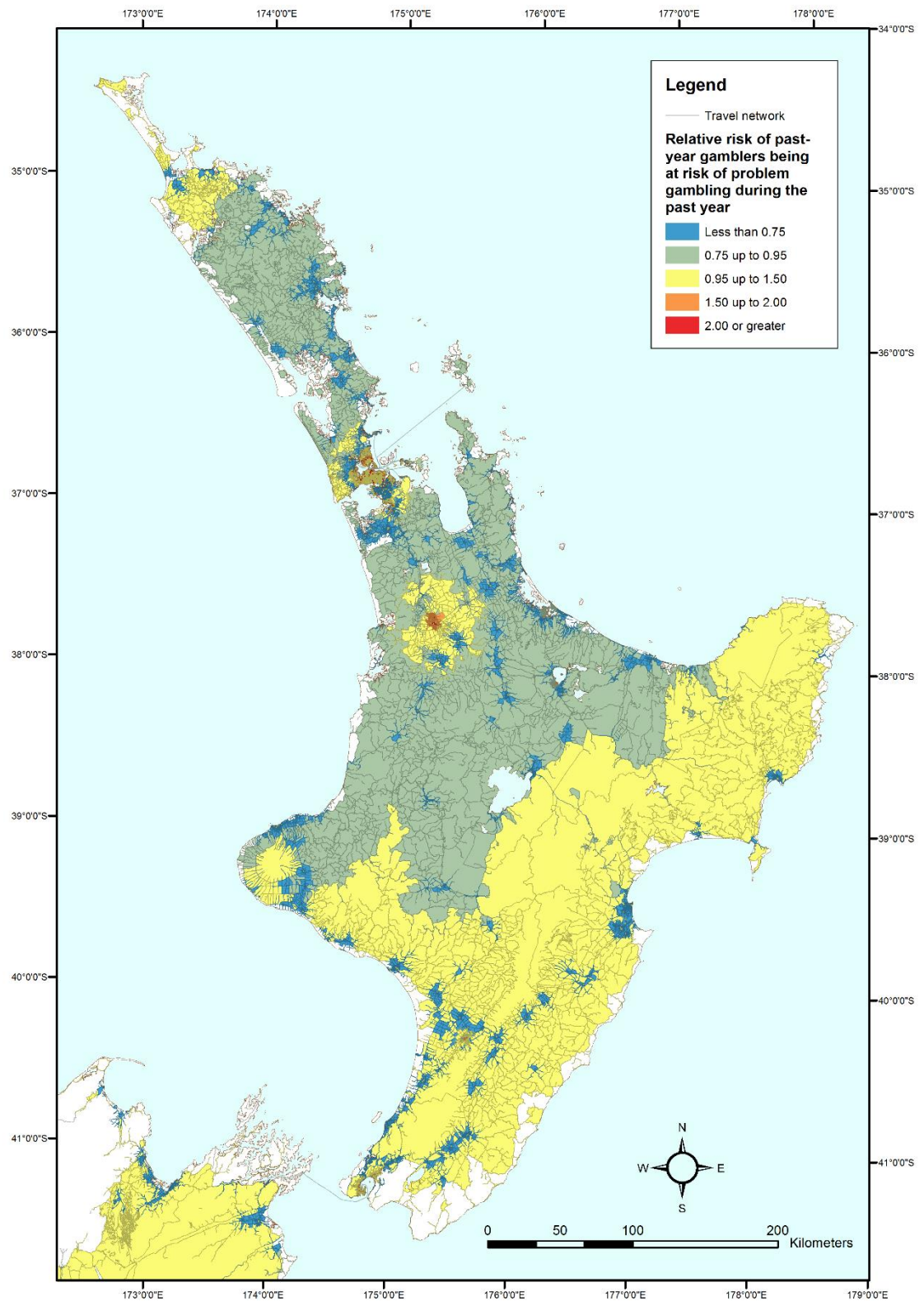


Figure 33. Map of relative risk of gamblers being at risk of problem gambling during the past year in the North Island.

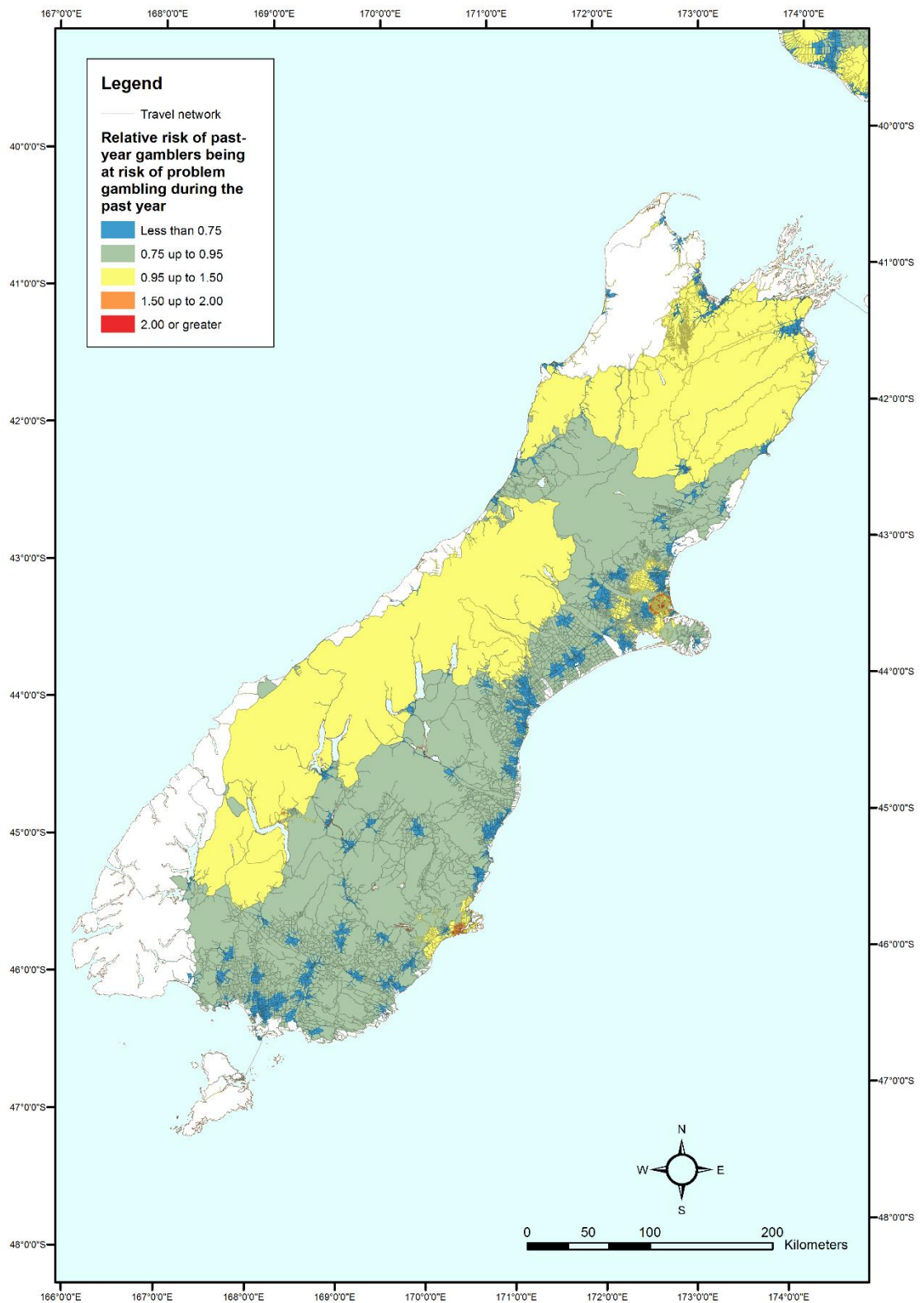


Figure 34. Map of relative risk of gamblers being at risk of problem gambling during the past year in the South Island.

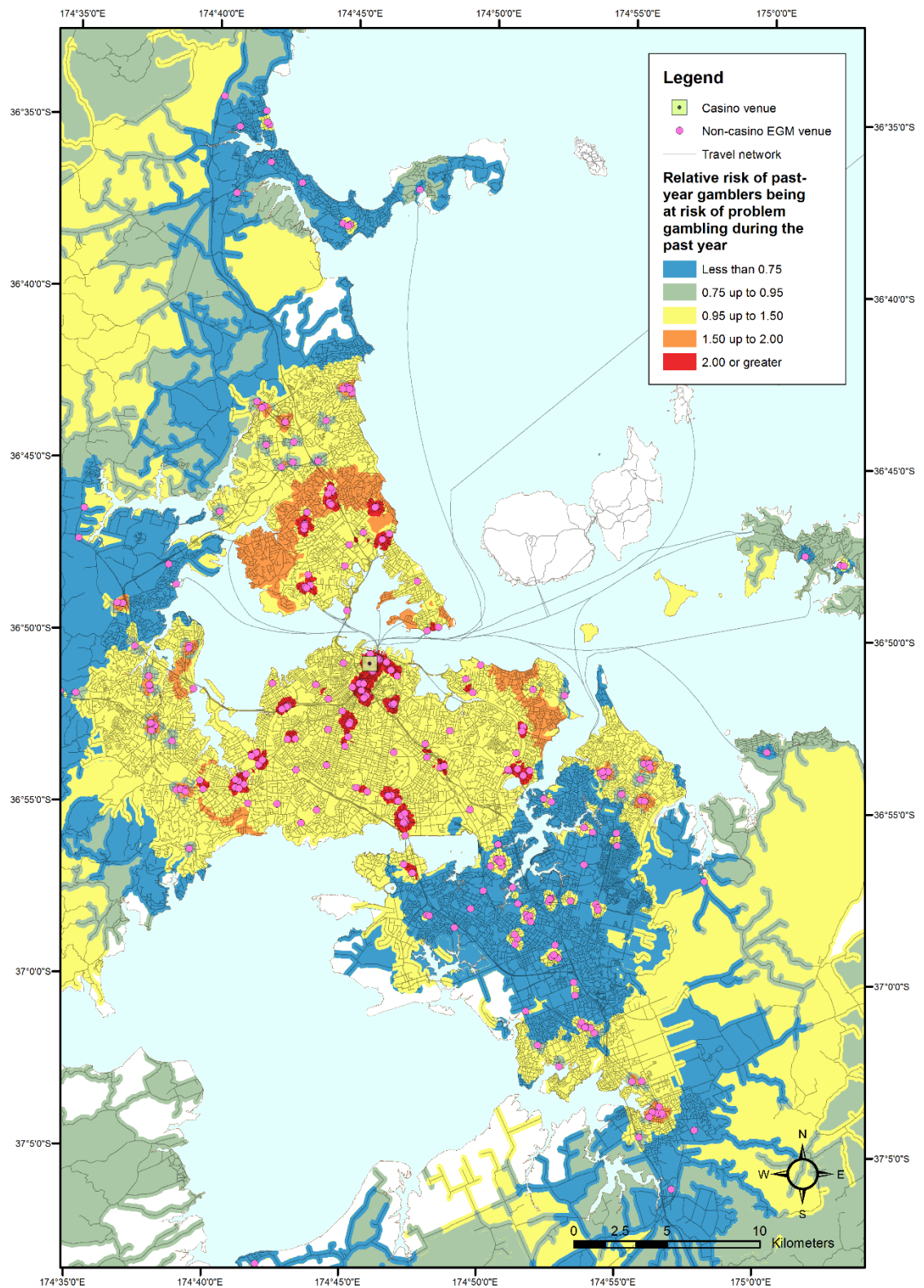


Figure 35. Map of relative risk of gamblers being at risk of problem gambling during the past year in the Auckland urban area.

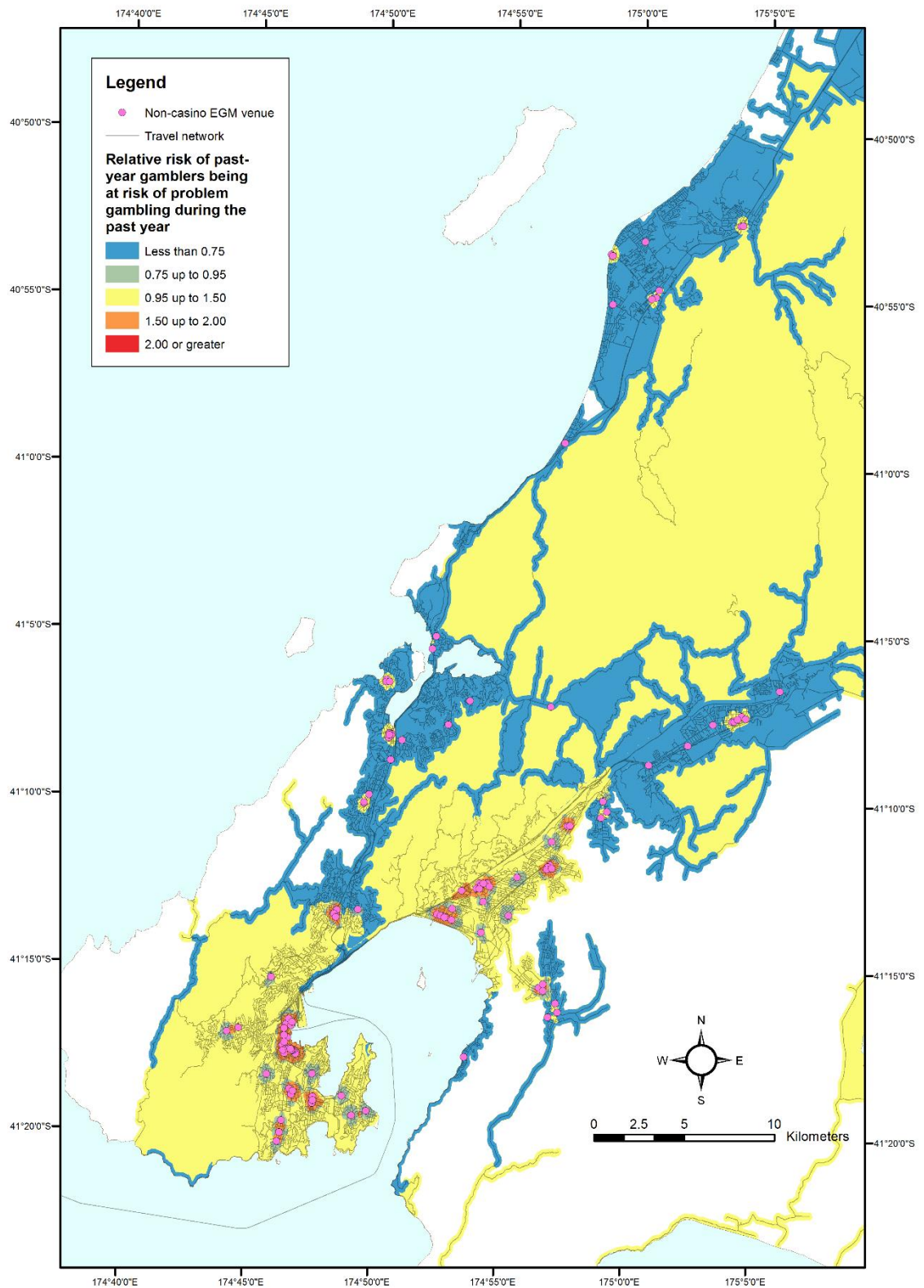


Figure 36. Map of relative risk of gamblers being at risk of problem gambling during the past year in the Wellington urban area.

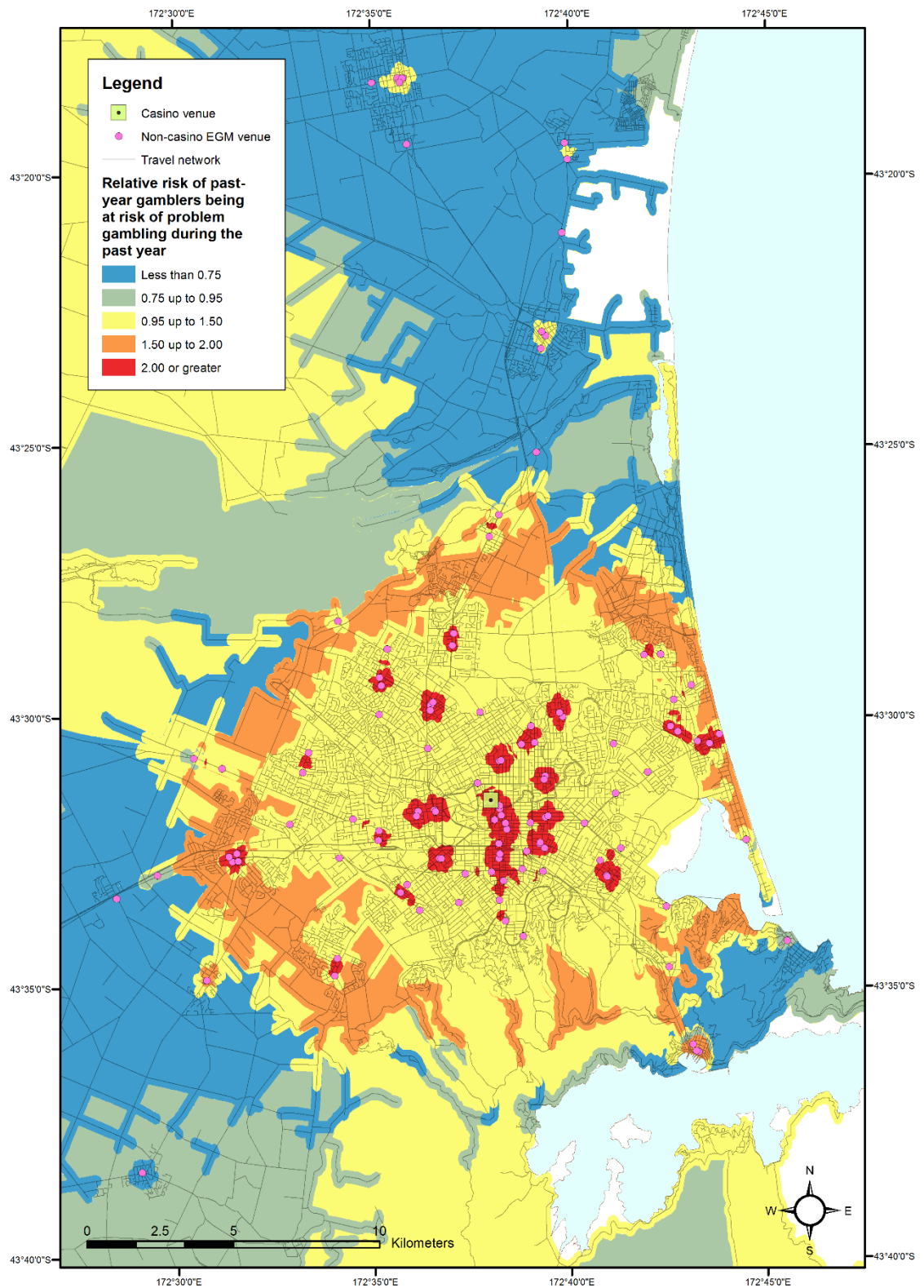


Figure 37. Map of relative risk of gamblers being at risk of problem gambling during the past year in the Christchurch urban area.

Chapter 5 Discussion

This chapter provides a discussion on the various findings presented in Chapter 4, including the distribution of EGM venues, the distance to the nearest venue for each of the two types of venues and the density of venues within the four distances measured. The various impacts that each of these measures have on overall gambling behaviour, gambling on EGMs and the risk of problem gambling for past-year gamblers will also be discussed, as will be the results of the multiple variable models in relation to the relevant literature reviewed in Chapter 2. Additionally, limitations relating to the study's methodology and assumptions made will also be considered, while possible recommendations for future work will be stated.

5.1 Distribution of electronic gaming machine venues

In terms of the distribution of casinos, it is evident that four of the six casinos in New Zealand are located in the CBDs of major urban areas, namely those of Auckland (Figure 7), Christchurch (Figure 9), Hamilton (Figure 38) and Dunedin (Figure 40), with the two remaining venues located in the city centre of Queenstown (Figure 47). Legislation which permitted the introduction of casinos in New Zealand stressed the importance of casinos as a way to entertain patrons, particularly tourists, and promote employment ("Casino Control Act," 1990). As the CBDs of urban areas are known to be centres of commerce and trade, functioning as catchment areas for residents from all parts of the metropolitan area they are situated in (McMillen & Doran, 2006; Young et al., 2009), placement of casinos in such areas allows the greatest exposure to potential patrons compared to other parts of the city. Additionally, as CBD areas are the most accessible in terms of being situated near the hubs of transport routes and are more likely to be frequented by tourists than other parts of the city, being situated in such areas would allow EGM venues to opportunistically take advantage of passing trade and tourist hotspots (Wardle et al., 2014; Young et al., 2009).

Numerically, there were also found to be overwhelmingly many times more non-casino EGM venues than casino venues (Figure 5 and Figure 6). In 2012, the year that the first phase of the NGS was conducted, there were an average of 1,429 venues with non-casino EGMs operating in the country (Department of Internal Affairs, 2017b), compared to only six casinos (Gambling Commission, 2013). In terms of the

distribution of non-casino venues in New Zealand, these were found to be spread out throughout the country, with venues being present in every single territorial authority in the country (Table 20). Venues were found to be located in every major urban area, secondary urban area, minor urban area and most rural service towns alike (Figure 5 and Figure 6), with the majority of towns having multiple venues present. In contrast, casino locations were found to be located in major urban areas only, with the exception of those located in Queenstown, a secondary urban area.

It is evident that many non-casino EGM venues are located in close proximity to other non-casino EGM venues, forming clusters (Figure 7, Figure 8, Figure 9 and maps in Appendix B). As most urban areas in New Zealand are subject to council zoning laws, the majority of non-casino EGM venues, being commercial venues, were found to be located in areas designated as commercial areas of towns, as found by Allen & Clarke (2015). In all urban areas, the highest concentration of venues containing EGMs were found in their respective CBD areas and their immediate surrounding areas, confirming higher provisions of such venues in CBD areas of cities as found by McMillen and Doran (2006), Young et al. (2009), Gilliland and Ross (2005), Wardle et al. (2014) and Robitaille and Herjean (2008).

In large cities such as Auckland, Wellington, Christchurch and Tauranga, clusters of EGM venues in suburban areas that were relatively far away from their respective city centres were also found, highlighting the existence of suburban gambling complexes that provided alternatives to the array of facilities found in the CBD area as described by Young et al. (2009). Additionally, many of these suburban complexes were found to be located in areas of high socioeconomic deprivation, such as Otahuhu, Papakura and Manurewa in the Auckland urban area (Figure 7), Hornby, Phillipstown and New Brighton in the Christchurch urban area (Figure 9) and the urban cores of Lower Hutt and Porirua in the Wellington urban area (Figure 8), mirroring results found by Rankine and Haigh (2003), the Ministry of Health (2006), Allen & Clarke (2015), Marshall and Baker (2001), Gilliland and Ross (2005) and Wardle et al. (2014) in which gambling opportunities were more likely to be located in areas of elevated socioeconomic deprivation. This was found to be true even in smaller-tier cities such as Rotorua (Figure 42) and Whangarei (Figure 41) where the suburbs of Ngongotaha in Rotorua and Kamo in Whangarei also had higher concentrations of EGM venues.

In addition to the CBD and suburban areas, high concentrations of EGM venues were also found in areas popular with nightlife activities, on major arterial roads and those known to be frequented by tourists. Such was found to be the case in the suburbs of Newton, Ponsonby and Grafton in Auckland (Figure 7) which are popular nightlife areas. EGM venues were found to be concentrated around major arterial roads such as Dominion Road, Great South Road and Onehunga Mall in Auckland (Figure 7), Ferguson Drive in Upper Hutt (Figure 8) and Colombo Street in Christchurch (Figure 9). The cities of Rotorua (Figure 42) and Queenstown (Figure 47) were also found to contain relatively high concentrations of venues in relation to their populations despite their smaller populations, highlighting the importance of these places as tourism and entertainment centres. These findings mirror results obtained by Young et al. (2009), Gilliland and Ross (2005) and Wardle et al. (2014) which found that apart from the expectedly high concentrations of gambling venues found in city centres, such venues are also disproportionately found opportunistic gambling nodes in popularly-frequented areas, around major arterial roads and in areas with elevated concentrations of tourists. Furthermore, as non-casino venues are required by Section 71 of Gambling Act 2003 to surrender their Class 4 licence if no gambling has taken place for four weeks on these machines ("Gambling Act 2003," 2003), placement of venues in areas that would maximise the likelihood of patrons frequenting them would naturally be expected to be in the best interests of Class 4 licence holders.

5.2 Distance to electronic gaming machine venues

All casinos in New Zealand were found to be located in five urban areas, namely those of Auckland (Figure 49), Christchurch (Figure 51), Hamilton (Figure 50) and Dunedin (Figure 52), which together accounted for approximately half of New Zealand's population at the 2013 Census (Statistics New Zealand, 2013). It was therefore be expected that approximately half of participants are located within 50 kilometres of a casino venue (Figure 10).

As mentioned earlier, there are numerically many times more non-casino EGM venues than casino venues. Due to the widespread distribution of non-casino EGM venues compared to casino venues, distances to the nearest non-casino venue in New Zealand (Figure 13) were accordingly found to be relatively small compared to those to the nearest casino (Figure 10). Half of participants lived within 1.28 kilometres of a

non-casino venue, a full 95% of participants lived within 10 kilometres of a non-casino EGM venue, while 99.9% lived within 50 kilometres of a venue. In comparison, only 51.6% of participants lived within 50 kilometres of a casino venue. This result is significant as it shows that a significant proportion of participants live within maximum walking distance of a non-casino venue and that 95% of people live within acceptable driving distance to a non-casino EGM venue, thereby resulting in non-casino venues being much more accessible to the general public than casino venues.

Although areas within 500 metres and one kilometre of a non-casino EGM venue were found to make up a substantial proportion of the total urban area of a city, the distribution of venue clusters in a city was found to play an important role in determining the physical extent of areas containing these densities. In the case of Auckland, Hamilton and Nelson, the majority of clusters containing non-casino EGM venues were found to be situated in certain pockets of the city. Accordingly, large urban areas of these cities, such as the suburbs of Mission Bay, Meadowbank, Green Bay and Ormiston in Auckland (Figure 16), Glenview and Rototuna in Hamilton (Figure 54) and Stoke and Enner Glynn in Nelson (Figure 62) were found to be void of having a non-casino EGM venue located within a kilometre. In contrast, in the majority of other cities, especially Christchurch (Figure 18), Dunedin (Figure 56) and Palmerston North (Figure 61) where clusters of non-casino EGM venues were found to be more evenly spread out, smaller proportions of these urban areas were found not to be within a kilometre of such venues. However, it must be noted that all cities mentioned, regardless of shape or extent, were found to be within five kilometres of a venue (Figure 16, Figure 17, Figure 18 and maps in Appendix D), confirming the widespread distribution of non-casino EGM venues in urban areas.

5.3 Density of electronic gaming machine venues

For all urban areas, the highest concentrations of EGM venues within 500 metres and one kilometre were found to be located in their respective CBD areas. As discussed earlier, the primary reasons such for elevated concentrations in these areas were the existing of zoning laws and the fact that city centres functioned as catchment areas for residents from all parts of the urban area that they are situated in (McMillen & Doran, 2006; Young et al., 2009).

As CBD areas were found to have the highest concentration of EGM venues, and as the majority of city centres are zoned for housing primarily commercial businesses and not residential areas, it is therefore unsurprising that the vast majority (88.2%) of participants were found to not live within 500 metres of such a venue (Figure 19). As the distance within which accessibility to EGM venues is measured is increased, more residential areas are encompassed, which leads to an increase in the number of venues present within that certain distance. Consequently, 62.1% of participants were found to not live within one kilometre of an EGM venue (Figure 20). When this distance is increased to five kilometres, 10.8% of participants were found to have no EGM venues within this distance (Figure 21) and only 5.3% were found to have no EGM venues present within 10 kilometres (Figure 25).

In terms of the number of venues within five kilometres of participants' addresses, both the size and shape of the city have been found to play a major role in determining which parts of the city have high densities of EGM venues. As discussed by Thorne et al. (2012), EGM venues serve to provide a place to meet and socialise with family and friends. Subsequently, cities with larger populations would be expected to have higher numbers of venues in order to meet the demand for such services. Due to the relatively continuous and contiguous sprawl of Auckland's suburbs, access to 21 or more venues was found to be highest in the western part of the Auckland isthmus region and the adjoining part of West Auckland, as well as the central North Shore and most of the northern part of the former Manukau City (Figure 22). The relatively circular shape of Christchurch has played a big role in the distribution of density of EGM venues, with the highest densities being found in the CBD area resulting in accessibility being highest in the city centre, decreasing in a concentric fashion with increasing distance away from the city centre (Figure 24). On the other hand, the Wellington urban area, which consists of non-contiguous urban areas spread outwards in a linear fashion, was only found to have concentrations of 21 or more venues in parts of Wellington City and Lower Hutt, with major parts of Porirua having access to 11 to 20 venues within five kilometres (Figure 23). The majority of urban areas of Upper Hutt and the Kapiti Coast were found to be between six to 10 venues within five kilometres.

Apart from Auckland (Figure 22), Wellington (Figure 23), Christchurch (Figure 24), Hamilton (Figure 65), Tauranga (Figure 66), Dunedin (Figure 67) and Palmerston North (Figure 72), most smaller cities did not have more than 20 venues located in their urban areas, and therefore areas within these cities cannot consequently have access to

21 or more venues. The cities of Rotorua (Figure 69) and Napier (Figure 70) were found to stand out as exceptions in this regard. Rotorua's unusually elevated concentration of venues (Figure 69), despite having a population of similar size to New Plymouth, Whangarei and Invercargill and a smaller one than Nelson (Statistics New Zealand, 2013), can be explained by its socioeconomic makeup and its reputation as a tourist destination. Many areas that constitute the Rotorua urban area have higher levels of socioeconomic deprivation compared to the national average, and it is known that non-casino EGM venues are more likely to be concentrated in more deprived areas. Additionally, the city is known to be a popular tourist destination with international and domestic tourists alike therefore resulting in more EGM venues than other cities of similar population to serve as forms of entertainment catering to tourists. The suburb of Pirimai in Napier was found to be the area with the highest concentration of venues within five kilometres in its urban area as opposed to Napier's city centre (Figure 70). This result can be explained in terms of its proximity to both the city centre and the suburb of Taradale, both of which have relatively high concentrations of venues. Areas in Pirimai have access to venues in both directions, leading to an elevated density of venues within five kilometres for the suburb.

Only areas in Auckland and Christchurch, along with a small stretch of the Ngauranga Gorge in Wellington were found to have concentrations of 51 or more EGM venues within 10 kilometres. Again, both size and shape of the urban area were found to play a part in defining how these concentrations were spread out. Only these three cities were found to contain more than 50 EGM venues, and consequently it would be expected that only these areas can be expected to have concentrations of more than 50 venues within 10 kilometres. As Auckland's CBD, its peripheral areas and the northern portion of the former Manukau City contain a relatively large number of venues, concentrations are found to be highest in these areas, with concentrations declining with increasing distance away from these places. In the case of Christchurch, concentration was found to decline in a concentric manner as distance away from the CBD was increased. In the case of Wellington, because the urban area is much more spread out in a linear fashion as opposed to Auckland and Christchurch, densities of EGM venues within 10 kilometres were found to be much lower and therefore only a small part of the city around the Ngauranga Gorge was found to have access to 51 or more venues within 10 kilometres.

In Hamilton, Tauranga, Dunedin and Palmerston North, the highest concentrations of EGMs within 10 kilometres were found to be between 26 to 50, while most of the other smaller cities only had between six and 25 venues within this distance. Again, the exceptions were Rotorua and parts of land situated between Napier and Hastings. Reasons for elevated concentrations in Rotorua, namely due large parts of the city being more socioeconomically deprived compared to other cities and its function as a tourist destination, have been discussed. The case of such elevated densities being found in the Napier-Hastings urban area presents a unique case where cities of sizable populations with elevated concentrations of EGM venues in their city centres are located in close proximity to each other. Consequently, areas between the two urban areas would therefore have access to the high number of venues in either city, therefore resulting in elevated concentrations in such area in comparison to those in more central areas of either city.

5.4 Impact of distance to electronic gaming machine venues and density of electronic gaming machine venues on various gambling activities

5.4.1 Past-year gambling

After correcting for demographic variables, logistic regression tests examining the effect of the distance and density variables on past-year gambling (Table 12) found that distance to the nearest casino was found to be the only significant factor in predicting past-year gambling. Consequently, the best fit multiple variable model predicting past-year gambling was found to be that where only distance to the nearest casino was a significant explanatory variable (Table 13). Maps of the results of the logistic regression model (Figure 26 and Figure 27) therefore reflect this result, with areas representing the two quartiles furthest away from a casino venue having higher rates of predicted past-year gambling than do the two quartiles closest to casinos.

Compared to the quartile of participants living furthest away from a casino, both Table 12 and Table 13 show that those located the closest and second-closest quartiles were found to be less likely to have gambled in any form in the past year, but those living in the third-closest quartile were 10% more likely to have gambled in any activity during the past year. It is worth noting that in terms of the distance covered by the two quartiles of participants living closest to casinos (less than 13.0 km and 13.0 km to 45.3

km), these cover relatively small distances compared with the two quartiles farthest from casinos (45.3 km to 287.0 km and 287.0 to 507.0 km). As a result, much of the areas represented by the two closest quartiles are either urban or areas with high urban influence.

The lower likelihood of gambling in any activity found in the two quartiles closest to casinos can be explained by two reasons. Firstly, as discussed by Eadington (1999), Gu et al. (2013), Sobrun-Maharaj et al. (2013) and Wong and Tse (2003), casinos are often regarded as a social destination in themselves where patrons, especially those from areas where such provisions are limited, are known to travel from far and wide places due to the perceived elegant, luxurious and vibrant atmosphere provided. Therefore, casinos located in the five urban areas are more likely to appeal to tourists visiting these cities rather than local residents who are more likely to be fixated on work, study and cultural commitments.

Secondly, the types of urban areas represented by the four quartiles may play a larger role in determining past-year gambling than may do distance to casino venues. As discussed, much of the areas within the two closest quartiles are either urban or areas with high urban influence, with areas further than 45.0 km from casinos consequently being more likely to be secondary, minor and rural areas. As discussed by Pearson et al. (2013), residents of dense urban areas are known to be more resilient in their behaviour, being less likely to gamble despite having high densities of and shorter distances to gambling venues. Additionally, results by Mason (2009) have shown that residents of secondary and rural areas are more likely to have participated in past-year gambling on any activity than are residents of major urban areas. Therefore, it would be expected that individuals living in areas farthest away from casinos have higher likelihoods of partaking in past-year gambling than those who inhabit areas closest to casinos.

Furthermore, past-year gambling includes all forms of gambling, including gambling on EGMs in casino and non-casino venues, partaking in track betting and participating in housie or raffles. As discussed by Young et al. (2009) and J. Thomas et al. (2012), participants living further away from casinos often use non-casino EGM locations as a substitute for casino gambling, which are many times more numerous and are more geographically widespread than casinos (Figure 5 and Figure 6). Additionally, with a large segment of the population regularly gambling on Lotto only and not on other forms (Rossen, 2015), with betting on Lotto products online available since 2008,

through mobile phone applications since 2012 (New Zealand Lotteries Commission, 2017b) and the increasing proportion of Lotto tickets bought online (New Zealand Lotteries Commission, 2017a), the need for participants to purchase a ticket through a physical terminal location has become increasingly irrelevant. Similarly, betting on TAB products was made available through the internet since 1998, through its PhoneBet service from 2003 and through its mobile phone app by 2015 (New Zealand Racing Board, 2015). Apart from games of housie that commonly take place in community halls, the only forms of gambling which require participants to be present at certain physical locations are gambling at casinos (EGMs and table games) and on non-casino EGM venues. Therefore, it may be possible that participants living in the predominantly smaller urban areas and rural areas in the two quartiles furthest away from casinos gamble more regularly on forms of gambling other than casino gambling as a possible consequence of the lack of recreational facilities in these areas (Young et al., 2009).

5.4.2 Past-year gambling on electronic gaming machines

Table 15 shows the results of logistic regression tests examining the effect of distance and density variables on past-year gambling on an EGM. Both distance to the nearest casino and distance to the nearest non-casino EGM venue were found to be significantly associated with having played on an EGM during the past year, as well as all four density variables. In the case of distance to the nearest casino and distance to the nearest non-casino EGM venue, distances to these gambling venues were found to be inversely proportional to the likelihood on having gambled on an EGM during the past year. Compared with participants living in the quartile furthest away from a casino, those living in the quartile closest to a casino were 43% more likely to have gambled on an EGM. Similarly, compared with participants who live in the quartile furthest away from a non-casino EGM venue, participants who lived in the closest quartile to such a venue were 62% more likely to have played on an EGM during the past year.

As shown by Pearce et al. (2008) and Brabyn and Barnett (2004), the presence of facilities closer to individuals' place of residence results in individuals more likely to utilise such services. Compared to participants living further away from a non-casino EGM venue, participants living close to such a venue have to travel a shorter amount of time as well as expend a smaller monetary amount on fuel in order to travel to that venue, therefore being more likely to visit a venue located within a shorter distance when the opportunity arises than visit a venue within a longer distance. As both types of

venues contain EGMs, living closer to either type of venue would consequently result in EGM gamblers being more likely to utilise the services available in such venues. Despite only six casinos being present in New Zealand versus 1,429 non-casino venues during 2012, the fact that distance to the nearest casino was found to be significantly correlated with gambling on an EGM reaffirms the disproportionate importance of casinos as a preferred destination compared to other types of venues.

In terms of the number of EGM venues within 500 metres and one kilometre, compared to participants having access to zero venues within these distances, all groups having access to at least one EGM venue were found to have higher odds ratios of having played on an EGM during the past year (Table 15). A distance of 500 metres is commonly regarded as acceptable walking distance to which many pedestrians would walk conveniently in order to access a service, while a distance of one kilometre is commonly regarded as maximum walking distance, beyond which walking to access services becomes increasingly cumbersome (Marshall & Baker, 2001; Wakenshaw & Bunn, 2015). The presence of a venue with EGMs within these distances allows individuals the opportunity to gamble at an EGM venue without the need to spend money on vehicle, public transport or parking costs, resulting in increased likelihoods of gambling for participants living with at least one venue within walking distances. In comparison, those living with no venues within these distances do not have the convenience of walking to such venues and are therefore unable to partake in gambling on EGMs within these distances.

In the case of the number of EGM venues within one kilometre, it can be seen that participants living with three or more venues have a significantly higher likelihood (OR 1.36) of playing on an EGM compared to those living with fewer venues within this distance. This result can be explained in terms of the likelihood of EGM gamblers' finding an optimum venue. As explained by Marshall (2005), Abbott (2006) and Moore et al. (2011), proximity is far from being the only factor when selecting a venue to gamble. In a situation where only one venue is present at a certain distance, the non-proximity factors such as inconvenient operating hours, a lack of machines, the lack of popular games or a lack of a pleasant atmosphere may deter gamblers from partaking in EGM gambling at the only available venue at this distance. However, the presence of more than one venue gives gamblers a choice of venues where they may partake in their gambling activities, resulting in a larger selection from which gamblers can pick that would better suit their hours, cater to their taste in particular games and enjoy a soothing

atmosphere. In this manner, increasing the number of venues at a certain distance would make it more likely that gamblers would find their optimum location that satisfies most of their criteria in terms of venue preference, thereby increasing the likelihood of playing on an EGM.

A distance of five kilometres is commonly considered as short driving distance (Austin et al., 2005), while a distance of 10 kilometres has been used to denote acceptable driving distance (Ahmad, 2012). Considering the effect of the number of venues within both five and 10 kilometres of participants' addresses, it was found that a U-shaped relationship existed where increasing the number of venues within these distances resulted in accordingly increased likelihoods of having played on an EGM during the past year up to a certain density (Table 15). The increase in likelihood seen when the number of venues within these distances is increased up to a certain point can be attributed to the effect of an increase in gambler's choices of venues, as explained earlier. Compared to having no venues located within these driving distances, having a small selection of venues gives EGM gamblers the opportunity to partake in gambling on EGMs. A further increase in the number of EGM venues within these distances would make it more likely that a gambler would find a venue that better suits their preferences including longer opening hours, having an adequate number of machines, having a good choice of games available and having a pleasant atmosphere, along with the additional benefit of being less likely to be recognised by acquaintances. Compared to those living with no venues present, those living with between six to 10 venues within five kilometres and those living with between 26 to 50 kilometres within 10 kilometres were found to have the highest odds ratios of having gambled on an EGM during the past year.

However, once these densities had been reached, a further increase in the number of venues within these distances did not seem to result in an increase in the likelihood of having gambled on an EGM venue, but rather resulted in a slight decrease. This effect can be attributed to the type of urban areas that constitute the areas with these higher densities. In the case of the number of venues within five kilometres, it is evident that densities of between 11 to 20 venues were only found in major urban areas, with densities of EGMs of 21 or higher only being found in the largest of urban areas. Similarly, densities of 51 or greater EGMs were only found in the urban areas of Auckland, Wellington and Christchurch. As discussed by Pearson et al. (2013) and Mason (2009), it has been established that residents of dense urban areas were more

likely to have not gambled on an EGM despite having some of the highest gambling venue densities, displaying resilience in their behaviour. Therefore, it can be seen that urban area type plays a greater role in predicting gambling on an EGM in contrast to the density of venues in the case of major urban areas.

Table 16 shows the results of the logistic regression model used to predict gambling on an EGM during the past year, after correcting for individuals' sex, age group, ethnicity, neighbourhood deprivation and individual deprivation. Distance to the nearest casino venue, distance to the nearest non-casino venue and the number of EGMs within 10 kilometres were found to be important in predicting whether an individual has played on an EGM during the past year.

Although there were far fewer casino venues compared to non-casino venues in 2012, distance to the closest casino was found to be significant in determining whether a participant had played on an EGM during the past year (Table 16). This result can be attributed to both the disproportionate number of EGMs located within casinos as well as the importance of casinos as a destination venue. The six casinos in New Zealand were collectively home to 13.6% of EGMs in 2012 despite only making up 0.4% of venues that contained EGMs (Gambling Commission, 2013). As shown in Table 1, casinos possess relatively large numbers of EGMs per venue compared to the maximum of 18 for non-casino EGM venues as mandated by the Gambling Act 2003. As an adequate number of gaming machines and a variety of games were cited as some of the important factors that EGM gamblers consider while picking a venue (Moore et al., 2011; A. Thomas et al., 2011), casinos would be more likely to satisfy these criteria than would non-casino EGM venues. Additionally, as discussed earlier, casino venues are more likely to be regarded as a destination in themselves due to their importance in providing entertainment facilities to tourists and other population groups (Eadington, 1999; Gu et al., 2013; Sobrun-Maharaj et al., 2013; Wong & Tse, 2003).

Distance to the nearest non-casino EGM venue was also found to be a significant factor in predicting whether an individual had played on an EGM during the past year (Table 16). Reasons for this result include both the relative abundance of non-casino EGM venues compared to casinos and shorter distances to the nearest non-casino EGM venue compared to those to casino venues. As has been discussed, many EGM gamblers prefer gambling at non-casino EGM venues to casinos due to the abundant choice in terms of the number of such venues, resulting in gamblers being able to

choose venues where they are less likely to be recognised by acquaintances. Because there are many times more non-casino EGM venues compared to casinos and because non-casino EGM venues are much more widely distributed than casino venues, distances to the nearest non-casino venues were found to be much shorter compared to those to the nearest casino, where the median distance to the nearest non-casino venue was found to be 1.28 kilometres compared to 13.0 kilometres. As many EGM gamblers who gamble on EGMs in casinos are also known to be regular gamblers on non-casino EGMs (J. Thomas et al., 2012), the presence of shorter distances to non-casino venues would therefore result in EGM gamblers being more likely to take advantage of amenities provided by such venues rather than have to expend a greater amount of time and money in order to travel to the nearest casino, which would not be feasible in areas outside the five urban areas that host casinos.

The number of EGM venues within 10 kilometres was found to be a significant explanatory variable in predicting whether an individual has played on an EGM during the past year out of all density variables. As a distance of 10 kilometres is commonly considered as convenient driving distance, the results of the best-fit model highlight the fact the travelling by private vehicle plays an important role in accessing places. As noted by (Marshall, 2005) and Garrett (2013), individuals might not necessarily travel to a gambling or other facility directly from their homes, instead choosing to look for facilities close to their workplace, educational facility, sporting facility or other venue where they spend a significant amount of time. As New Zealanders are known to travel relatively long distances to travel to work or study (Ministry of Transport, 2013), the importance of 10 kilometres in comparison to the other distances examined is therefore expected. Furthermore, as anonymity was found to be an important factor in the choosing of an EGM venue by gamblers (Moore et al., 2011; J. Thomas et al., 2012), where gamblers have expressed preferences for venues where they are less likely to be recognised by those known to them, it may be possible that EGM gamblers may be more prepared and willing to drive longer distances in order to avoid being recognised by those known to them.

5.4.3 Risk of problem gambling for past-year gamblers

Table 18 shows the results of logistic regression tests examining the effect of distance and density variables on the risk of problem gambling. Distance to the nearest

casino, the number of EGMS within 500 metres and the number of EGMS within 10 kilometres were found to be correlated with the risk of problem gambling.

Compared to quartile of participants living furthest away from a casino, those living in the quartile closest to a casino were found to be 69% more likely to be at risk of problem gambling. It has been well-established that gambling on EGMs, whether at casino or non-casino locations, is the source of the majority of problem gambling cases (Barratt et al., 2014; Paton-Simpson et al., 2001, 2003). As mentioned earlier, despite making up a small proportion of the total number of venues with EGMs, casinos account for a disproportionately large proportion of EGMS. The presence of a large number of machines therefore guarantees an adequate number of machines available as well as a good selection of games to choose from. Furthermore, as already discussed casinos are also more likely to appeal to EGM gamblers as a destination venue due to their perceived environment as vibrant, opulent and safe space with minimal interruptions. Additionally, as quartiles nearest to casinos are more likely to be major urban areas, these areas are also more likely to have higher densities of other gambling venues such as non-casino EGM venues, Lotto outlets and TAB venues which provide other forms of gambling. Incidentally, five out of the six casinos in New Zealand have TAB terminals located in their premises themselves (Totalisator Agency Board, 2018b), providing track and sports betting activities which have been known to be associated with problem gambling after gambling on EGMS (Paton-Simpson et al., 2001, 2003; Thimasarn-Anwar et al., 2017). All these factors would be assumed to play a major role resulting in gamblers who live in environments closest to casinos being at a higher risk of problem gambling than other places.

Compared with gamblers living with no venues within 500 metres, the risk of problem gambling was also found to be 87% higher for gamblers who lived within two or more venues from this distance. As discussed, the presence of multiple venues makes it more likely that EGM gamblers find an optimum venue to partake in gambling on EGM, providing an ideal ambience, an adequate number of gaming machines and an appealing selection of games, leading to higher rates of participation in EGM gambling than if living with fewer venues at this distance. As it has been well-established that gambling on non-casino EGMS and on casino EGMS has been the source of the majority of problem gambling cases, it is therefore expected that the total risk of problem gambling for past-year gamblers living with two or more venues within walking

distance is significantly higher than for participants and gamblers with no venues within this distance.

In terms of the effect of the number of EGM venues within 10 kilometres, compared to gamblers with no venues within this distance, past-year gamblers with between one and 25 venues were found to be less likely to be at risk of problem gambling. Geographic location is an important factor in explaining these results. In contrast to the number of venues within 500 metres, one kilometre and five kilometres, relatively few participants (5.3%) did not live within 10 kilometres of an EGM venue (Figure 25). As the majority of urban areas, both small and large were found to have at least one EGM venue within their jurisdictions, it would follow that participants living with no venues within 10 kilometres are almost exclusively located in highly rural and remote areas, with limited availability of non-casino EGM venues, let alone casino venues. As discussed by Mason (2009), residents of rural areas were significantly more likely to have gambled in general in the past year, therefore possibly being more likely at risk of problem gambling compared to participants in non-rural areas. Additionally, although problem gambling is often associated with gambling on non-casino EGMs and casino EGMs (Paton-Simpson et al., 2001, 2003; Thimasarn-Anwar et al., 2017), these two activities are by no means the only ones capable of causing gambling-related harm as argued by Blaszczyński (2013), where excessive gambling on forms other than on EGMs may be to blame for the higher risks of problem gambling found in such areas.

Compared to participants with no venues located within 10 kilometres, past-year gamblers with 26 to 50 venues within 10 kilometres were found to be 23% more likely to be at risk of problem gambling. As explained, the presence of a larger number of venues gives gamblers a choice in terms of finding a venue with convenient timings, availability of machines, anonymity and refreshment options, among other factors. Therefore, a larger selection of venues results in an increase in the likelihood of problem gambling for participants with a large number of venues. However, the likelihood of problem gambling was found to be not significantly different for participants and gamblers with 51 or more venues. As observed, areas with access to more than 50 venues are only found in the major metropolitan areas of Auckland, Christchurch and Wellington, and major urban area dwellers are known to gamble less on non-casino EGMs compared to dwellers in minor and secondary urban areas (Mason, 2009; Pearson et al., 2013). As gambling on EGMs is the most associated form of gambling with problem gambling, participants and gamblers in these areas have led to a

lower than expected risk of problem gambling when compared to those living with between six to 25 venues within 10 kilometres.

Table 19 shows the results of the logistic regression model used to predict whether a past-year gambler is at risk of problem gambling, after correcting for individuals' sex, age group, ethnicity, neighbourhood deprivation and individual deprivation. All three factors that were significant in determining whether a past-year gambler was at risk of problem gambling, namely distance to the nearest casino, the number of EGMs within 500 metres and the number of EGM venues within 10 kilometres were included in the final best-fit model.

Reasons for the importance of casino venues in terms of being perceived as a destination venue due to its pull factors have already been elaborated. The inclusion of the number of venues within 500 metres and 10 kilometres in the final model shows that these distances make the biggest impact in terms of travel. As a distance of 500 metres is regarded as accessible walking distance, beyond which walking becomes increasingly tiresome and inconvenient, the number of venues within this distance makes a major difference in terms of giving gamblers a choice of finding an optimum location for their gambling needs. Similarly, a distance of 10 kilometres, regarded as convenient driving distance, allows gamblers a much larger choice in terms of venue options, where gamblers are more likely to find a venue that suits their taste in games and their preferred atmosphere along with the added bonus of being less likely to be recognised.

5.5 Limitations

A number of limitations exist with regards to the assumptions made and the methodology used in this study.

Firstly, the study measures accessibility by measuring distances from participants' residential addresses to their nearest casino and non-casino EGM venue or the number of venues within a certain distance from their residential address. While residential address is a good approximate of where an individual spends a substantial portion of their time, it is important to note that the majority of individuals who are in employment or take part in sporting or cultural activities may not necessarily choose to gamble at venues closest to their residence, but rather at places close to their workplace, sporting or cultural centre or on route to these places, as found by Garrett (2013) and A. Thomas et al. (2011).

Many addresses did not have street numbers. This was particularly true of addresses of EGM venue locations, of which 5.3% did not have a street number associated with their residential address, many being located in commercial areas of suburbs and shopping complexes. In these cases, the geometric centroid for the entire street was used as a proxy for the actual point location of the venue, and this had to be manually geocoded. Therefore, when measuring distances from residents' addresses to EGM locations, actual distances may differ remarkably in cases where the location of the EGM venue is significantly far away from the centroid of the street or shopping complex.

Due to time constraints, while performing the network analysis in order to find the closest route from participants' addresses to EGM venue locations, all street segments, whether they be motorways, highways, arterial routes, residential roads, walkways or ferry routes, were given the same level of impedance in terms of the time taken to travel a given distance. Several problems arise due to this assumption. Firstly, due to the various types of road having different speed limits, the time taken to traverse a given length of a motorway or expressway would be expected to be significantly shorter compared to that for the same length of a residential road. These times would be expected to vary even more should actual traffic conditions be taken into account during different times of the day. Therefore, once speed limits are taken into account, the shortest path to a destination in terms of distance might not necessarily be the fastest path in terms of time. A second problem arises due to the equal impedance given to walkways and ferry routes, where individuals travelling in cars would not be able to travel using off-road routes designated as walkways and the majority of ferry routes. In addition, even on ferry routes that do allow the transport of cars, the relatively high monetary cost of taking one's car on a ferry route as opposed to driving on a land route may deter travellers from taking ferries, making them instead choose a longer land route if possible.

An important limitation of this study is the fact that participants were not randomly sampled. In order to minimise the time taken to travel between participants' residential locations, a number of meshblocks were first randomly selected from which a selection of individual dwellings to be sampled were then made (National Research Bureau, 2012). As it is known from Tobler's First Law of Geography that individuals from the same geographic neighbourhood would be more likely to exhibit similar behaviour (Mayhew, 2015), there is likely to be some bias in results as participants were

not selected in a complete random fashion. Additionally, it must be noted that only participants that lived in permanent private dwellings were surveyed (Abbott et al., 2014b), therefore excluding participants living in non-permanent, non-private dwellings, such as caravans, hotels, motels, homes for the elderly, hospitals and prisons, whose gambling behaviours may be vastly different to that of the general population. The inhabitants of most offshore islands many of which have sizeable populations, such as the Chatham Islands, Great Barrier Island, Stewart Island, Matakana Island and Kawau Island, were also not included in the survey, with the exception of those living on Waiheke Island.

For this study, it was assumed that all non-casino EGM locations are accessible to the general public. In reality, club locations are open only to members and their guests and are therefore not accessible to the general public in the way that the majority of bars and pubs are. Although the names of venues provide some indication of the type of venue, further, there is considerable difficulty in deciding which non-casino EGMs venues are clubs and which are pub venues. Additional data on the type of non-casino EGM location would have to be obtained by the Department of Internal Affairs in order to overcome this problem.

For each venue, the number of machines per venue was not taken into account. As discussed by J. Thomas et al. (2012), one of the key factors that gamblers on non-casino EGM venues look for is the availability of machines to gamble at a particular venue. A small number of machines at a particular venue, especially at a more-frequented venue, would make it more likely that these machines are always occupied and are therefore fully saturated with people, resulting in accessibility not being guaranteed to gamblers.

5.6 Conclusions

This study investigated the relationship between accessibility to venues with EGMs and certain types of gambling behaviour, finding strong associations between accessibility to gambling venues with EGMs and likelihood of gambling in general, gambling on EGMs and the risk of problem gambling for gamblers, thereby contributing to existing research in understanding how various measures of accessibility to casinos and non-casino venues with EGMs affect these outcomes. Both measures of accessibility, namely distance to the nearest casino or non-casino EGM venue and the

density of EGM venues with various distances were found to be important in predicting various types of gambling behaviour.

Likelihood of past-year gambling in any activity was correlated with distance to the nearest casino, where individuals who lived in the two quartiles furthest away from casinos were found to have higher rates of past-year gambling than those who lived in quartiles closest to casinos, although the type of urban environments encompassed by these quartiles may play a bigger role in determining such behaviour rather than distance to the nearest casino.

Both distance to the nearest casino and distance to the nearest non-casino EGM venue were found to be significant in terms of predicting gambling on an EGM, with increasing likelihood of playing on an EGM in the past year correlated with decreasing distance to both types of venues. Additionally, the number of EGM venues within 500 metres, one kilometre, five kilometres and ten kilometres were all found to be statistically significant. The likelihood of having gambled on an EGM was found to be associated with an increase in the number of venues within 500 metres and one kilometre, and in the case of the number of venues within five kilometres and 10 kilometres, increasing the density of venues was found to be correlated with increasing likelihood of gambling, up to a certain density after which likelihood did not increase further.

The likelihood of being at risk of problem gambling for past-year gamblers was found to be correlated with distance to the nearest casino and with the number of EGM venues within 500 metres and 10 kilometres. Compared to the quartile of participants living furthest away from casinos, those living in the quartile closest to a casino were found to be at 69% more likely to be at risk of problem gambling. Compared to individuals with no venues within 500 metres, those with two or more venues were 87% more likely to have gambled in the past year. Similarly, compared to individuals with no venues within 10 kilometres, individuals with 26 to 50 venues within 10 kilometres were 23% more likely to have gambled during the past year, although those living with between one and 25 venues were found to be at least 25% less likely to be at risk.

Final multiple variable models for all three outcomes found distance to the nearest casino to be an important predictor, signifying the importance of casinos as destinations for entertainment and tourism, while those predicting past-year gambling on EGMs and the risk of problem gambling additionally found the number of venues

within 10 kilometres to be a strong predictor, thus signifying the importance of convenient driving distance in reaching their desired venue. The results of the multiple variable models were illustrated using maps of different geographical areas in New Zealand.

5.7 Recommendations for future work

A number of improvements can be made to with respect to the methodology undertaken in order to improve this study.

As it is known that participants might not necessarily visit the closest venue of a particular type from their homes, it would be of interest to find venues on route to other places frequented by these participants. In order to take into account a participant's entire journey made during the timespan of a day, distances to EGM venues from all venues that a participant spends time at, including their workplace, sporting or other venues could be taken into account, rather than just their residential locations.

As this study only investigated past-year gambling participation on various activities as a measure of gambling behaviour, it would be of interest to take into account other aspect of gambling behaviour which would provide a more useful measure of addiction, such as gambling expenditure, time spent on gambling activities and frequency of gambling by individuals.

As this study only measures accessibility by taking into account EGM venues, it would be of interest to take into account venues that enable other types of gambling such as the purchase of Lotto products and track or sports betting, such as Lotto terminals and TAB standalone venues and venues with TAB terminals. Data on gambling behaviour is already available from the NGS, while data on Lotto terminal locations and on venues with TAB facilities would have to be sourced from the New Zealand Lotteries Commission and the New Zealand Racing Board respectively. However, as discussed already, it is expected that the correlation between accessibility to physical venues and gambling behaviour might not be as strong for these forms of gambling due to opportunities for remote gambling such as placing bets through mobile phones and the internet, although the vast majority of Lotto tickets are still purchased through terminals (New Zealand Lotteries Commission, 2017a).

In terms of the differentiation between pub and club non-casino EGM venues, it would be of interest to investigate the effect of accessibility to pub venues only as these

venues are accessible to the general public in contrast to club venues which are accessible primarily by club members and their guests.

As discussed by Abbott (2006) and Moore et al. (2011), the number of available EGMs per venue was found to be an important determinant in choosing to play at a particular venue. A metric which takes into account the number of machines per venue could therefore be created in order to take into account the availability of gambling opportunities in areas that contain high numbers of machines but not necessarily high numbers of EGM venues. A possible suggestion would be to use kernel density analysis to investigate the density of EGMs per unit area in a similar manner used by McMillen and Doran (2006) and Young et al. (2009).

It would be of interest to investigate how changes in venue locations may possibly affect gambling behaviour, either due to the opening of new venues, due to existing venues closing down or choosing to retire their gaming machines, or due to the relocation of existing venues with machines. Longitudinal data measuring changes in gambling behaviour from 2012 to 2015 would already be available from the second, third and fourth phases of the NGS, while changes in EGM venue locations over this period can be assessed from data on venue locations available from the Department of Internal Affairs (2017b).

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Appendices

Appendix A: Number of participants and non-casino electronic gaming machine venues.

Table 20. Number of survey participants and number of non-casino EGM venues in 2012 by Territorial Authority.

Territorial Authority	Number of participants	Number of non-casino EGM venues
Far North District	111	32
Whangarei District	119	24
Kaipara District	42	10
Auckland	2322	306
Thames-Coromandel District	28	24
Hauraki District	24	10
Waikato District	122	21
Matamata-Piako District	54	14
Hamilton City	234	31
Waipa District	49	15
Otorohanga District	9	3
South Waikato District	31	13
Waitomo District	23	7
Taupo District	68	16
Western Bay of Plenty District	81	14
Tauranga City	174	42
Rotorua District	124	29
Whakatane District	65	14
Kawerau District	17	4
Opotiki District	26	5
Gisborne District	135	14
Wairoa District	8	4
Hastings District	132	22
Napier City	89	24
Central Hawke's Bay District	32	7
New Plymouth District	107	28
Stratford District	6	5
South Taranaki District	32	13
Ruapehu District	15	7
Whanganui District	77	18
Rangitikei District	27	8
Manawatu District	42	7
Palmerston North City	105	33
Taranua District	20	13
Horowhenua District	40	13

Territorial Authority	Number of participants	Number of non-casino EGM venues
Kapiti Coast District	89	14
Porirua City	72	16
Upper Hutt City	65	10
Lower Hutt City	143	38
Wellington City	263	49
Masterton District	32	8
Carterton District	12	4
South Wairarapa District	6	7
Tasman District	49	16
Nelson City	53	20
Marlborough District	33	21
Kaikoura District	8	4
Buller District	7	11
Grey District	5	15
Westland District	8	7
Hurunui District	8	12
Waimakariri District	43	13
Christchurch City	342	104
Selwyn District	36	14
Ashburton District	36	15
Timaru District	42	24
Mackenzie District	0	5
Waimate District	3	6
Chatham Islands Territory	0	1
Waitaki District	19	14
Central Otago District	19	15
Queenstown-Lakes District	21	12
Dunedin City	119	41
Clutha District	19	13
Southland District	29	24
Gore District	16	7
Invercargill City	62	21
Area Outside Territorial Authority	0	1
Total	6249	1429

Appendix B: Maps showing the location of electronic gaming machine venues for various New Zealand cities.

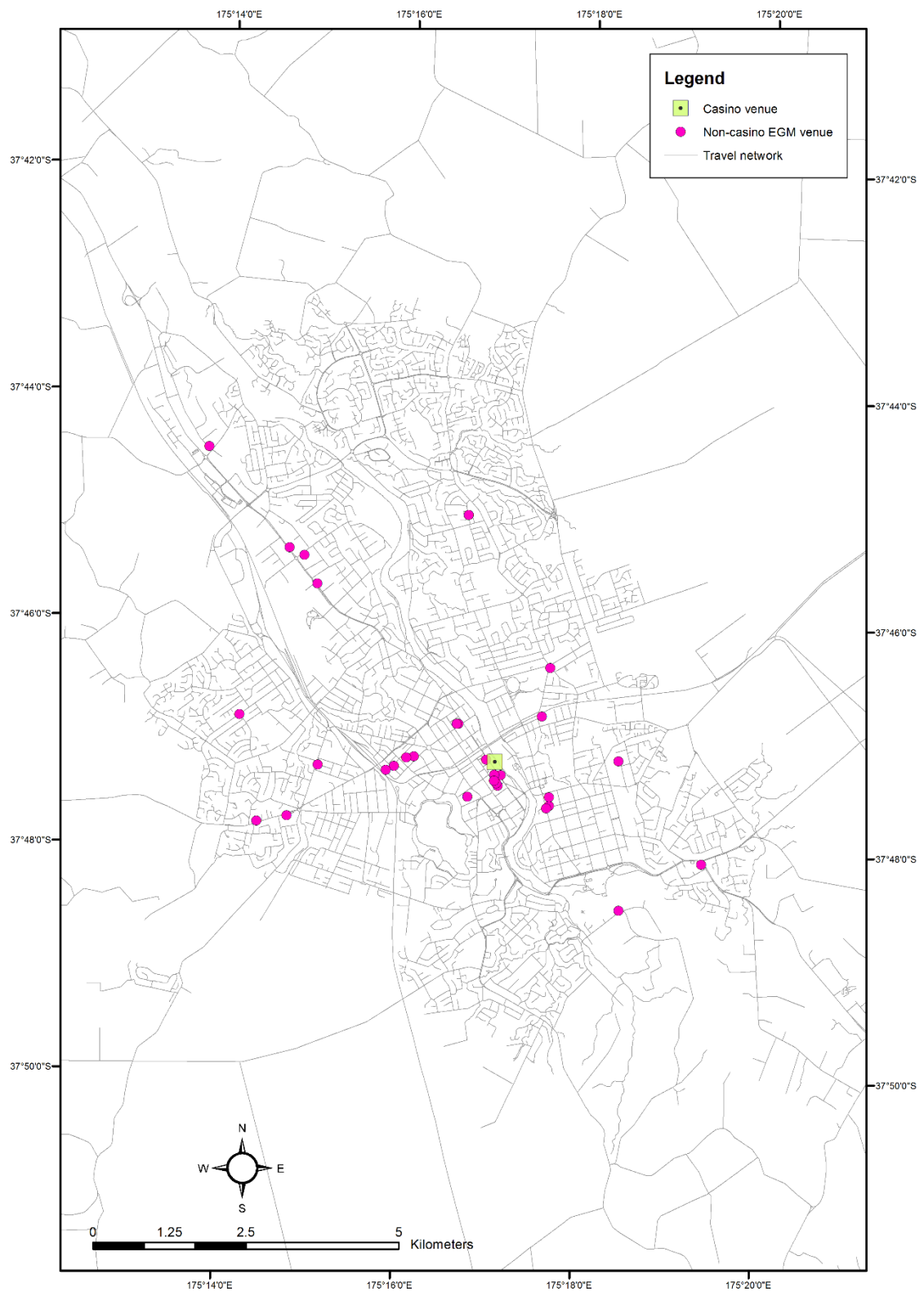


Figure 38. Map of EGM venue locations in the Hamilton urban area.

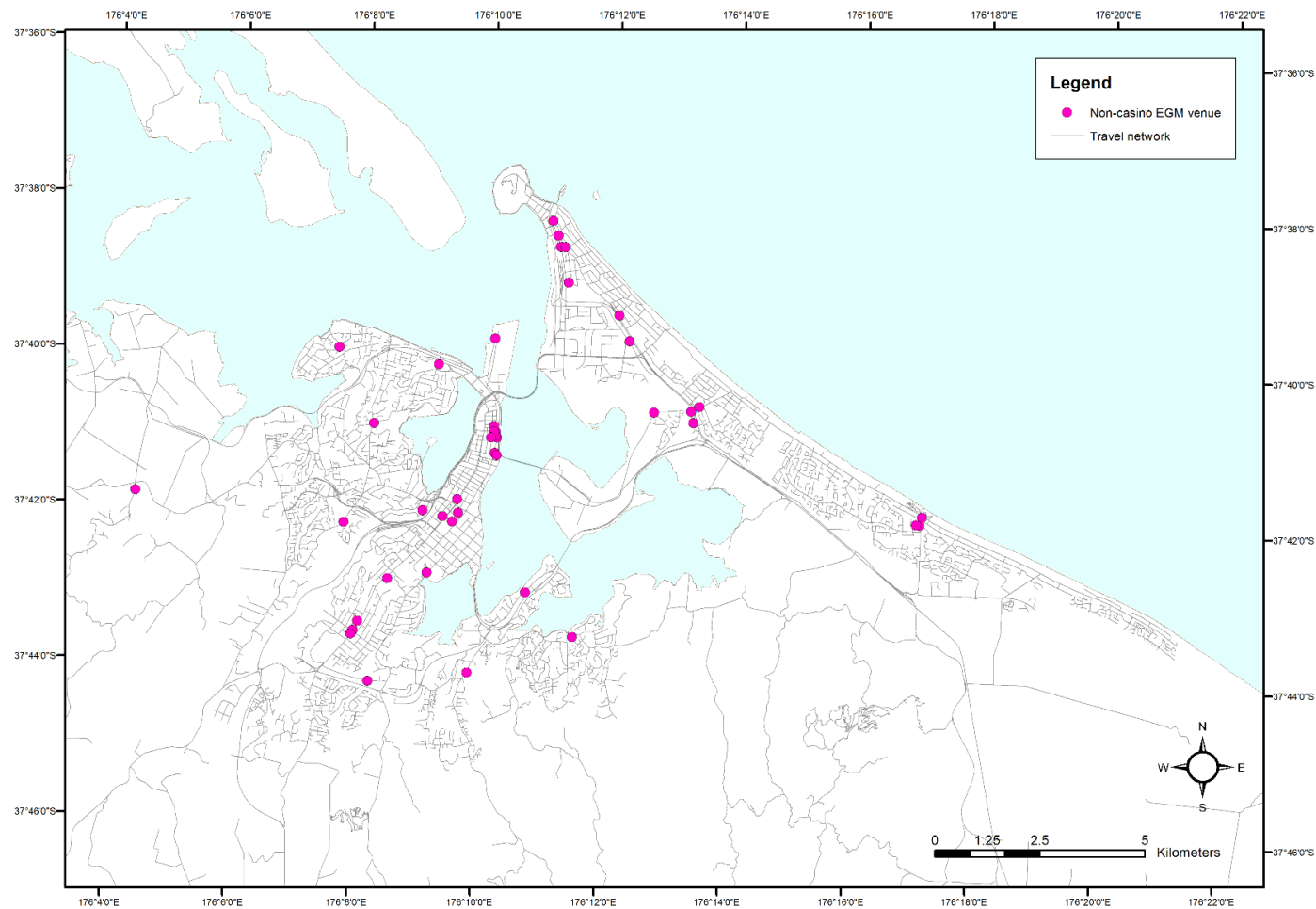


Figure 39. Map of EGM venue locations in the Tauranga urban area.

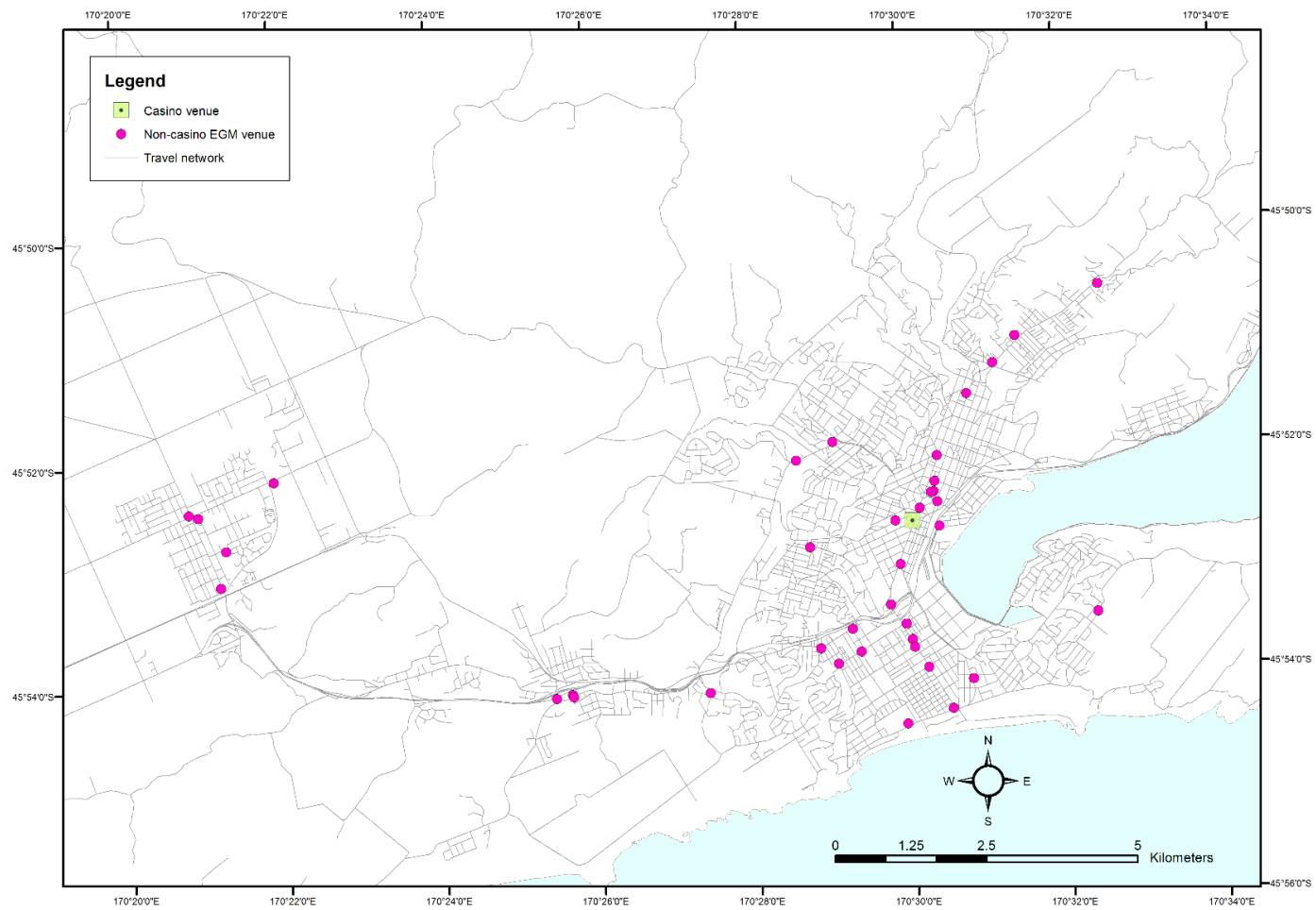


Figure 40. Map of EGM venue locations in the Dunedin urban area.

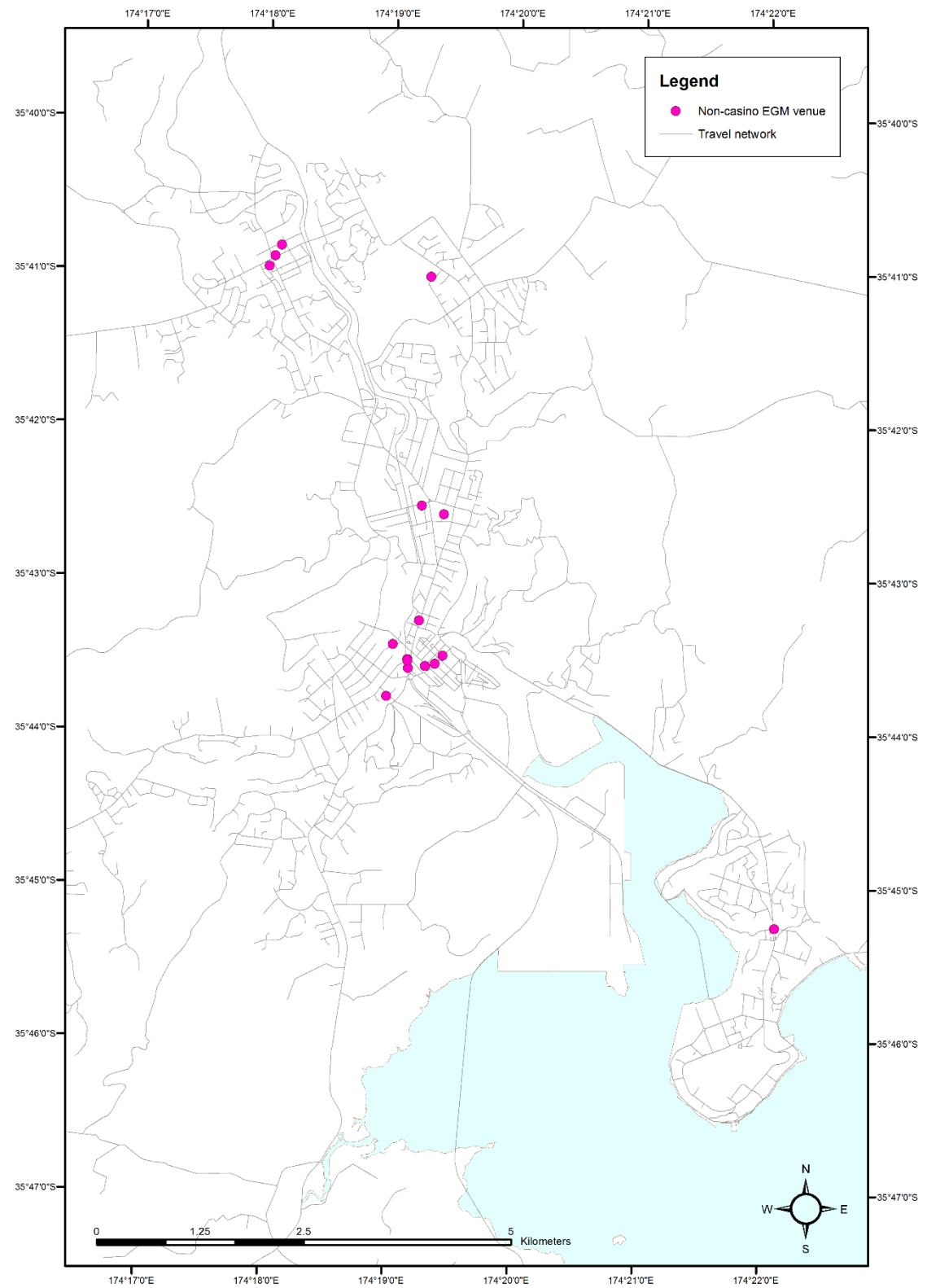


Figure 41. Map of EGM venue locations in the Whangarei urban area.

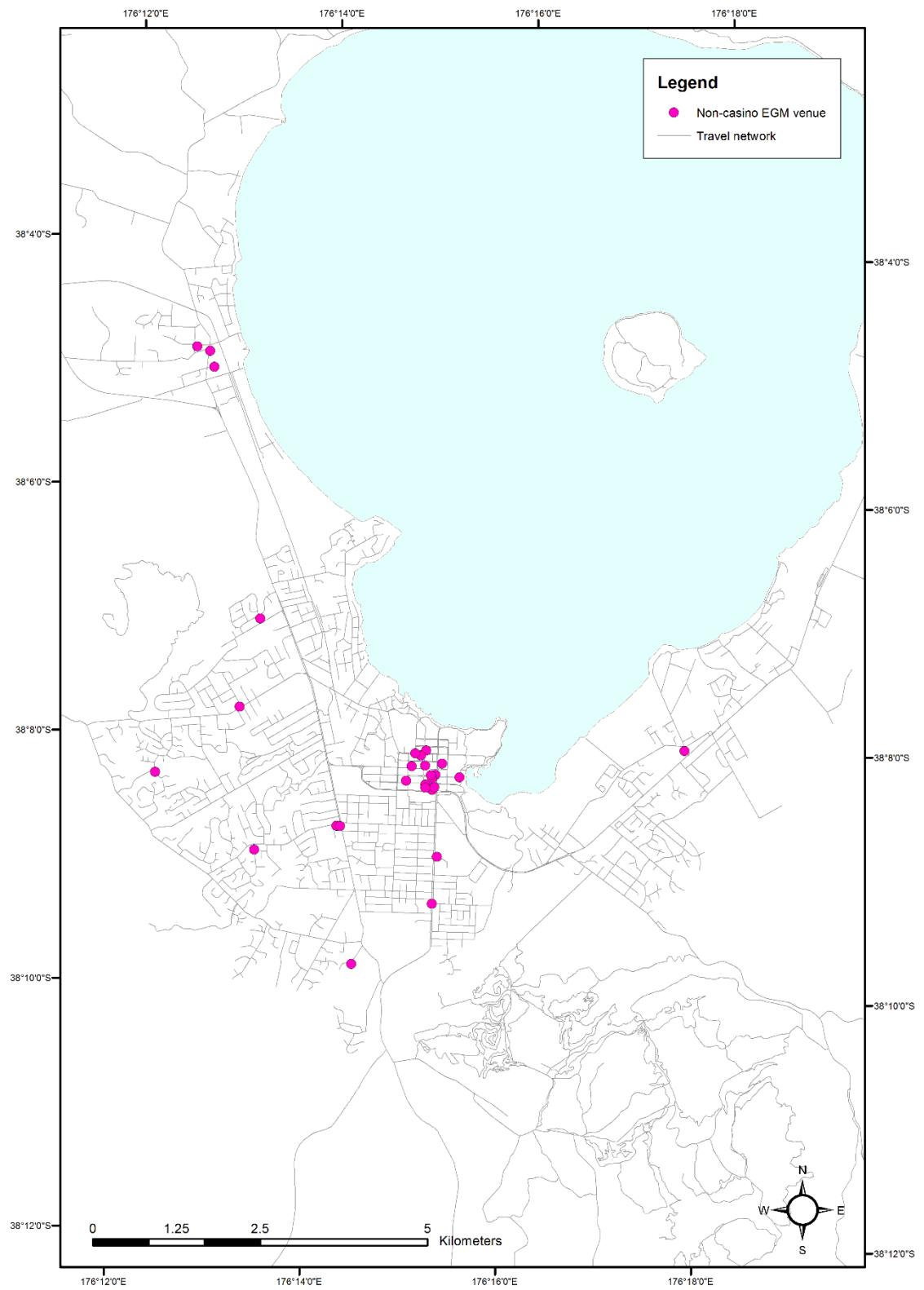


Figure 42. Map of EGM venue locations in the Rotorua urban area.

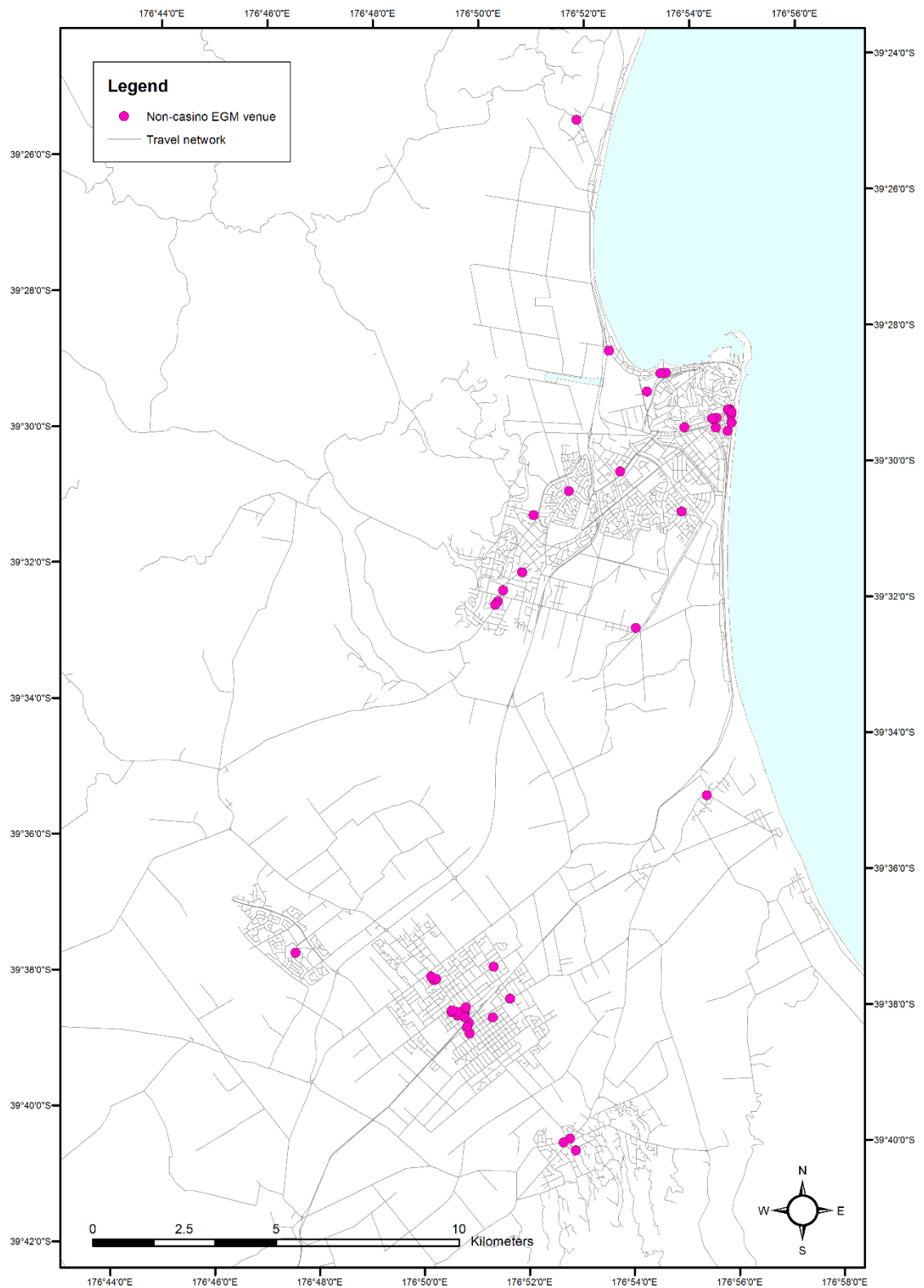


Figure 43. Map of EGM venue locations in the Napier-Hasting urban area.

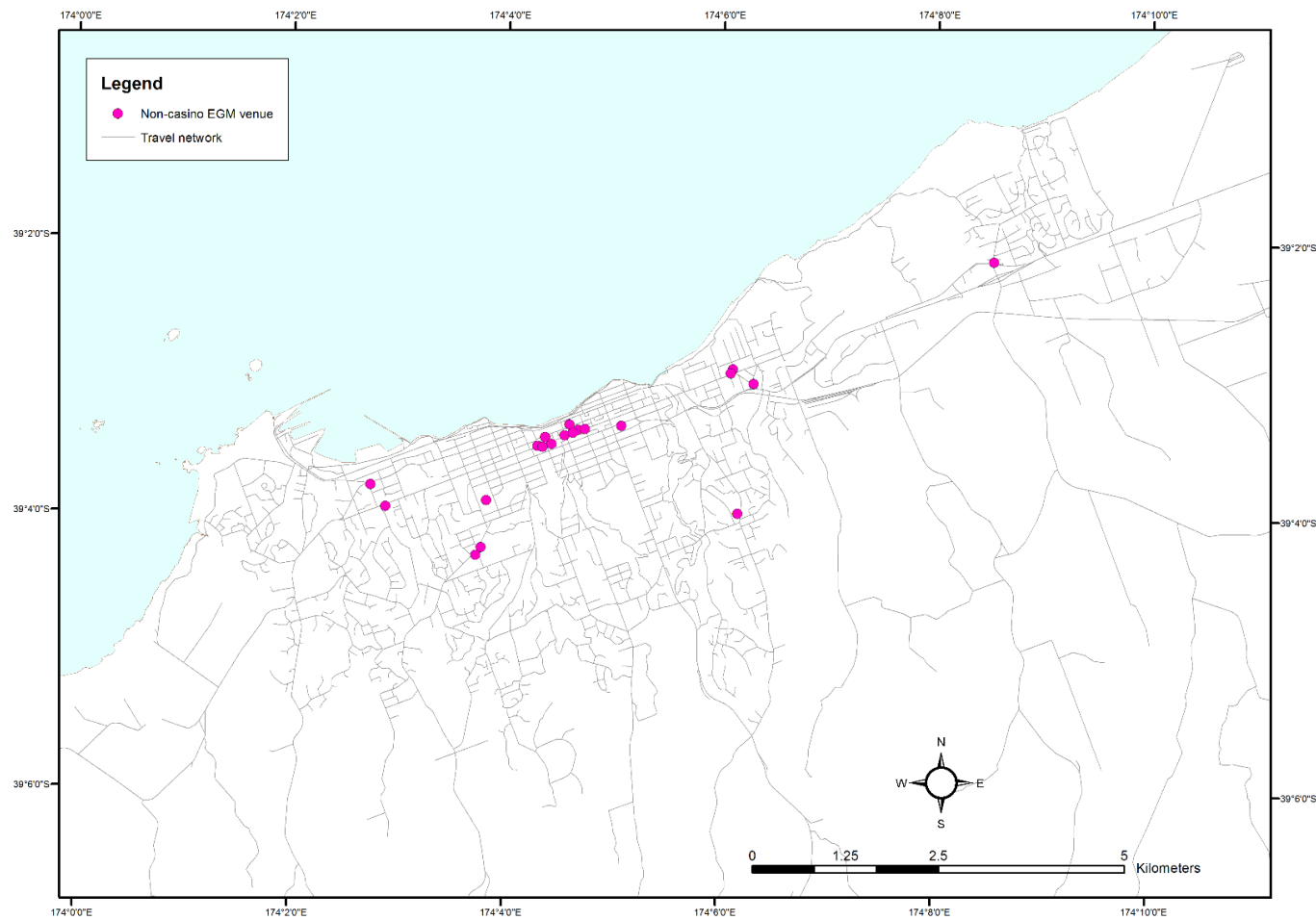


Figure 44. Map of EGM venue locations in the New Plymouth urban area.



Figure 45. Map of EGM venue locations in the Palmerston North urban area.

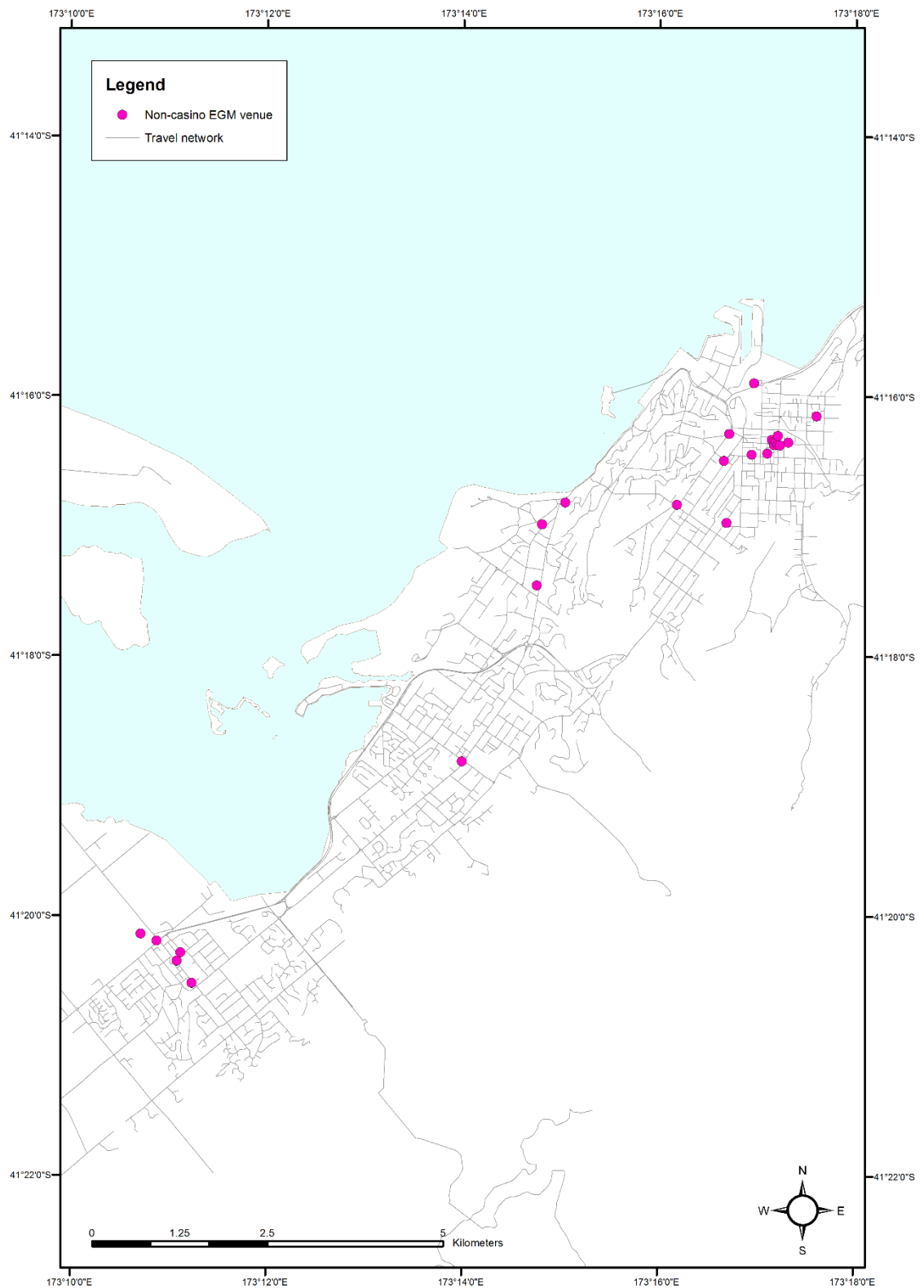


Figure 46. Map of EGM venue locations in the Nelson-Richmond urban area.

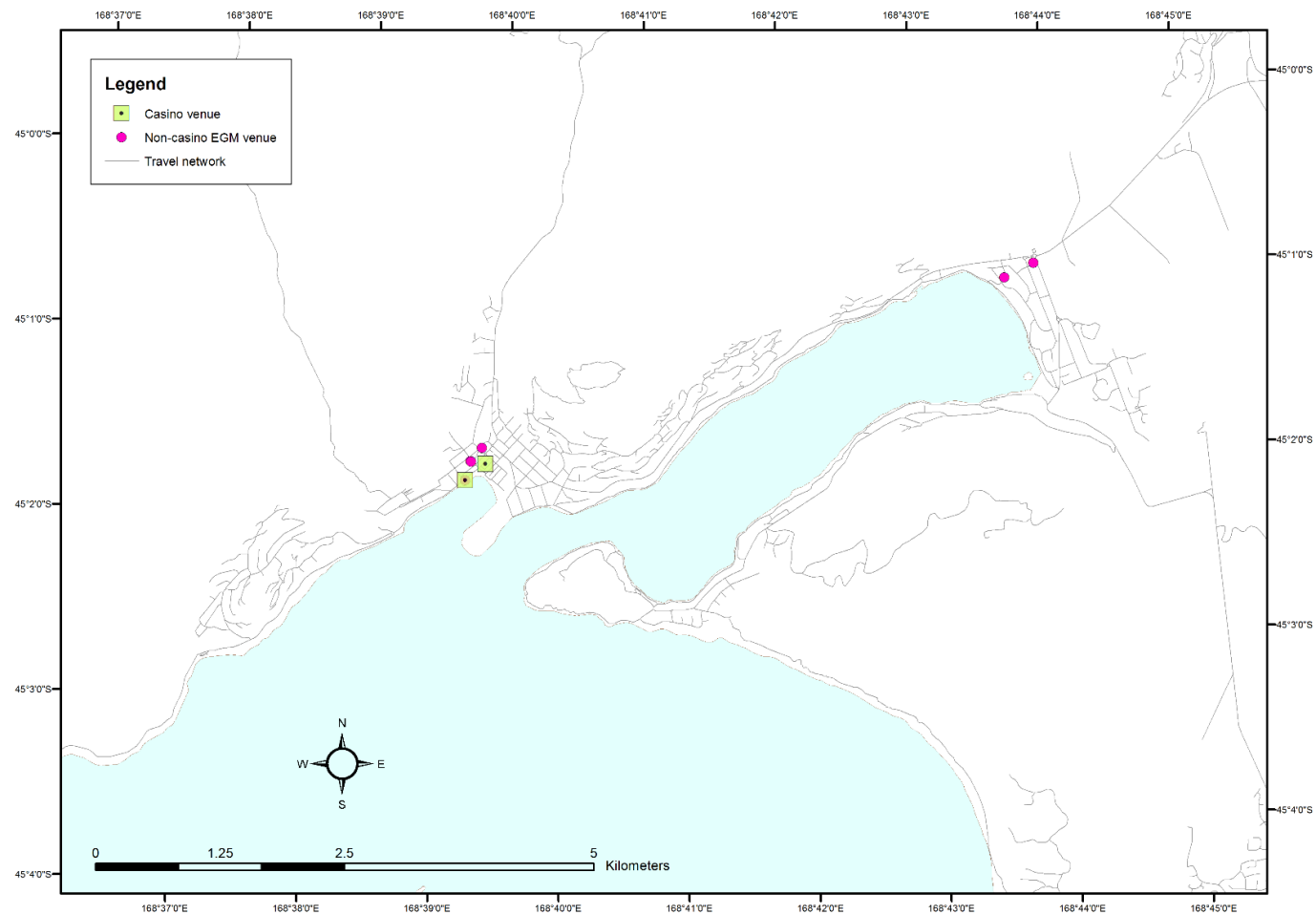


Figure 47. Map of EGM venue locations in the Queenstown urban area.

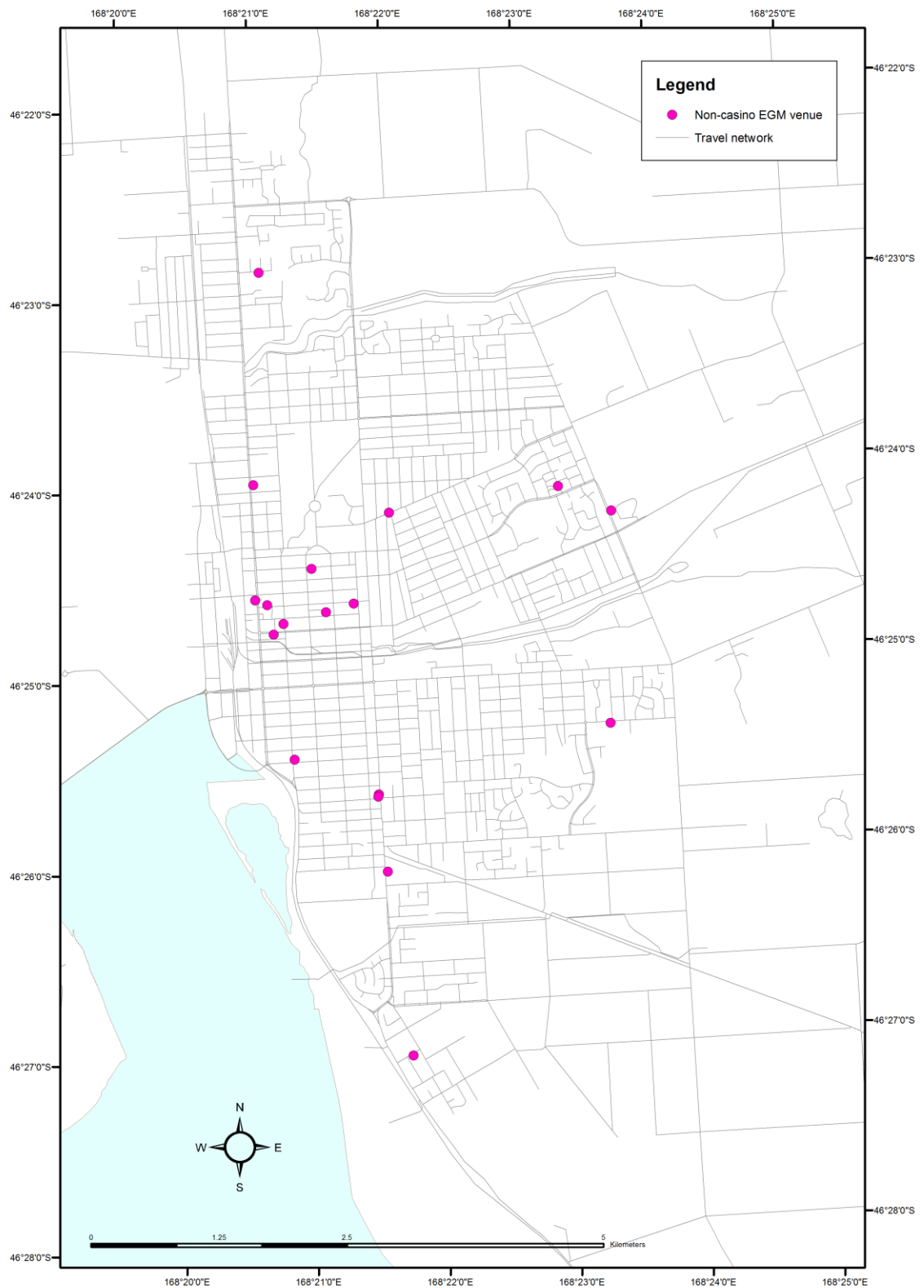


Figure 48. Map of EGM venue locations in the Invercargill urban area.

Appendix C: Maps showing distances to the closest casino for each New Zealand city or town with a casino.

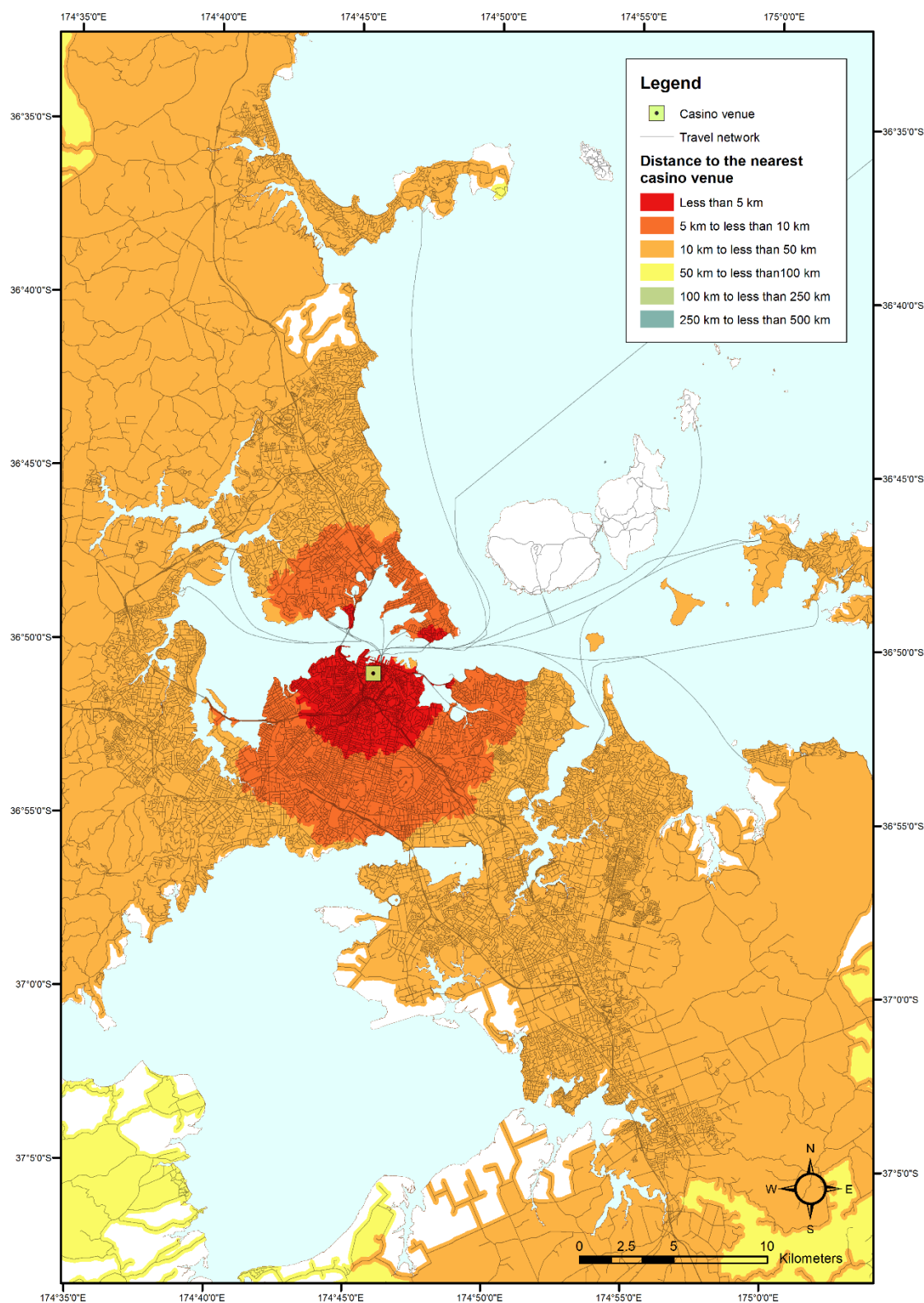


Figure 49. Map of distance to the nearest casino venue in the Auckland urban area.

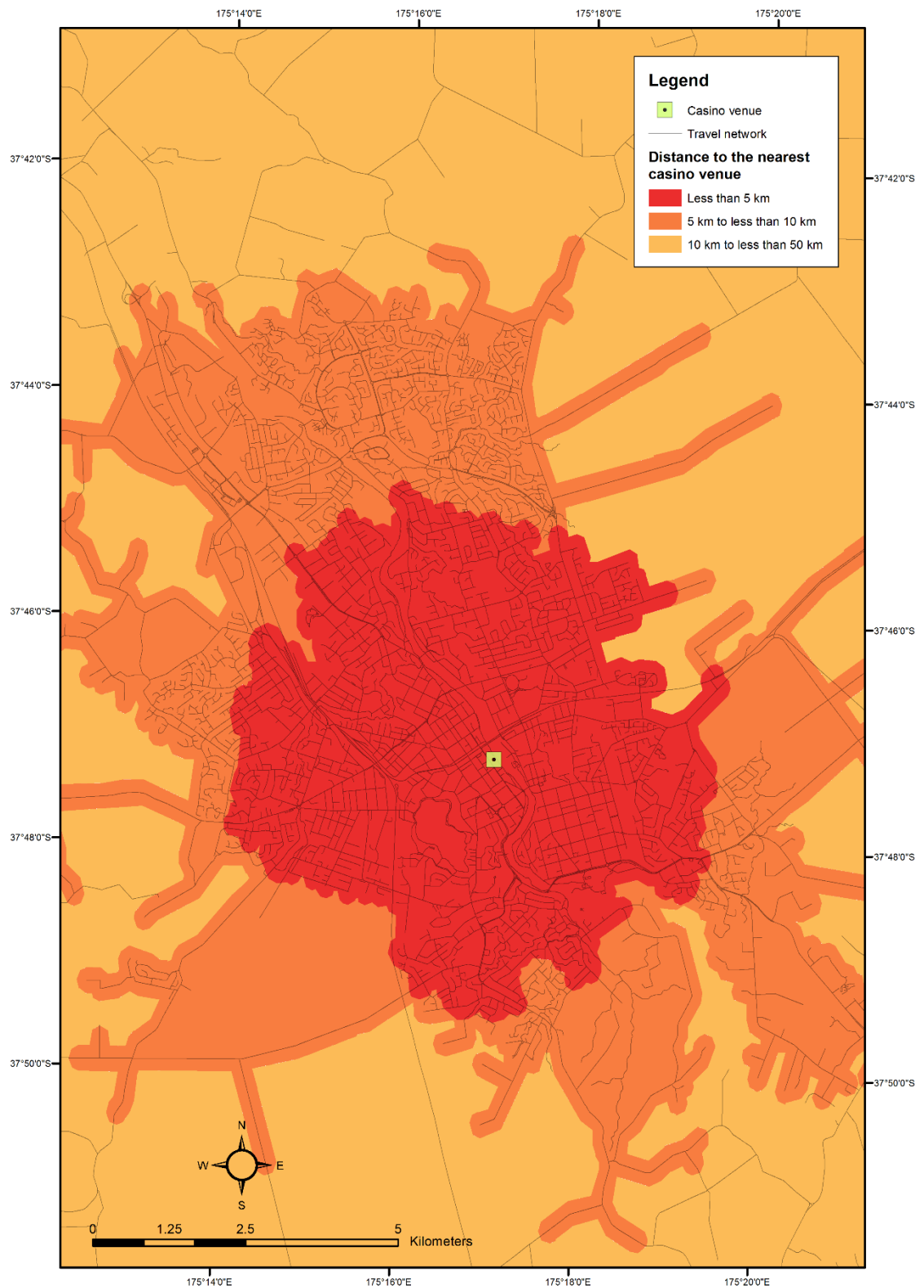


Figure 50. Map of distance to the nearest casino venue in the Hamilton urban area.

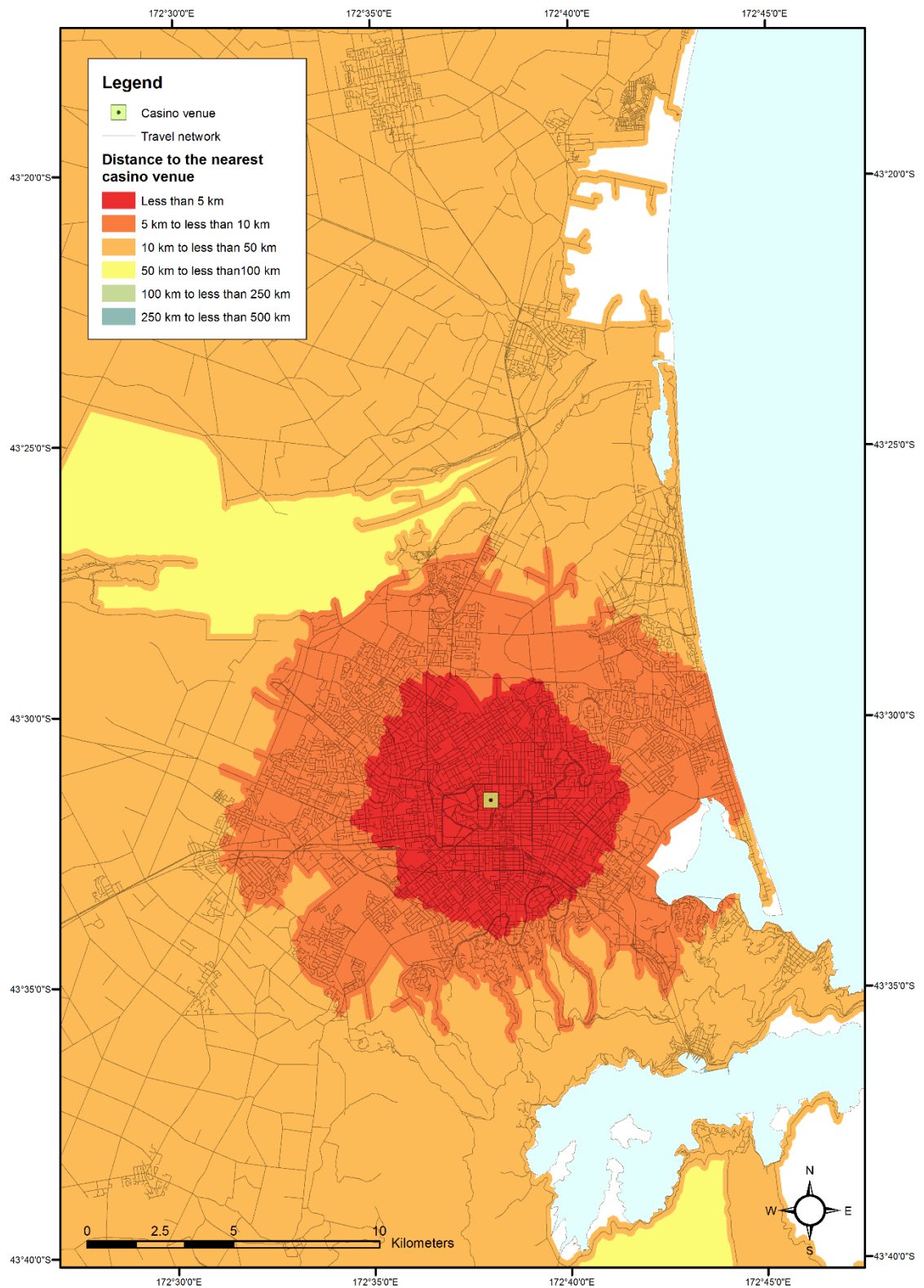


Figure 51. Map of distance to the nearest casino venue in the Christchurch urban area.

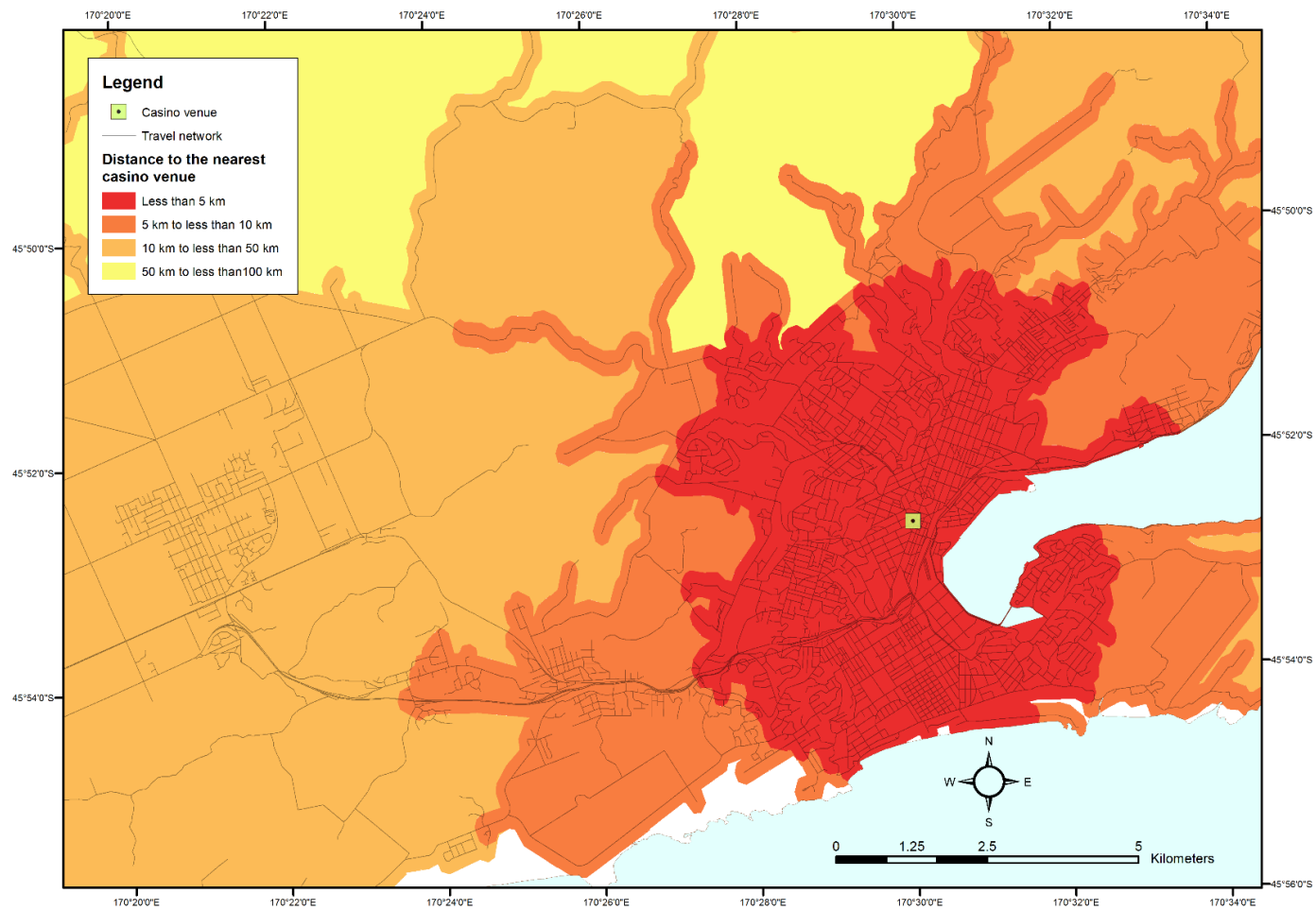


Figure 52. Map of distance to the nearest casino venue in the Dunedin urban area.

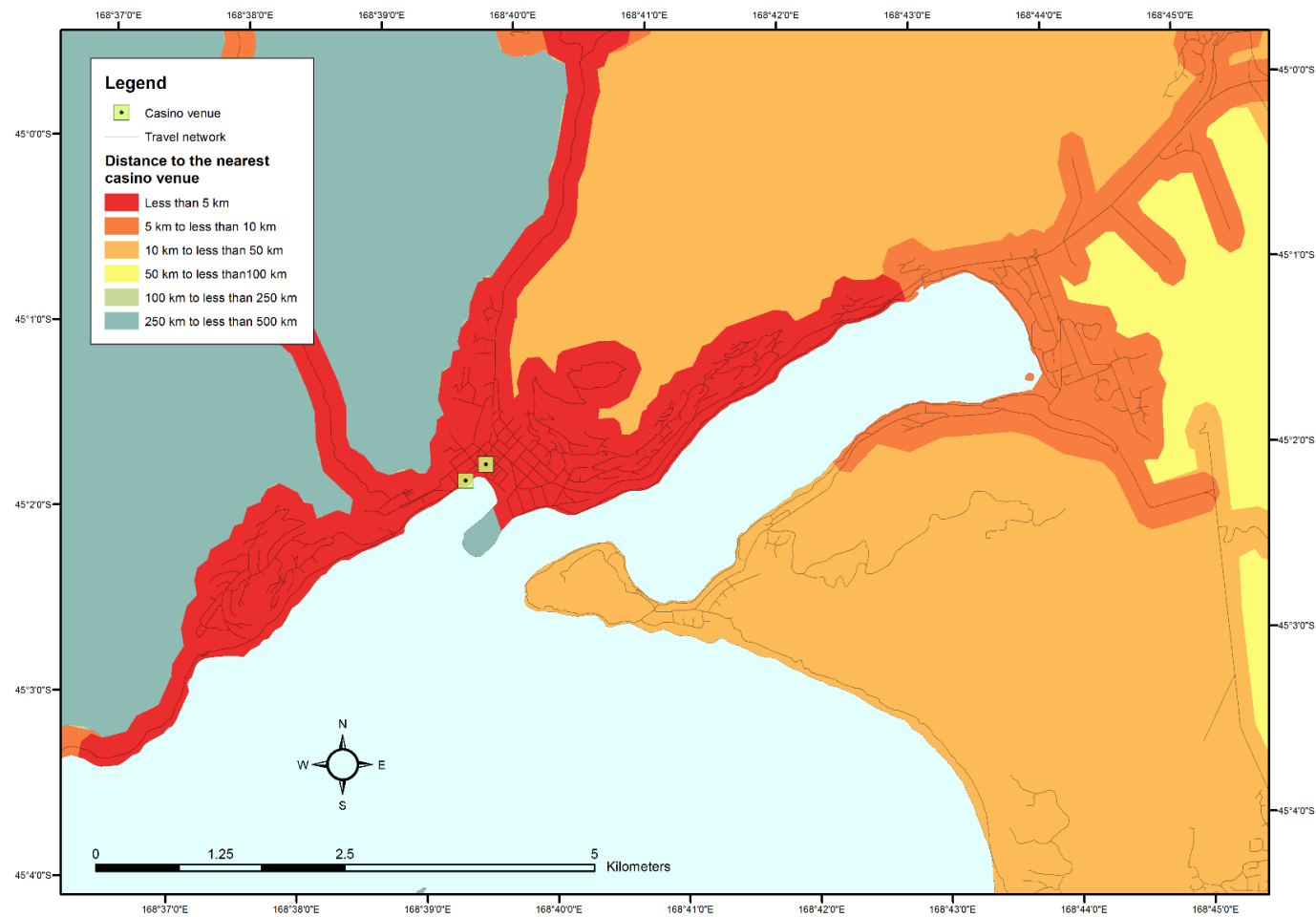


Figure 53. Map of distance to the nearest casino venue in the Queenstown urban area.

Appendix D: Maps showing distances to the closest non-casino electronic gaming machine venue for various New Zealand cities.

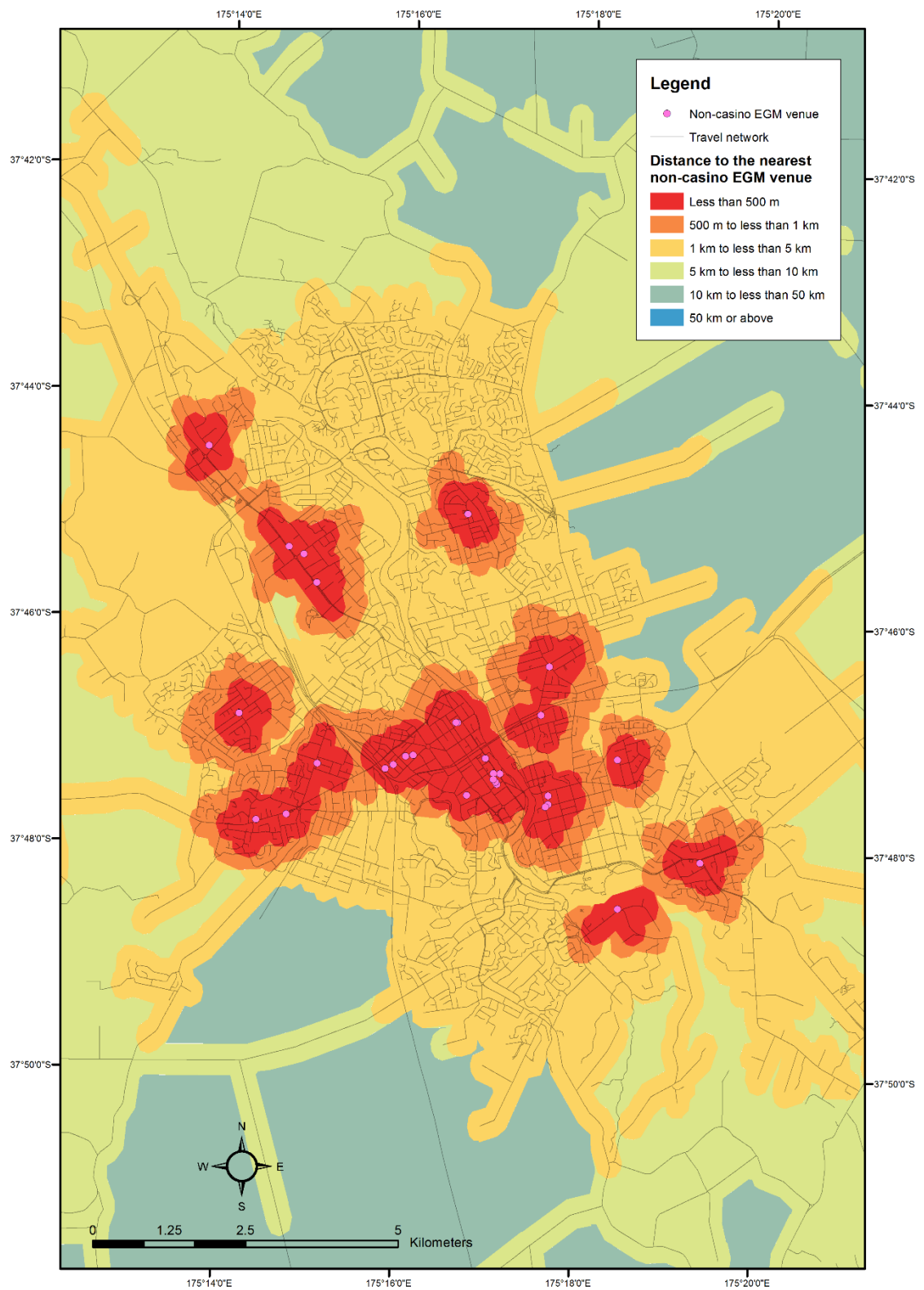


Figure 54. Map of distance to the nearest non-casino EGM venue in the Hamilton urban area.

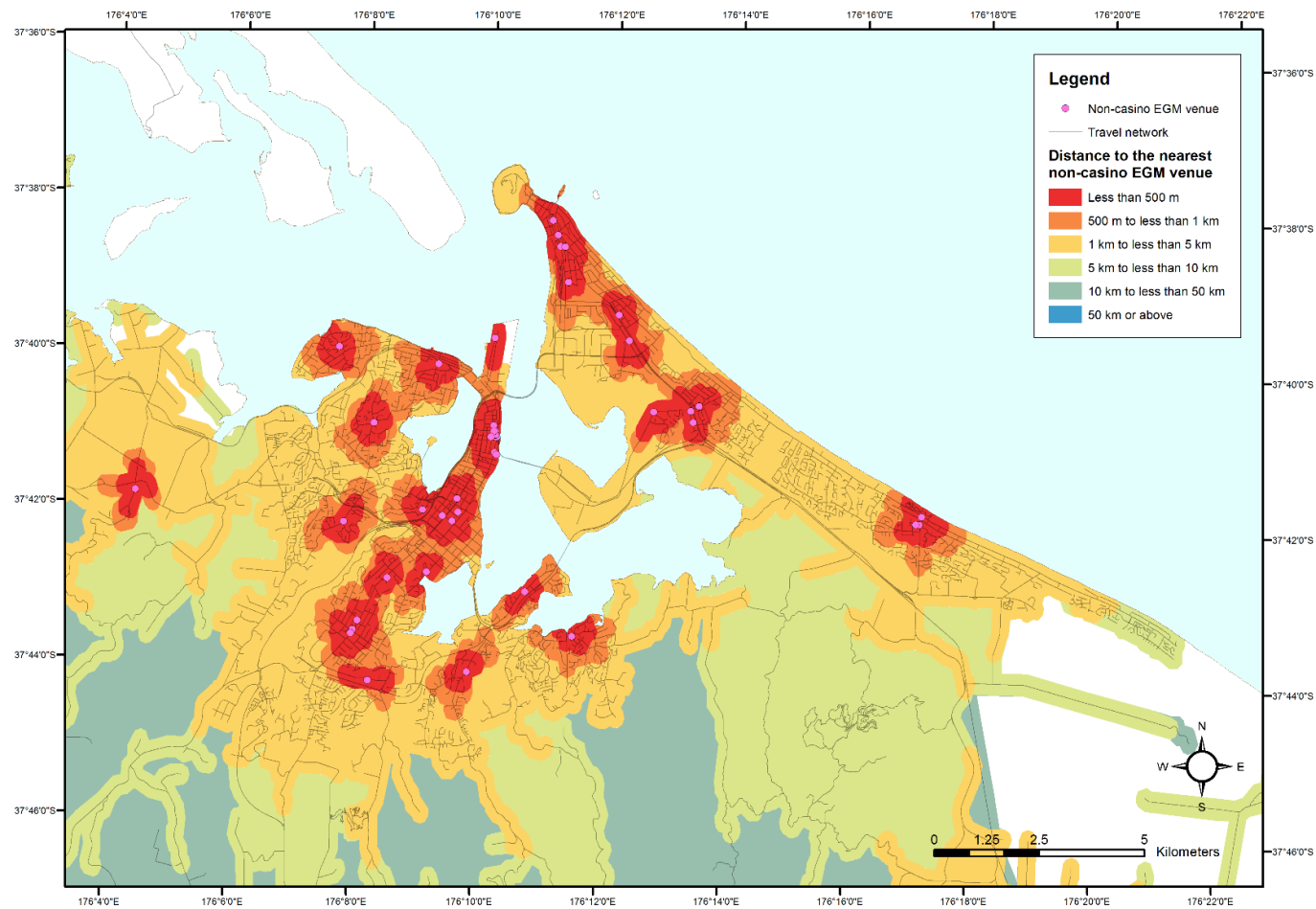


Figure 55. Map of distance to the nearest non-casino EGM venue in the Tauranga urban area.

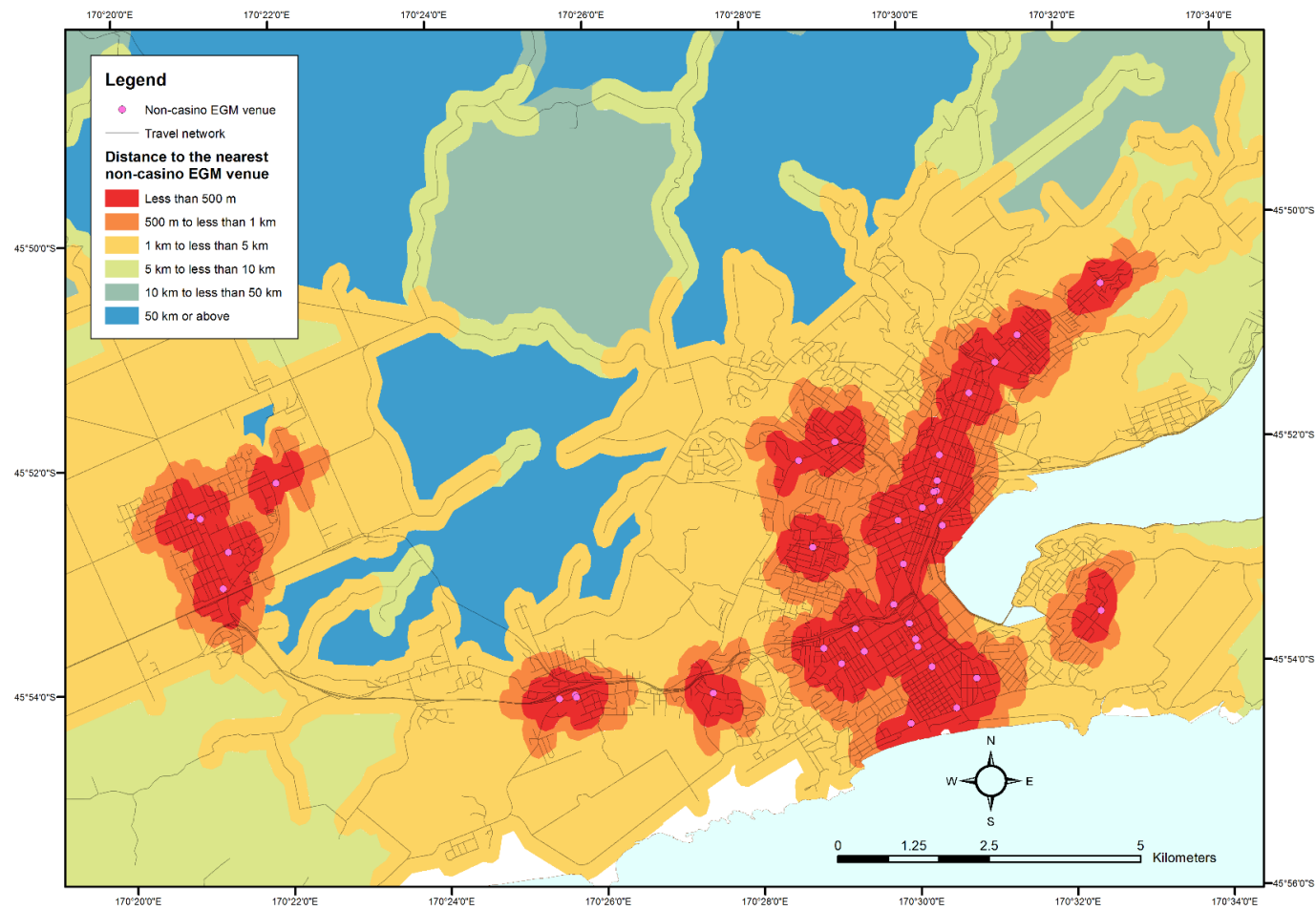


Figure 56. Map of distance to the nearest non-casino EGM venue in the Dunedin urban area.

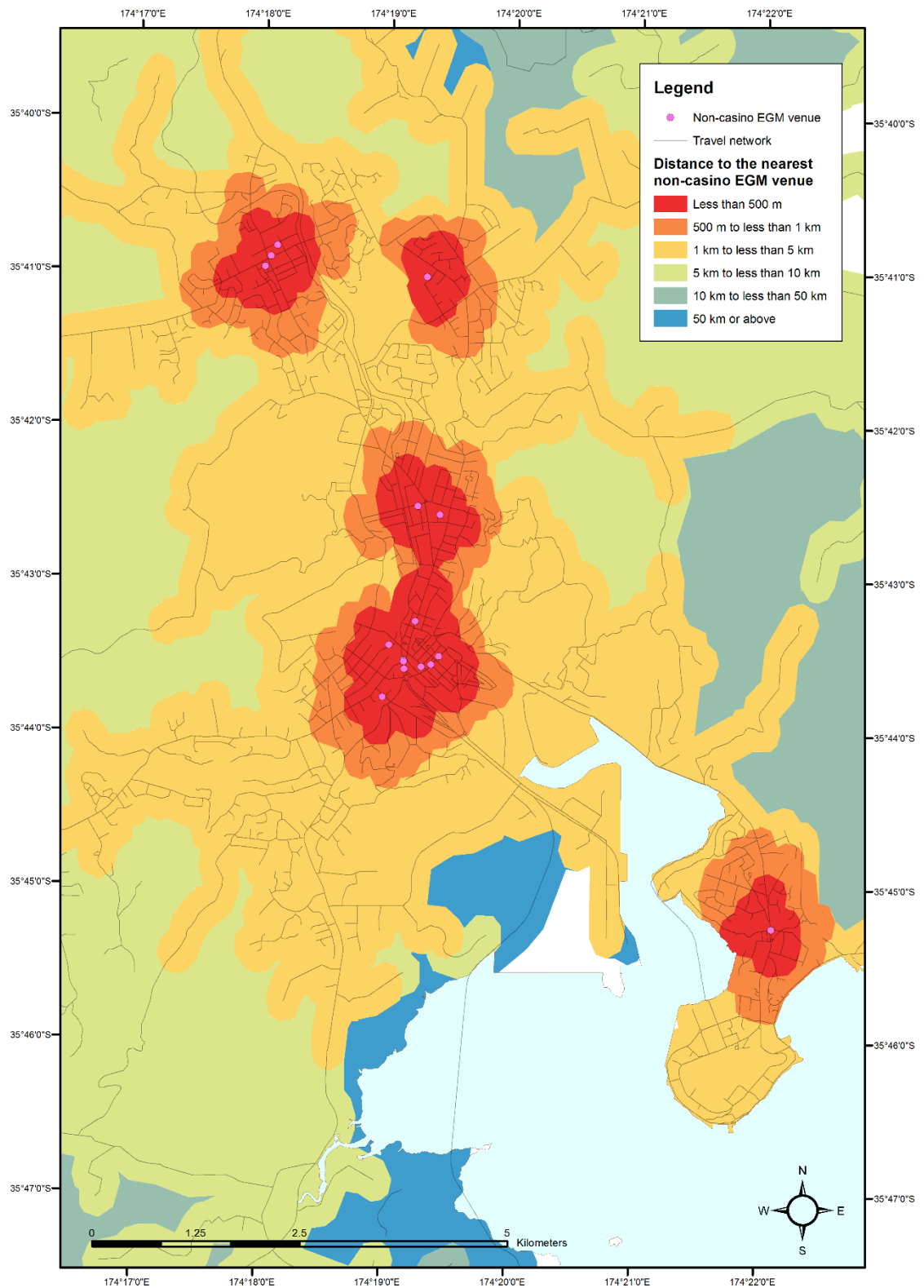


Figure 57. Map of distance to the nearest non-casino EGM venue in the Whangarei urban area.

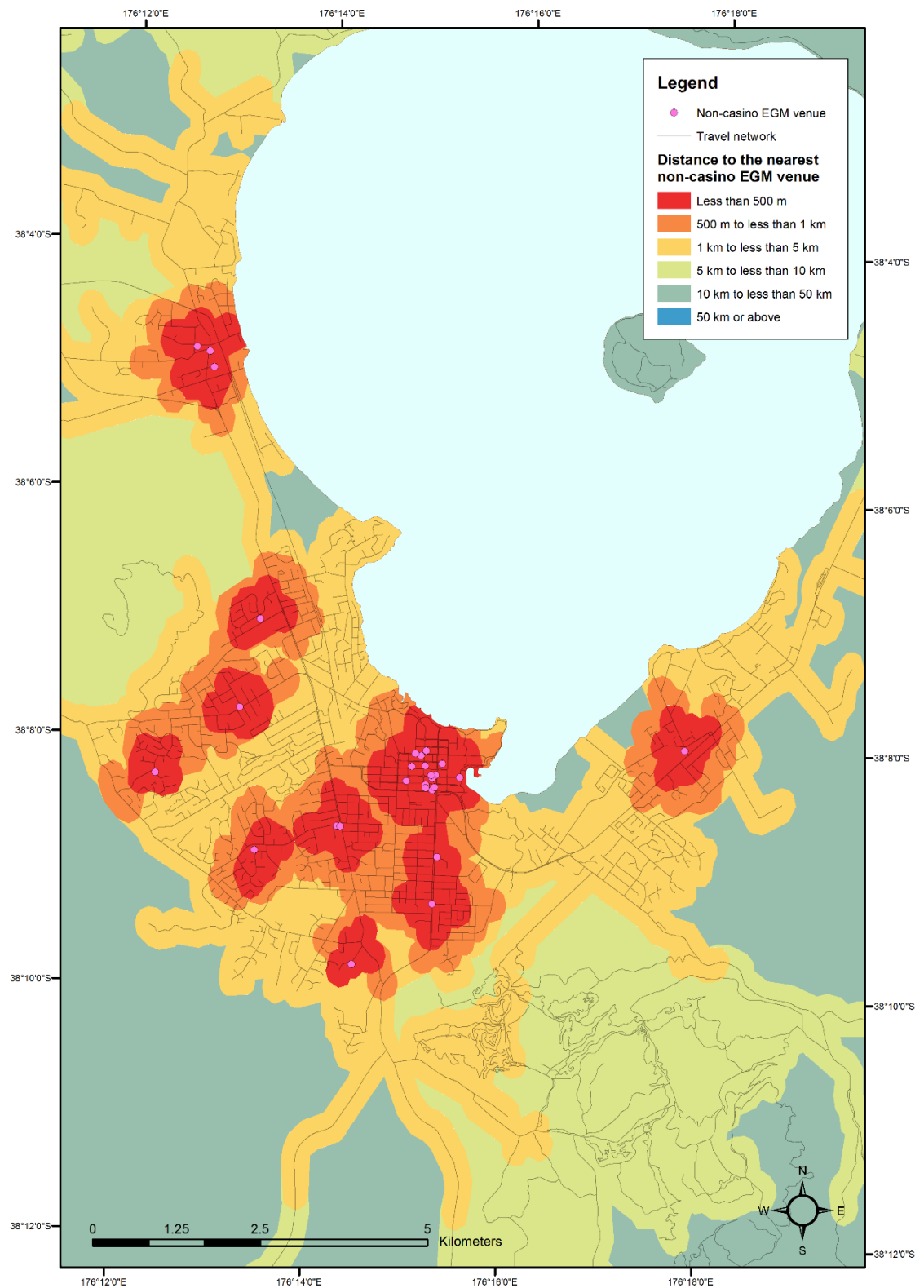


Figure 58. Map of distance to the nearest non-casino EGM venue in the Rotorua urban area.

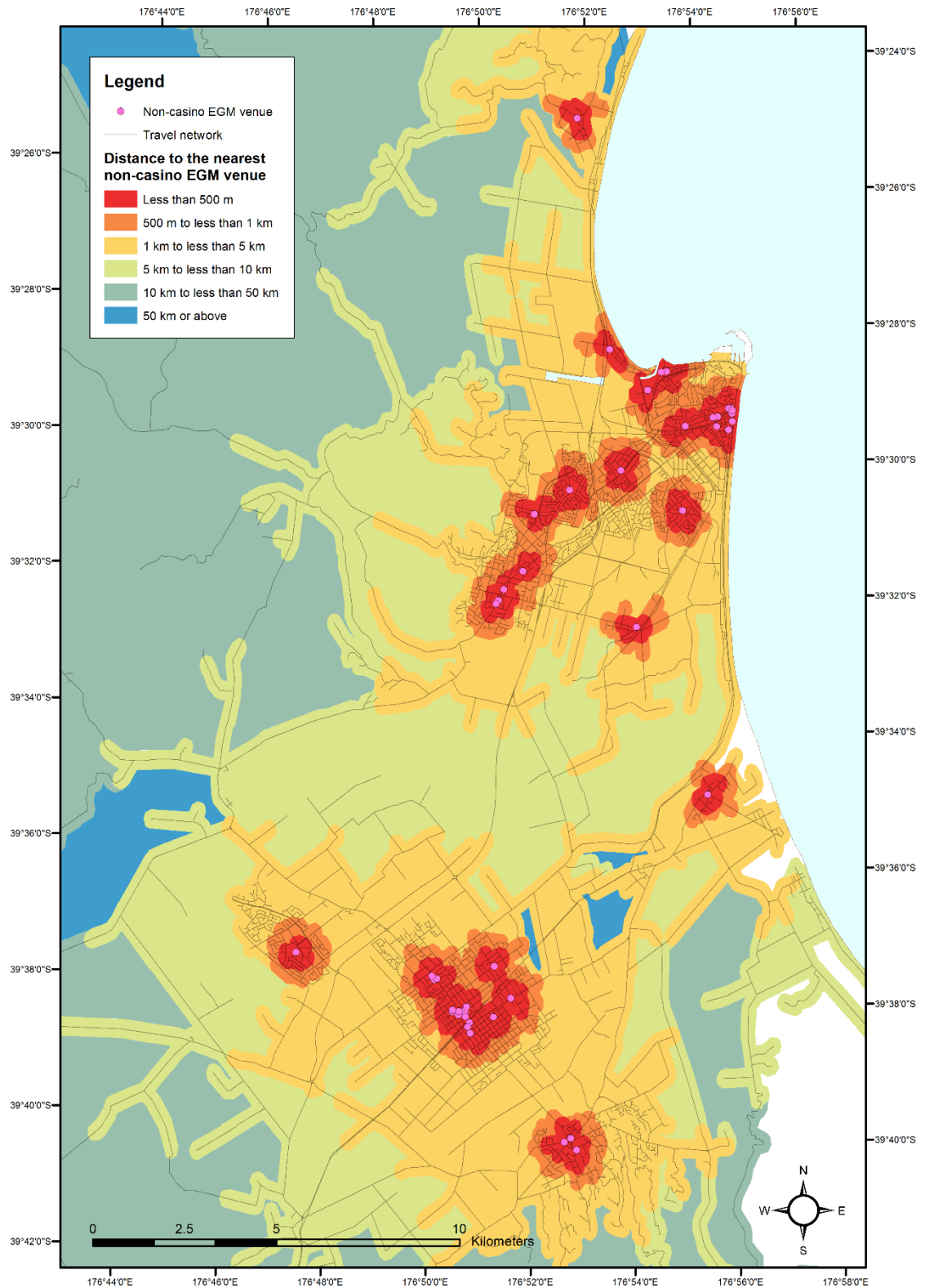


Figure 59. Map of distance to the nearest non-casino EGM venue in the Napier-Hastings urban area.

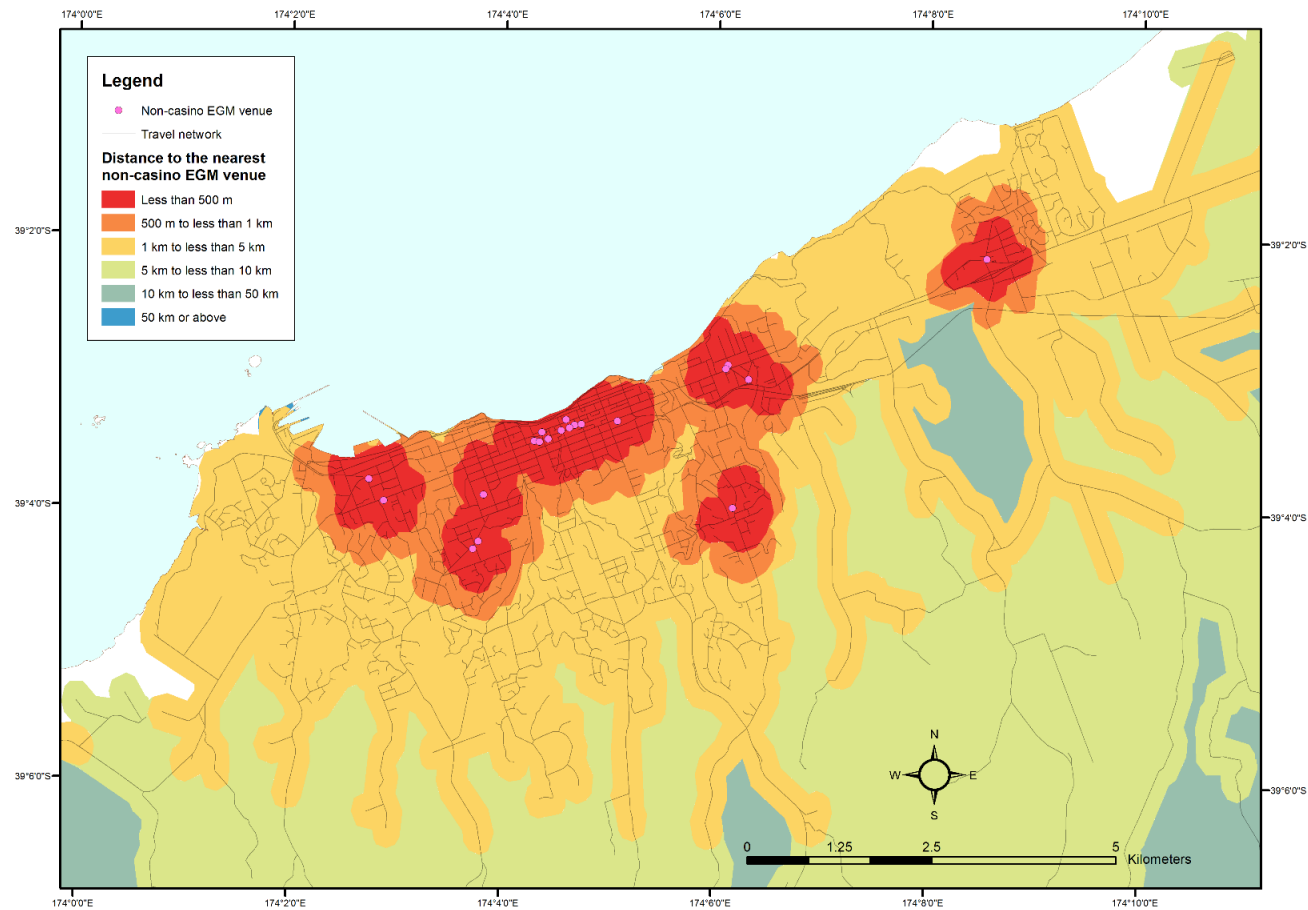


Figure 60. Map of distance to the nearest non-casino EGM venue in the New Plymouth area.

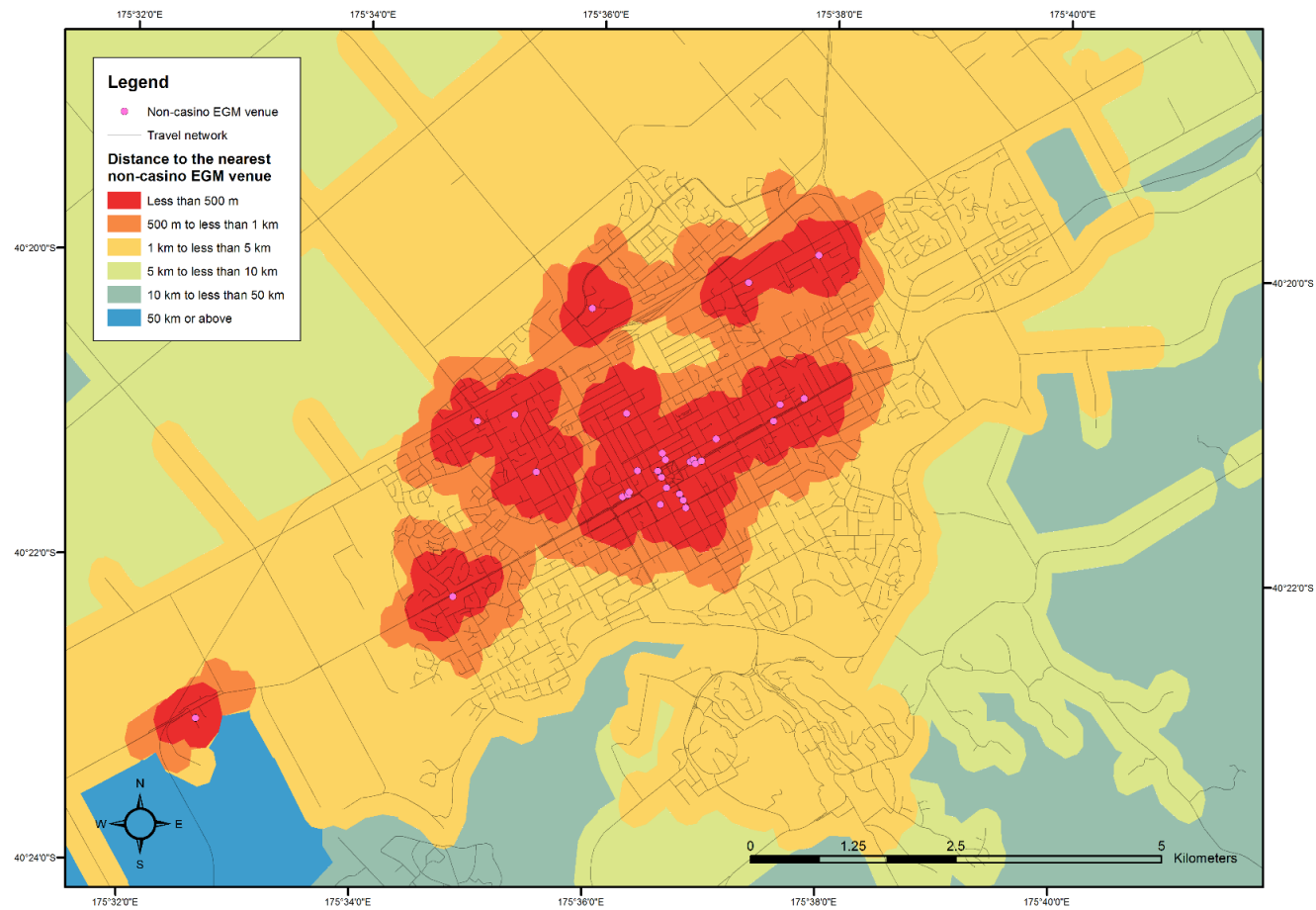


Figure 61. Map of distance to the nearest non-casino EGM venue in the Palmerston North urban area.

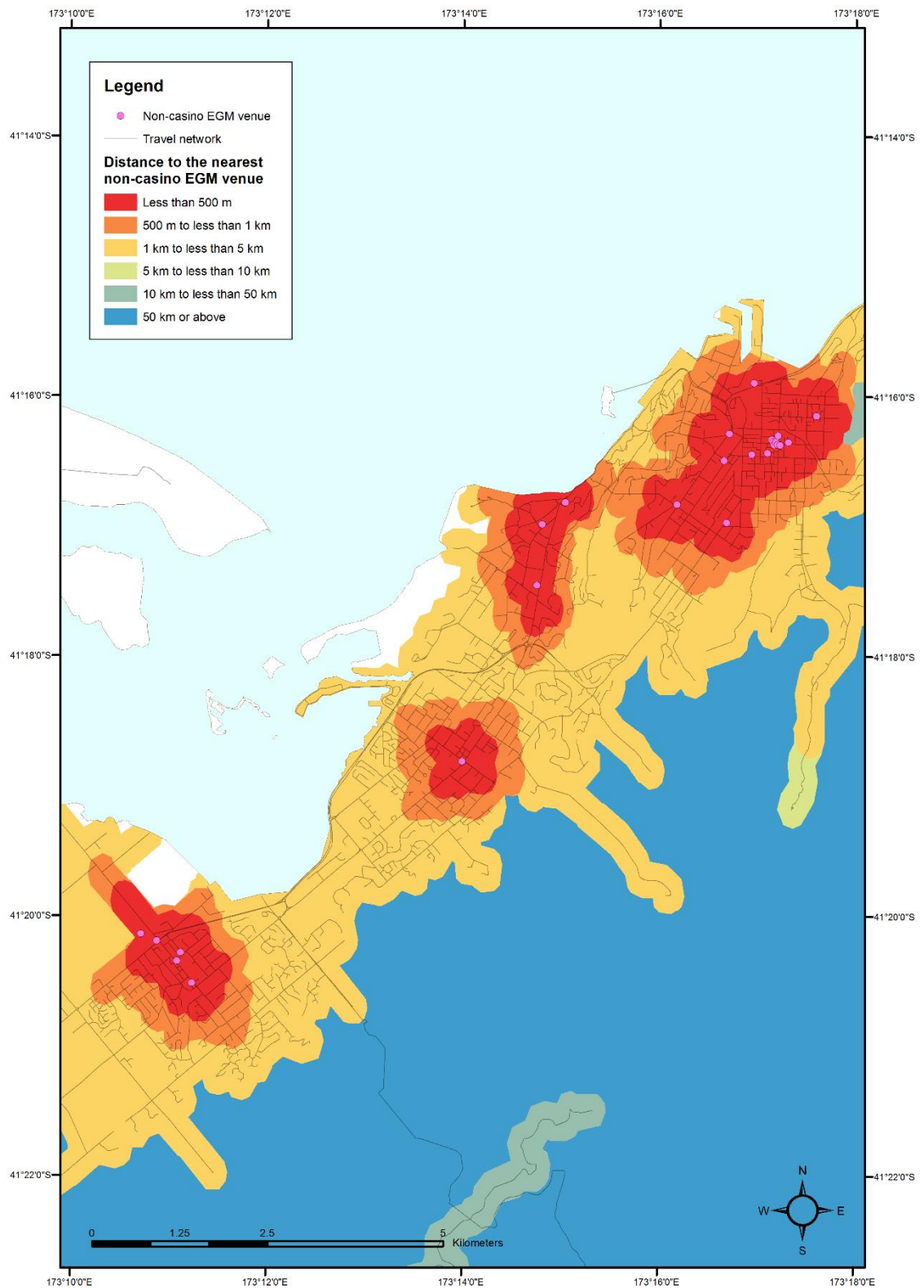


Figure 62. Map of distance to the nearest non-casino EGM venue in the Nelson-Richmond urban area.

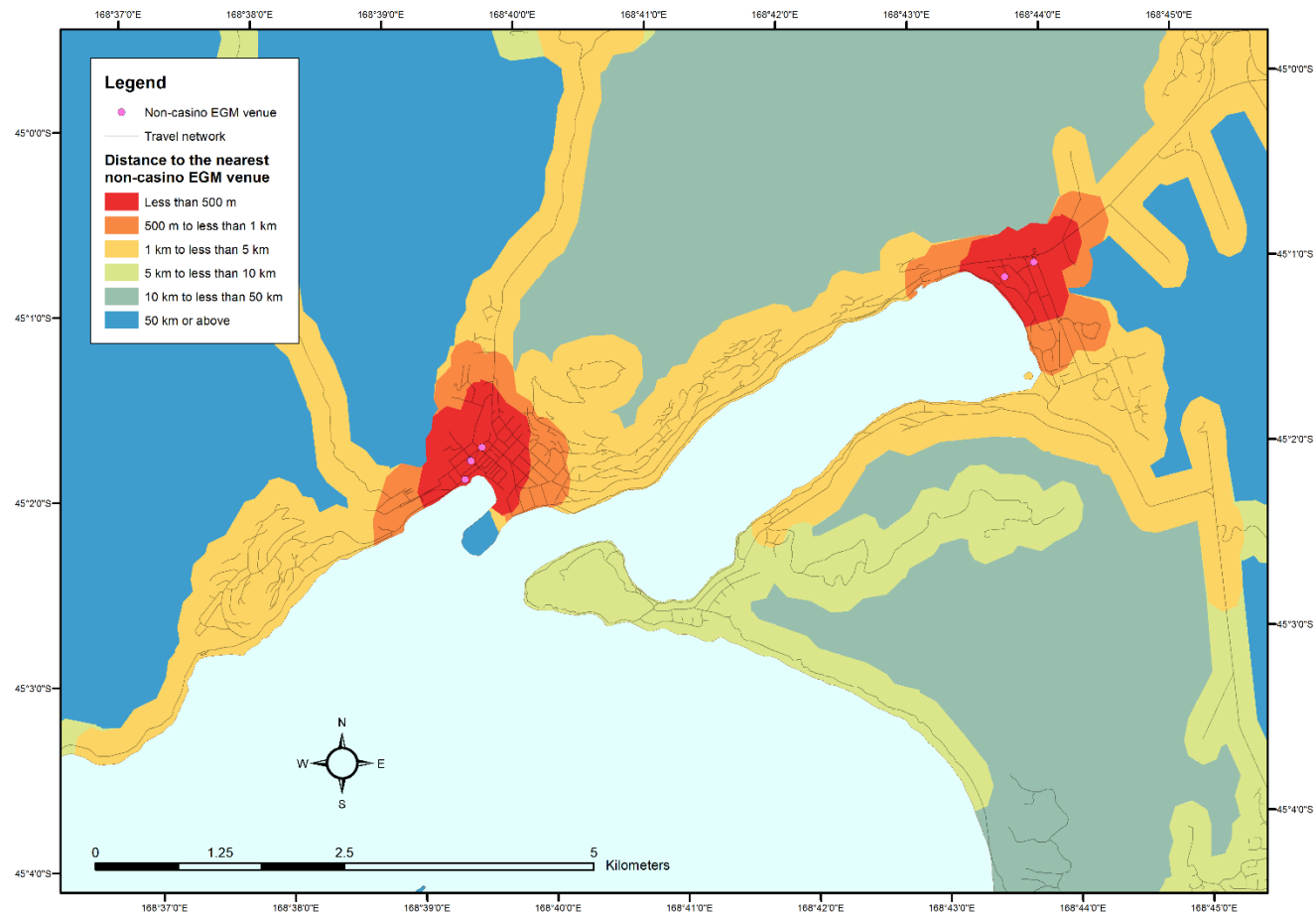


Figure 63. Map of distance to the nearest non-casino EGM venue in the Queenstown urban area.

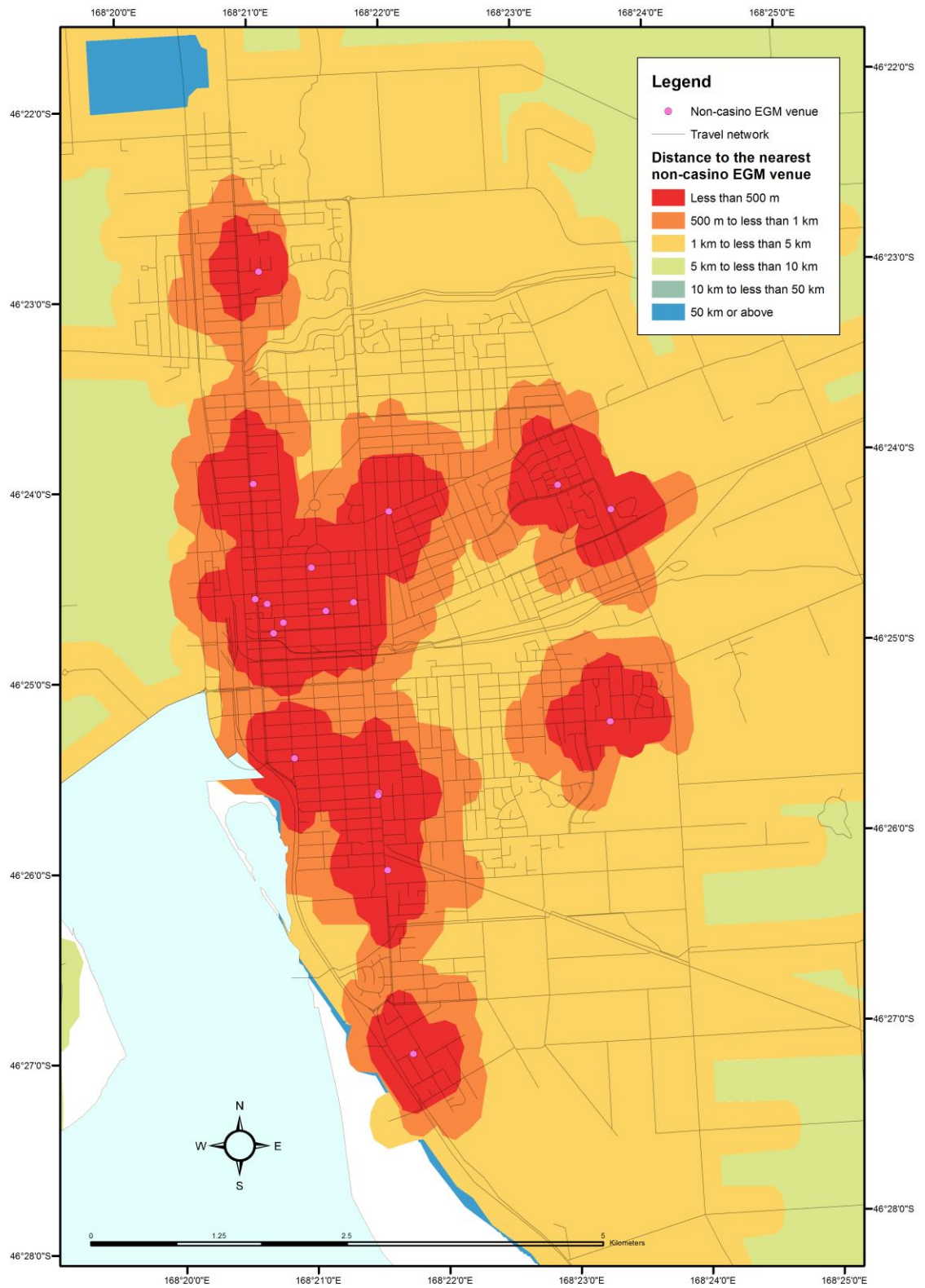


Figure 64. Map of distance to the nearest non-casino EGM venue in the Invercargill urban area.

Appendix E: Maps showing the number of electronic gaming machine venues within five kilometres for various New Zealand cities.

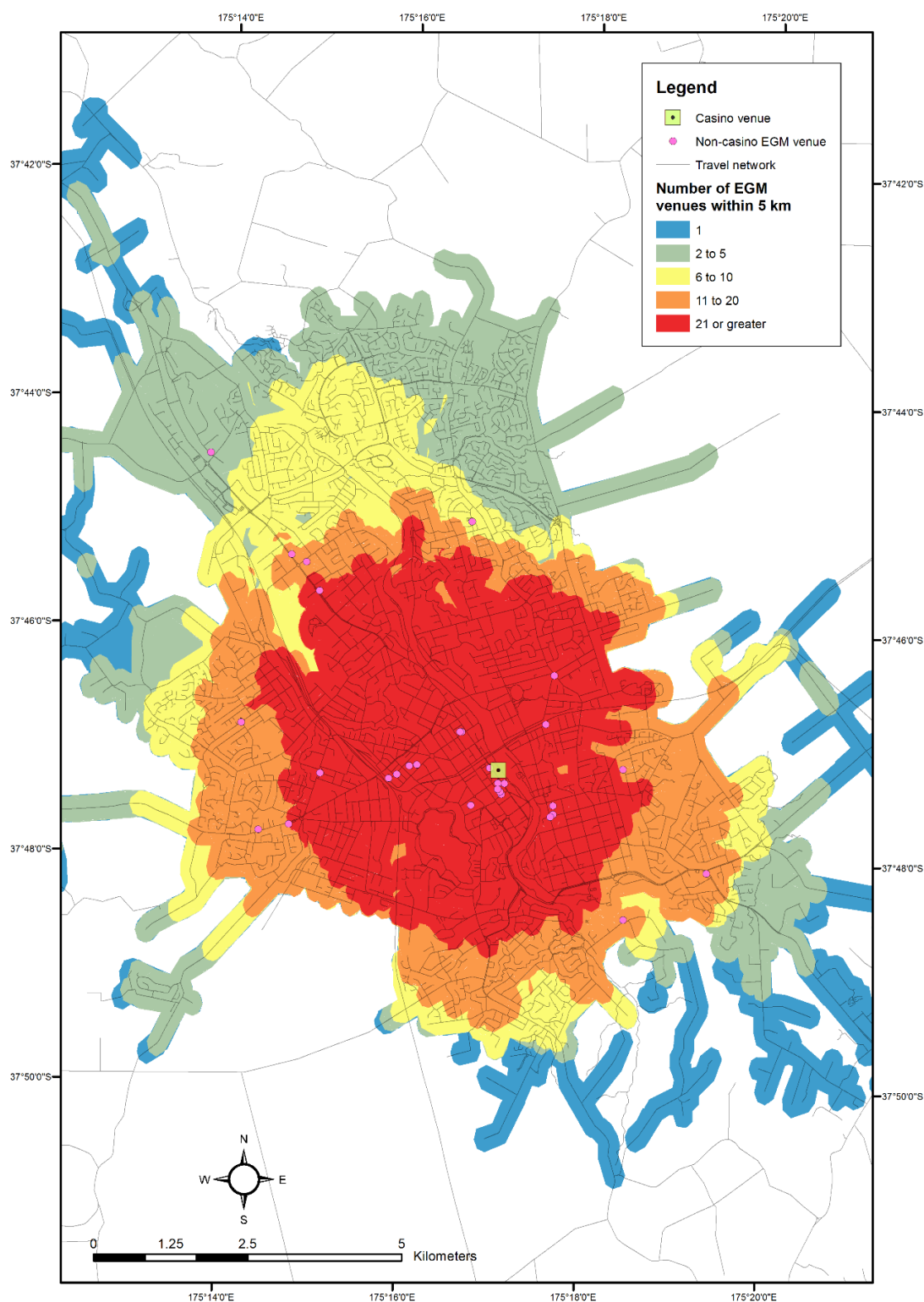


Figure 65. Map of the number of EGM venues within five kilometres in the Hamilton urban area.

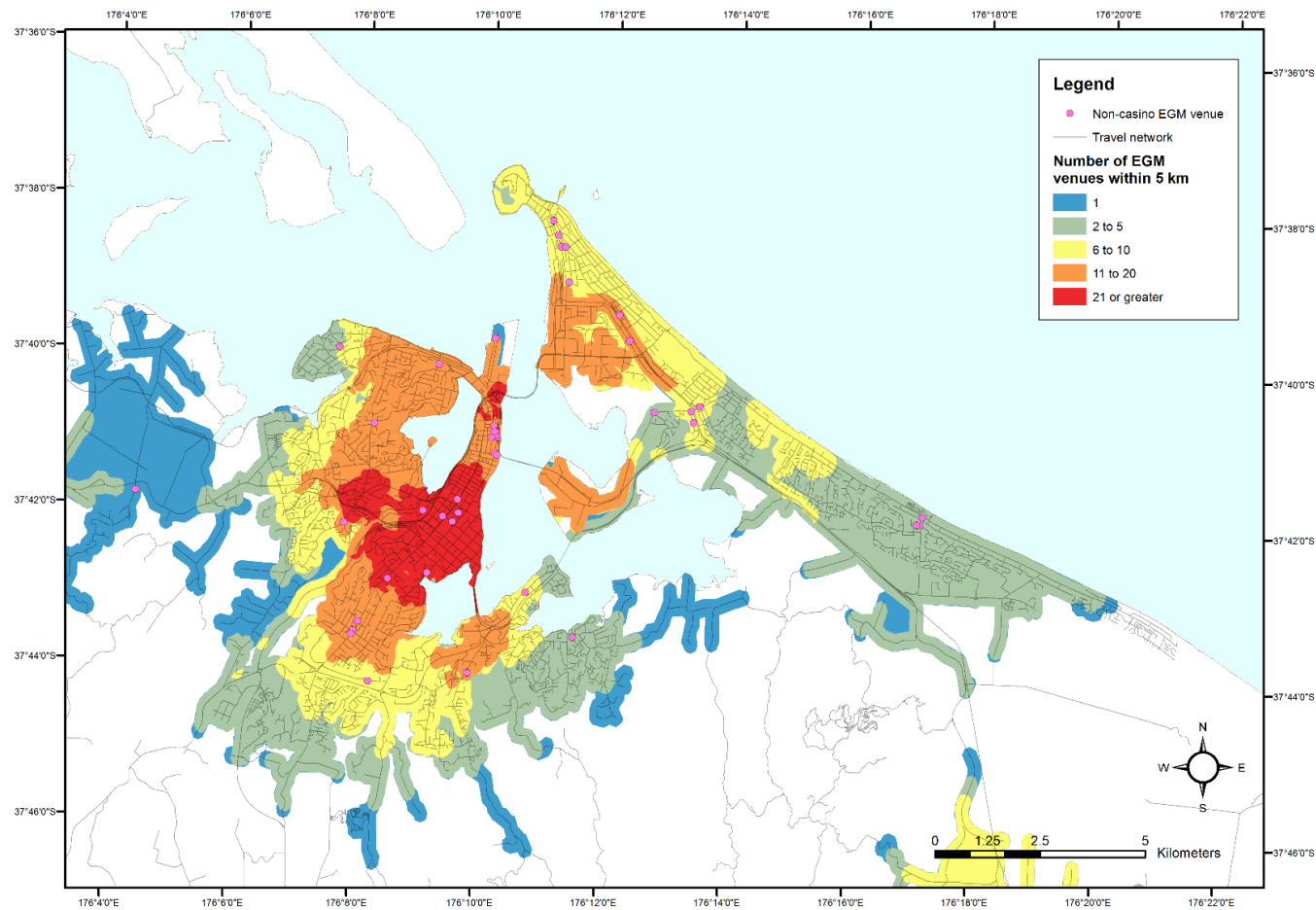


Figure 66. Map of the number of EGM venues within five kilometres in the Tauranga urban area.

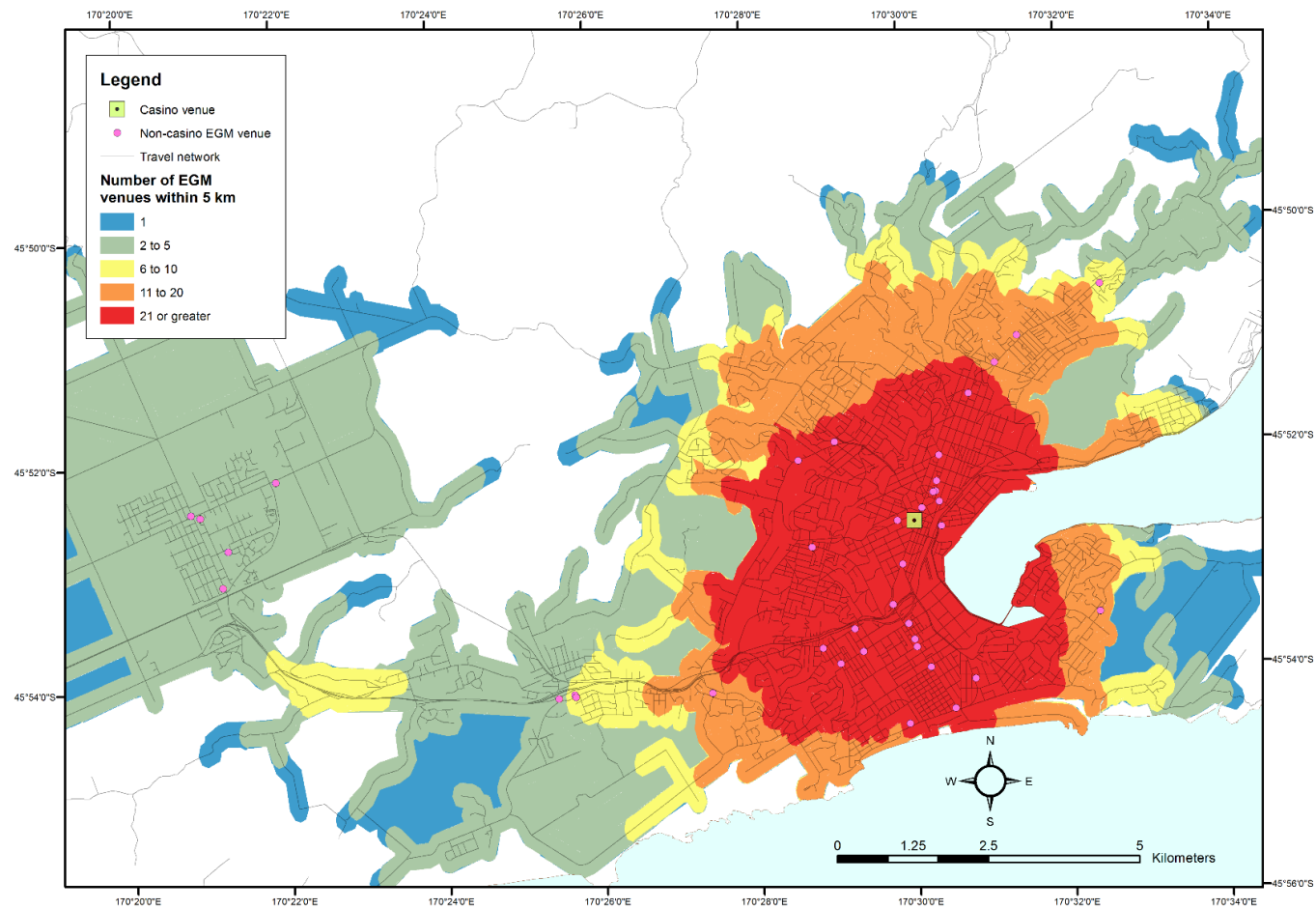


Figure 67. Map of the number of EGM venues within five kilometres in the Dunedin urban area.

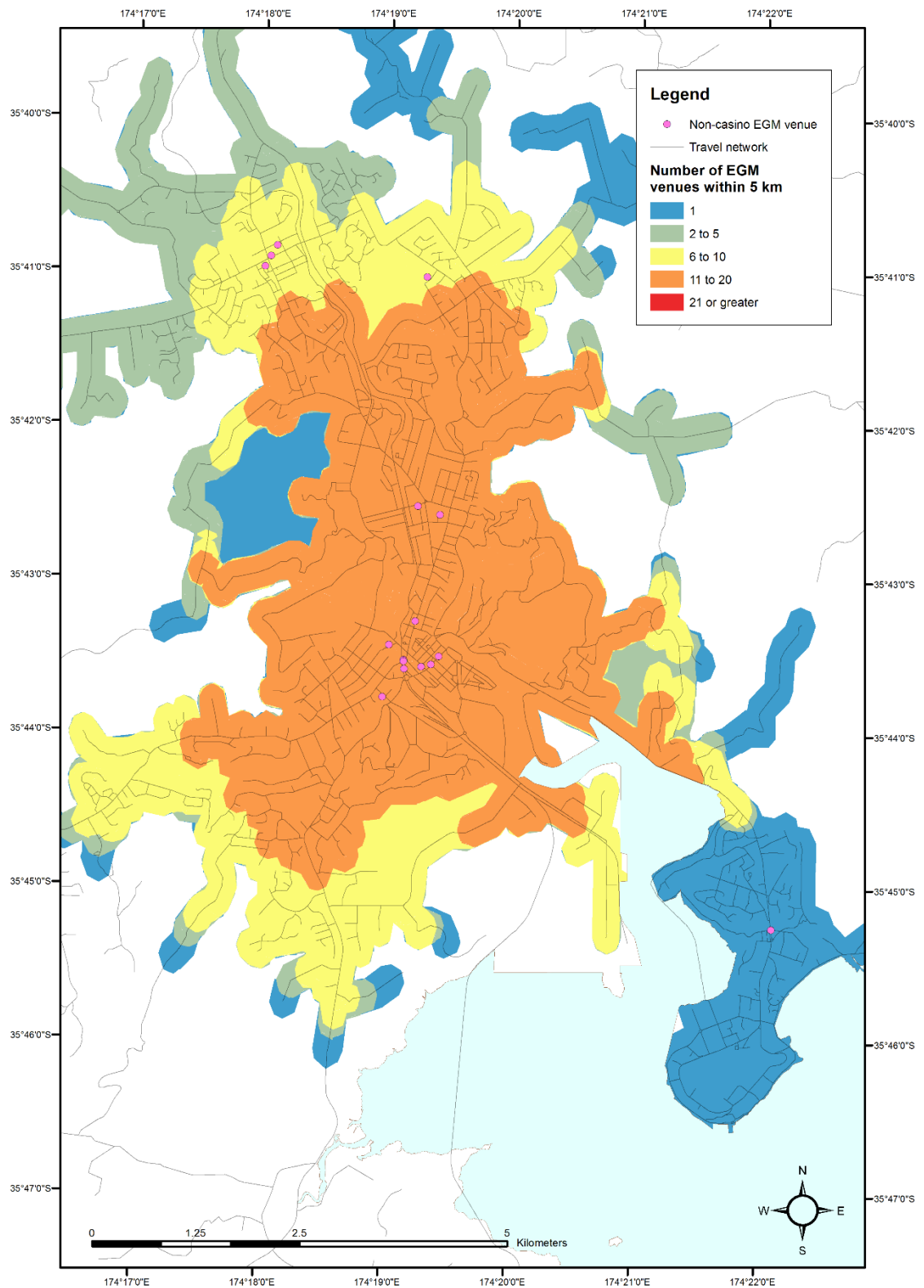


Figure 68. Map of the number of EGM venues within five kilometres in the Whangarei urban area.

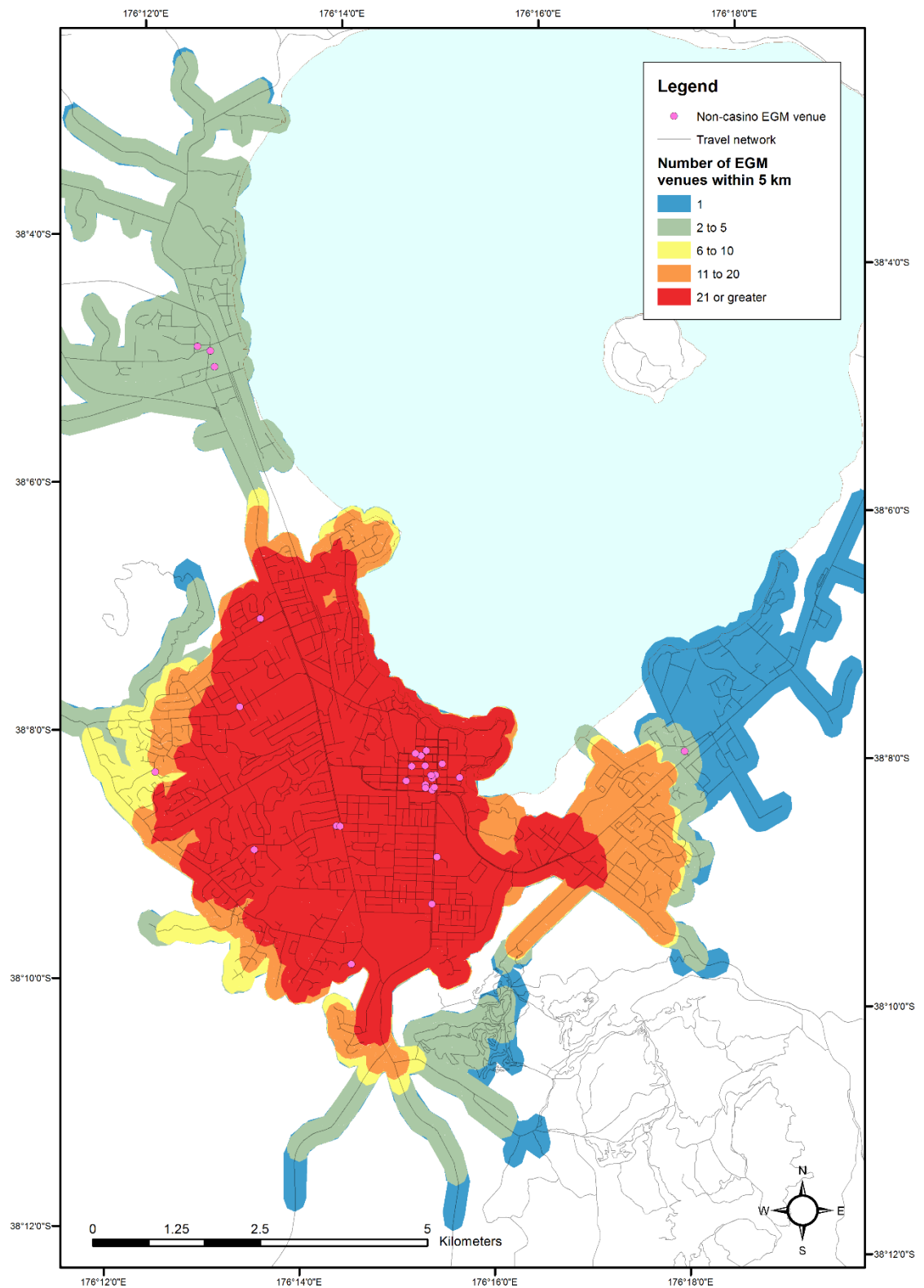


Figure 69. Map of the number of EGM venues within five kilometres in the Rotorua urban area.

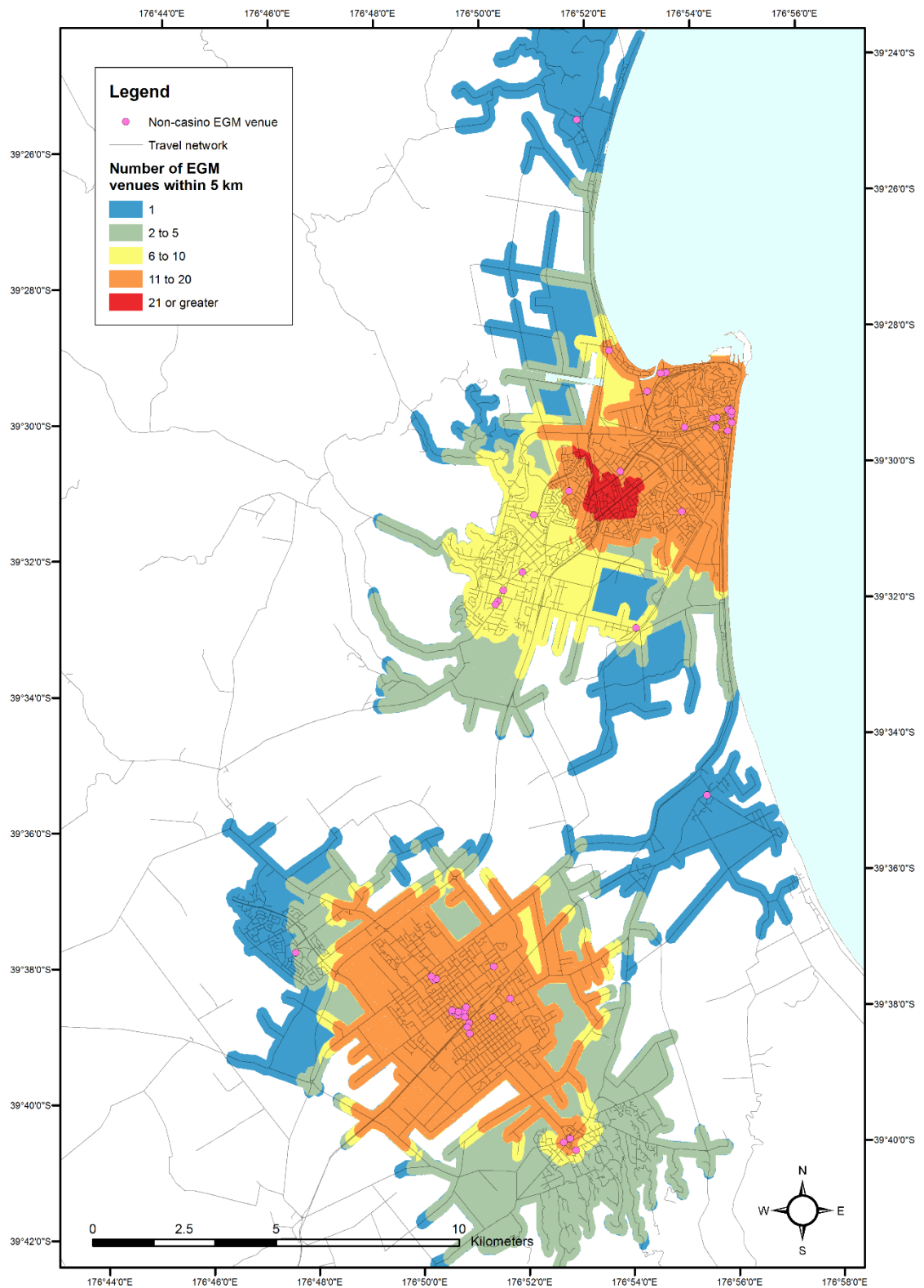


Figure 70. Map of the number of EGM venues within five kilometres in the Napier-Hastings urban area.

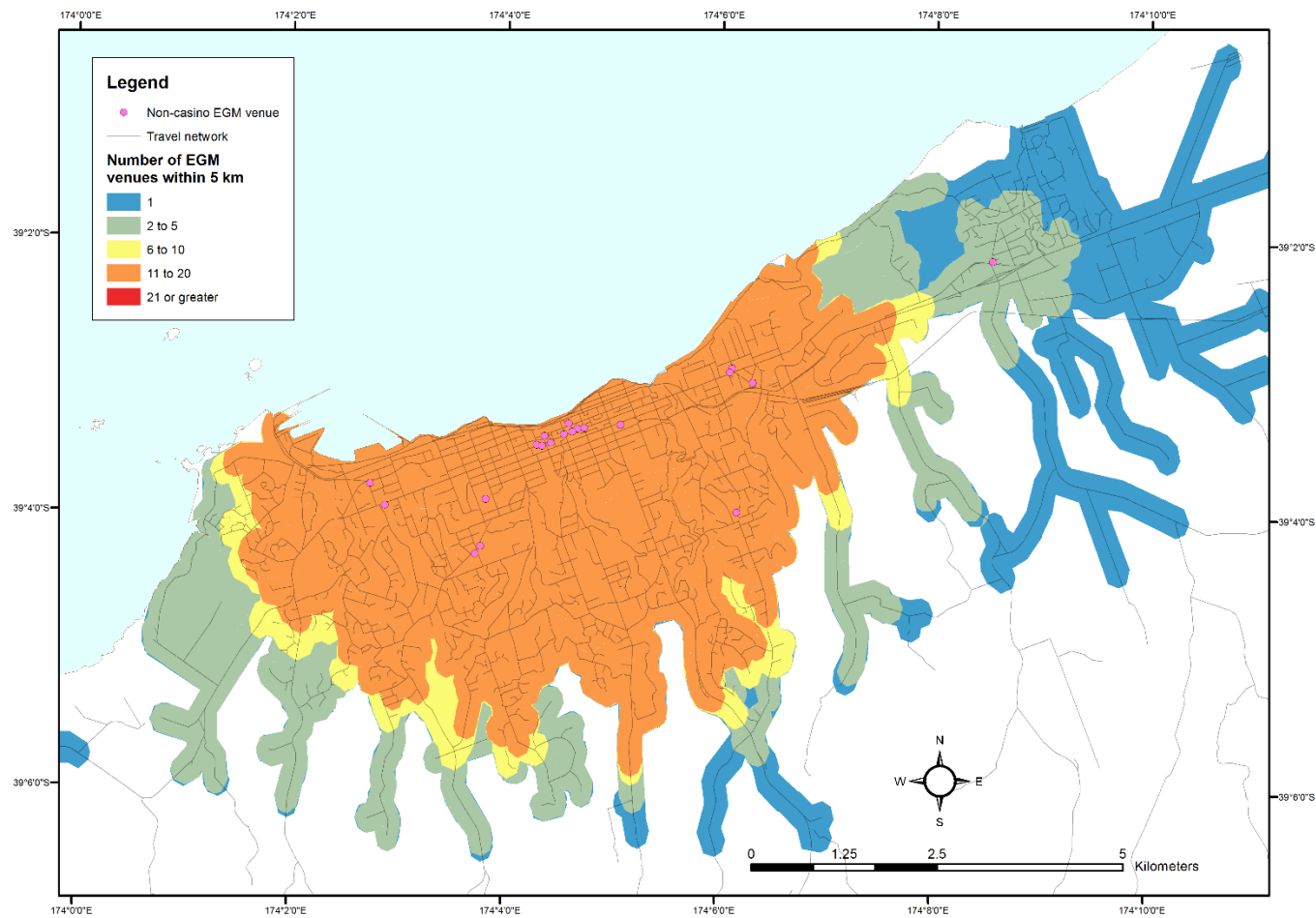


Figure 71. Map of the number of EGM venues within five kilometres in the New Plymouth urban area.

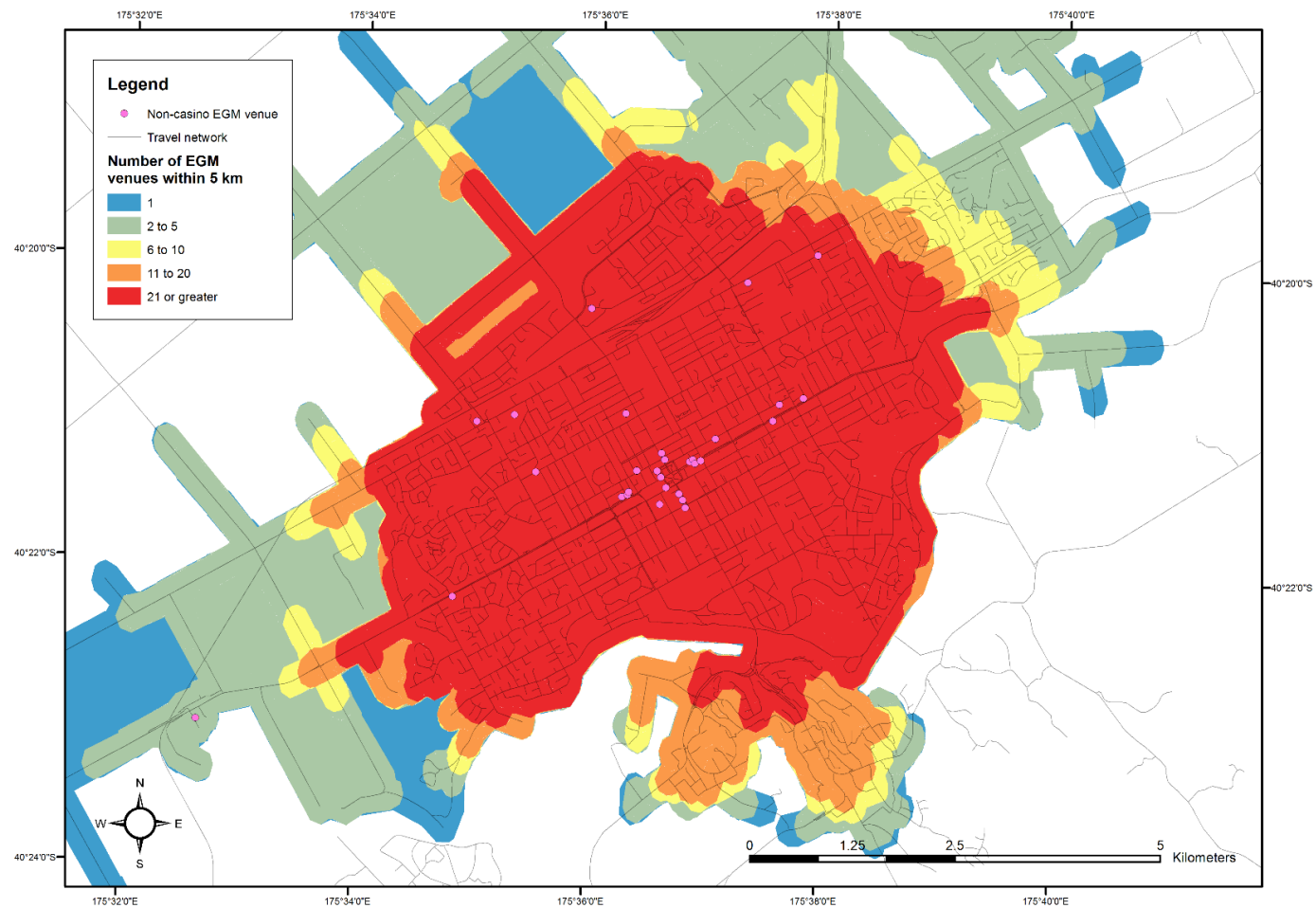


Figure 72. Map of the number of EGM venues within five kilometres in the Palmerston North urban area.

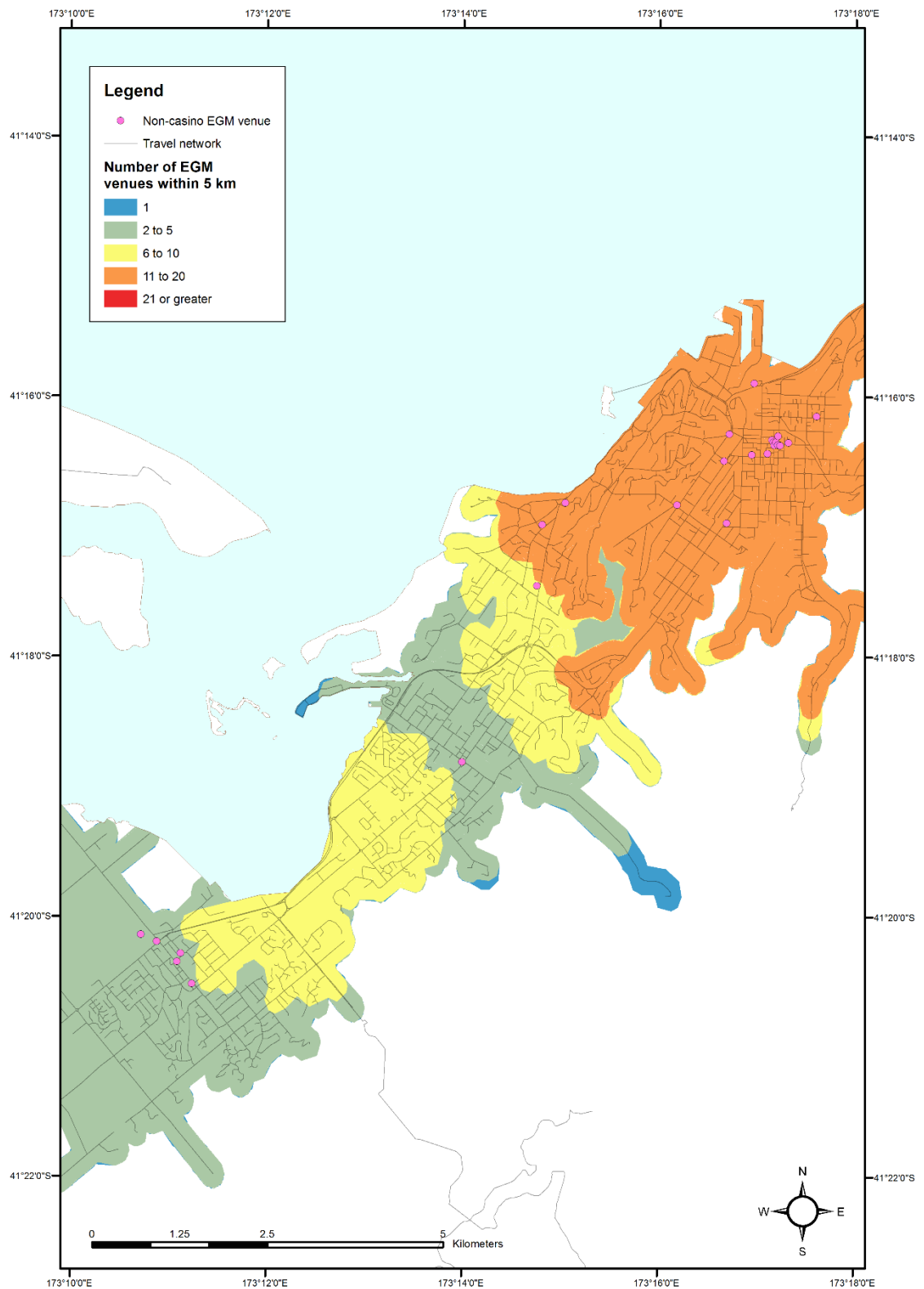


Figure 73. Map of the number of EGM venues within five kilometres in the Nelson-Richmond urban area.

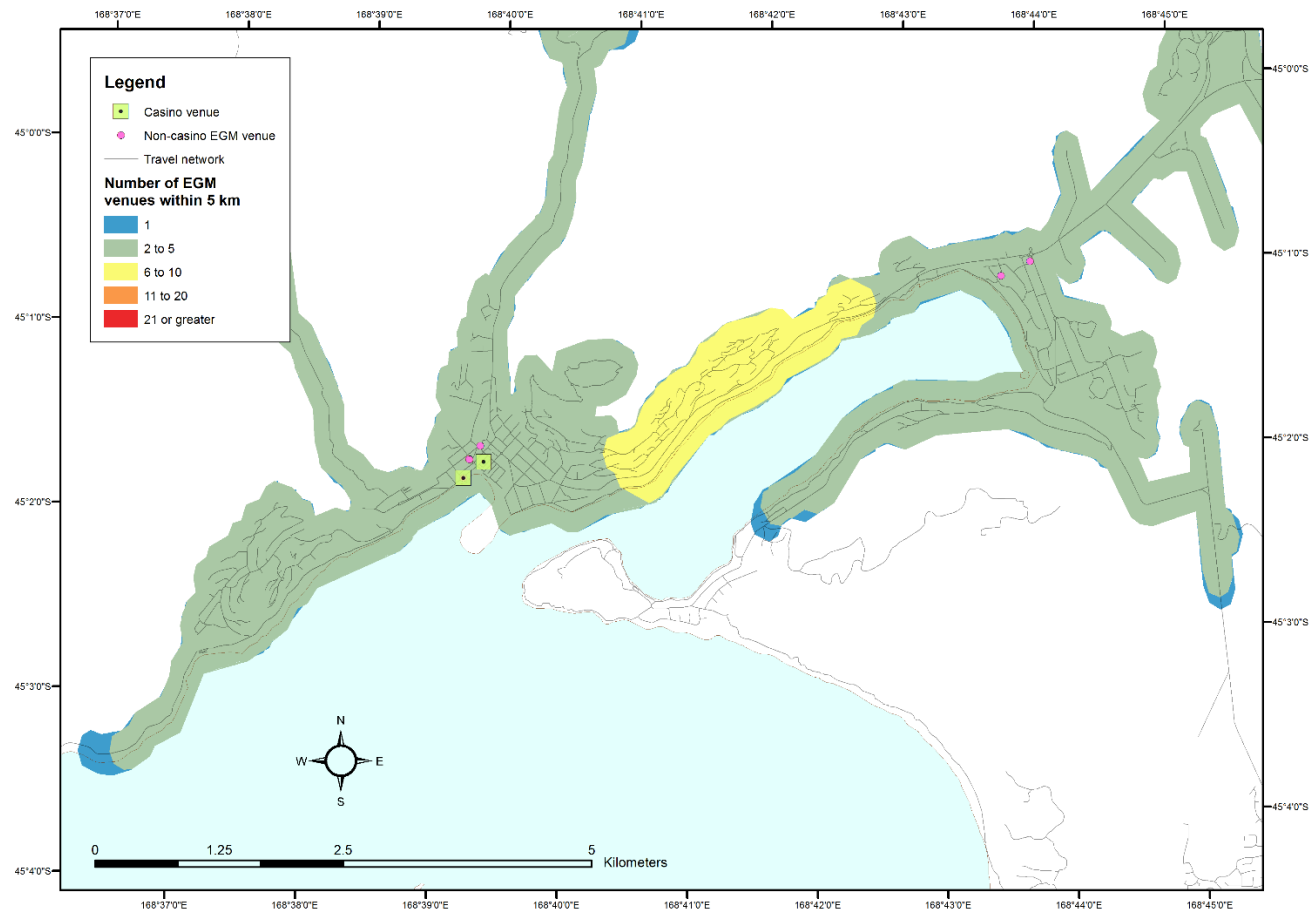


Figure 74. Map of the number of EGM venues within five kilometres in the Queenstown urban area.

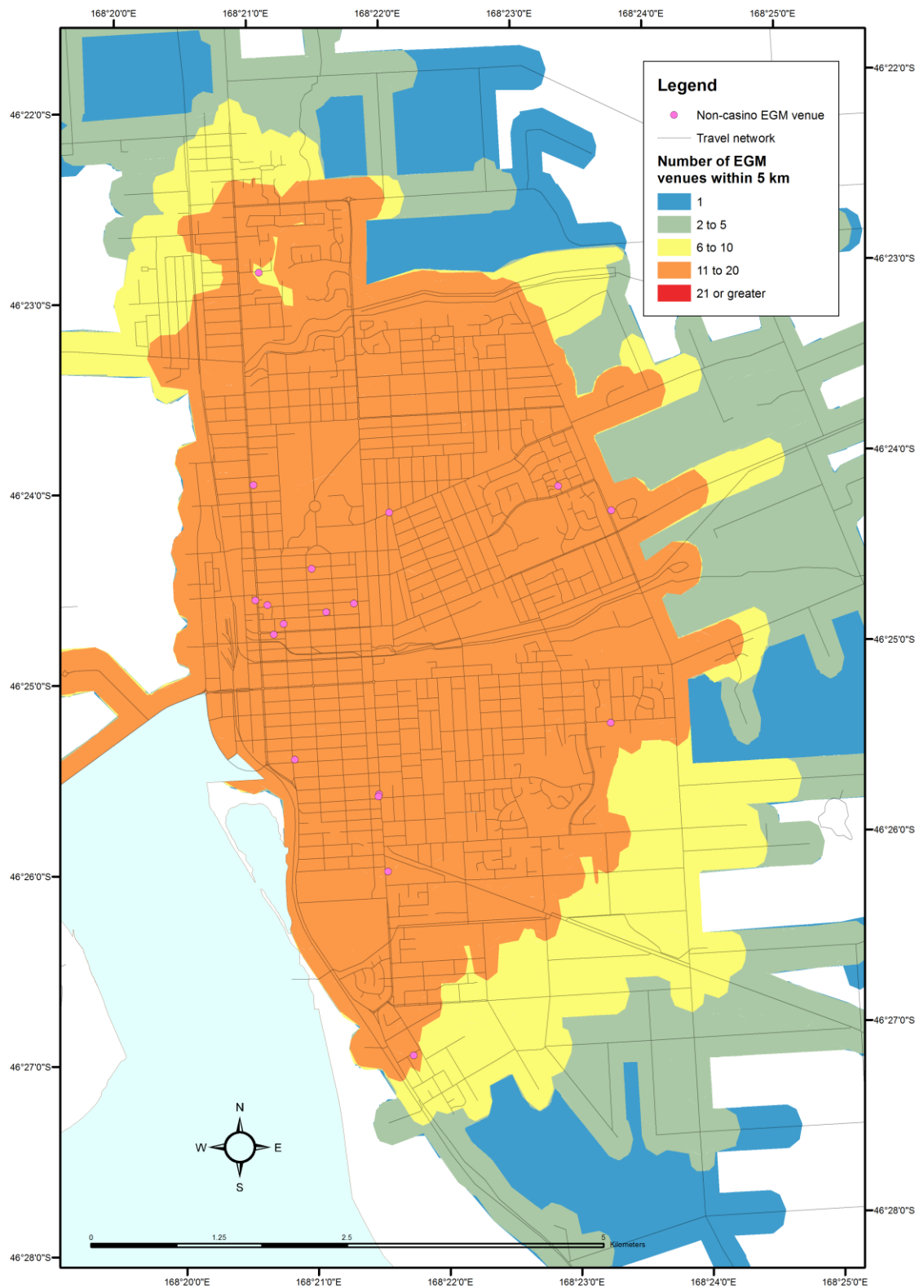


Figure 75. Map of the number of EGM venues within five kilometres in the Invercargill urban area.

Appendix F: Maps showing the relative risk of having played on an electronic gaming machine in the past year for various New Zealand cities.

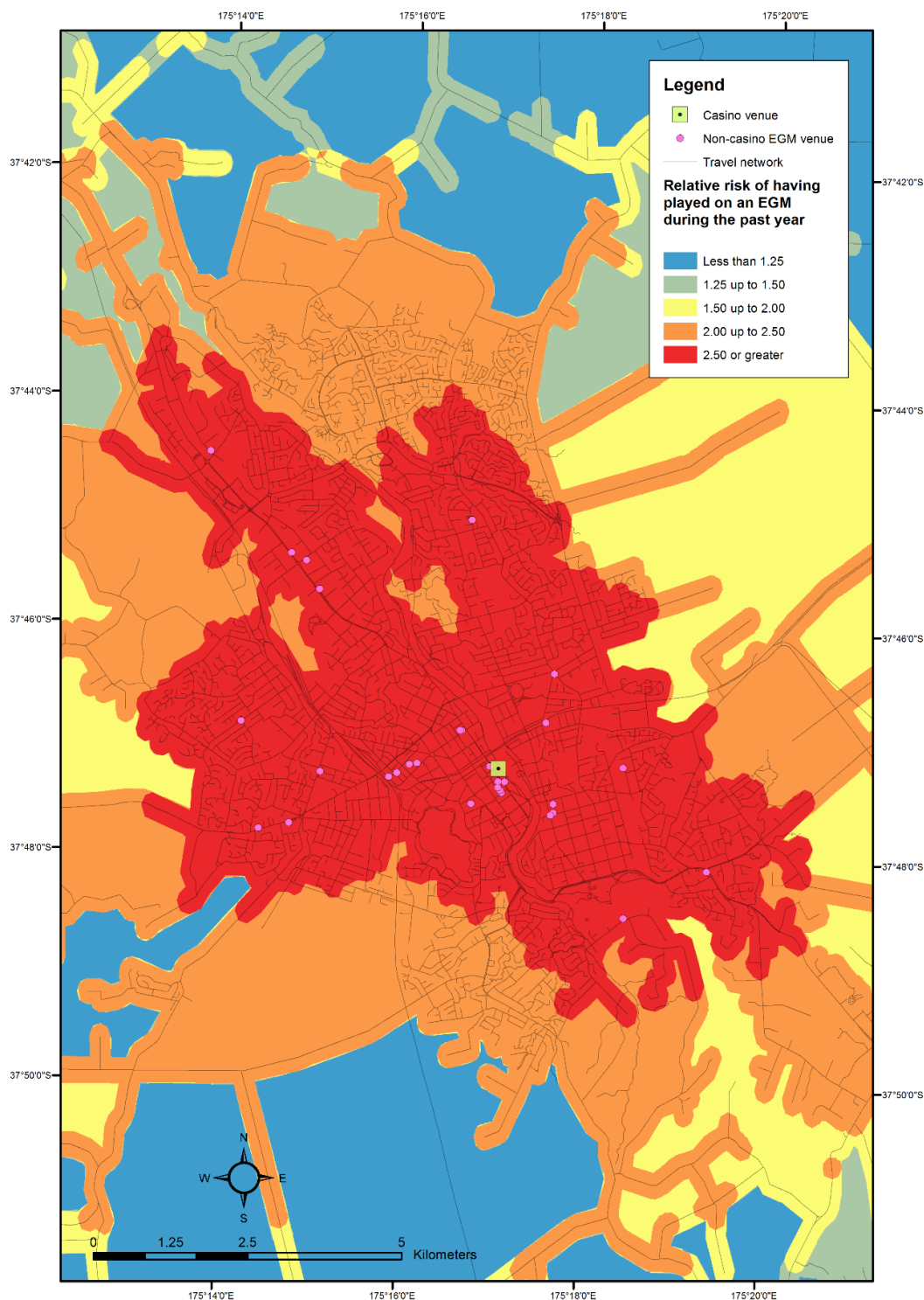


Figure 76. Map of relative risk of having played on an EGM during the past year in the Hamilton urban area.

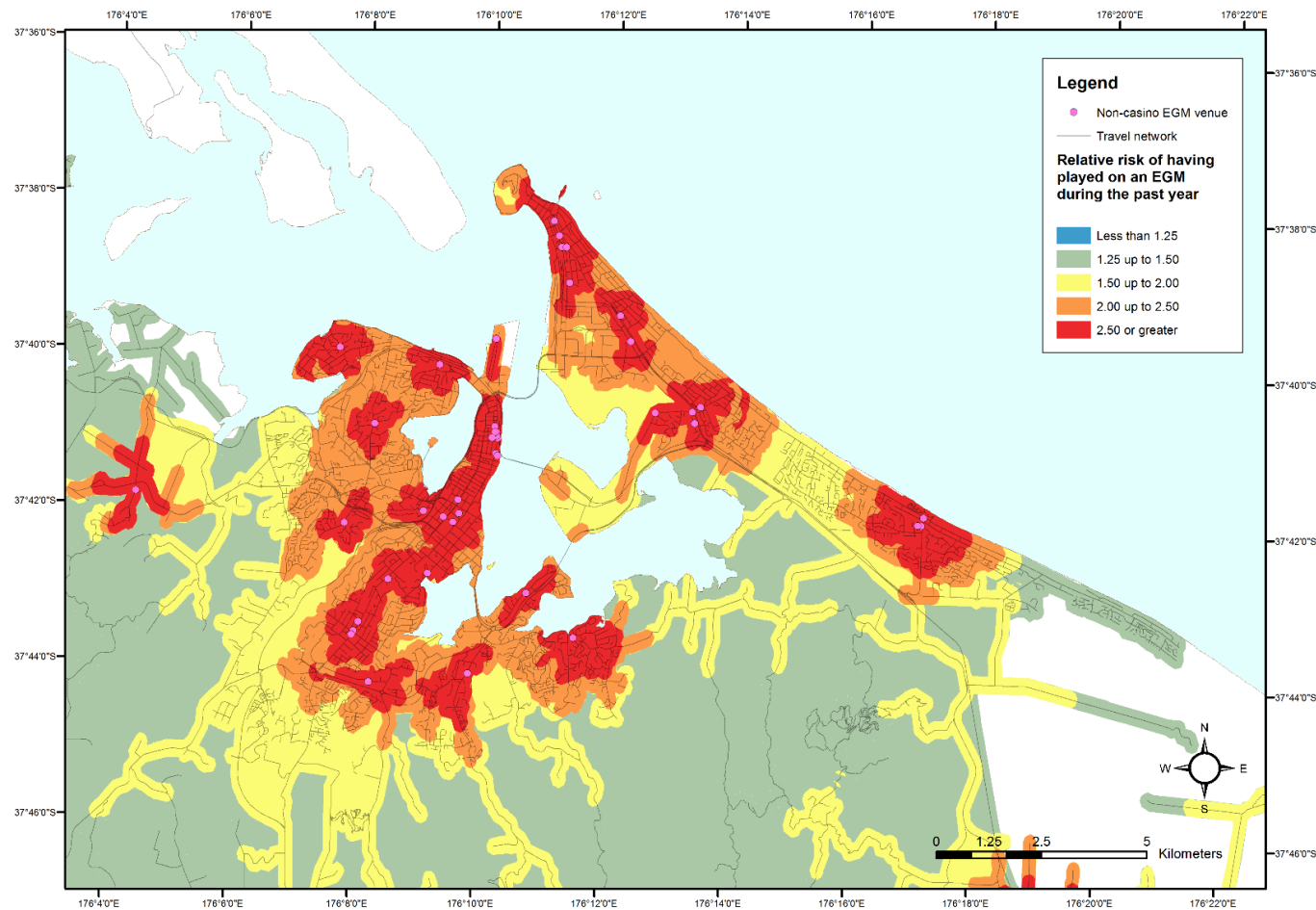


Figure 77. Map of relative risk of having played on an EGM during the past year in the Tauranga urban area.

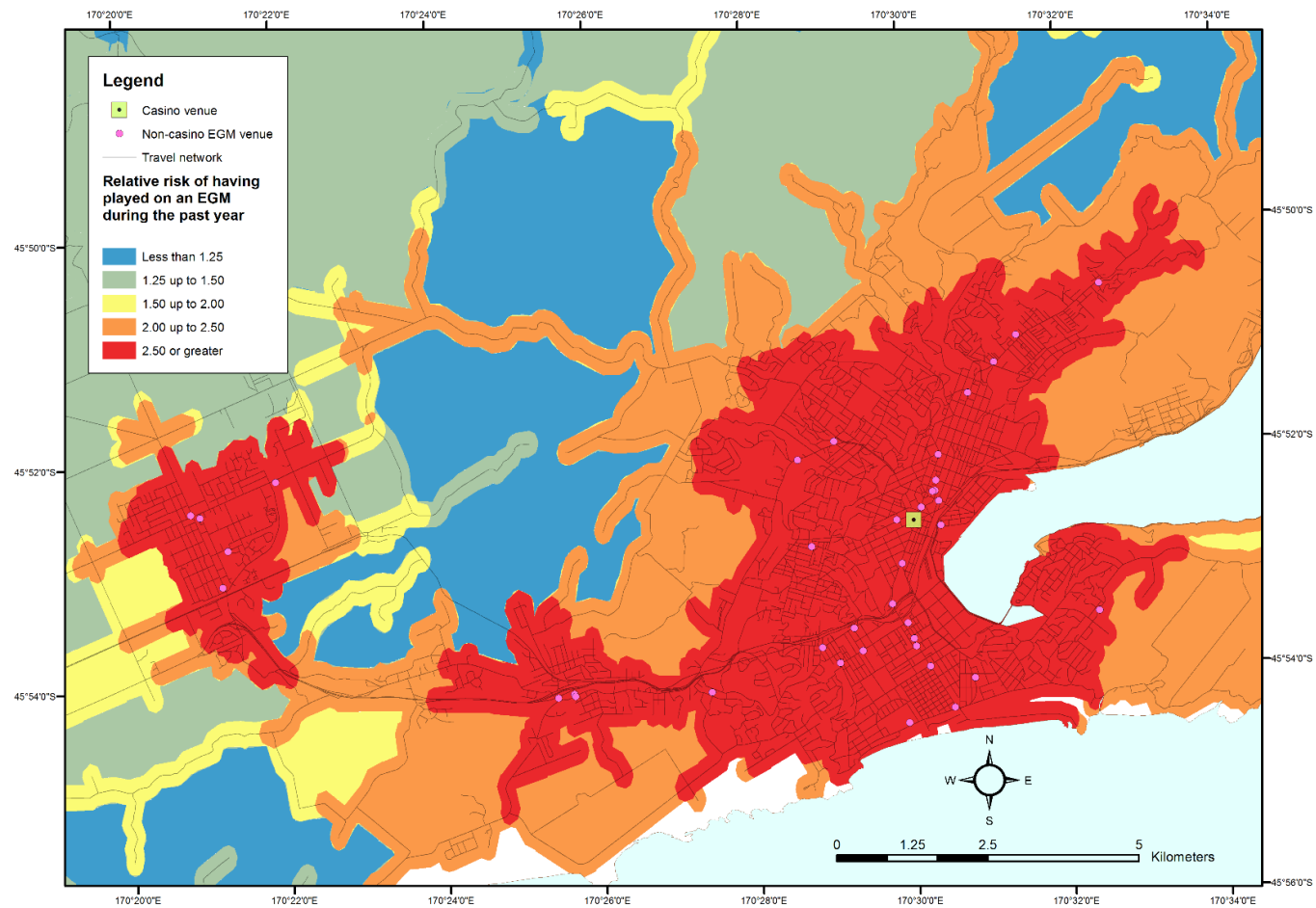


Figure 78. Map of relative risk of having played on an EGM during the past year in the Dunedin urban area.

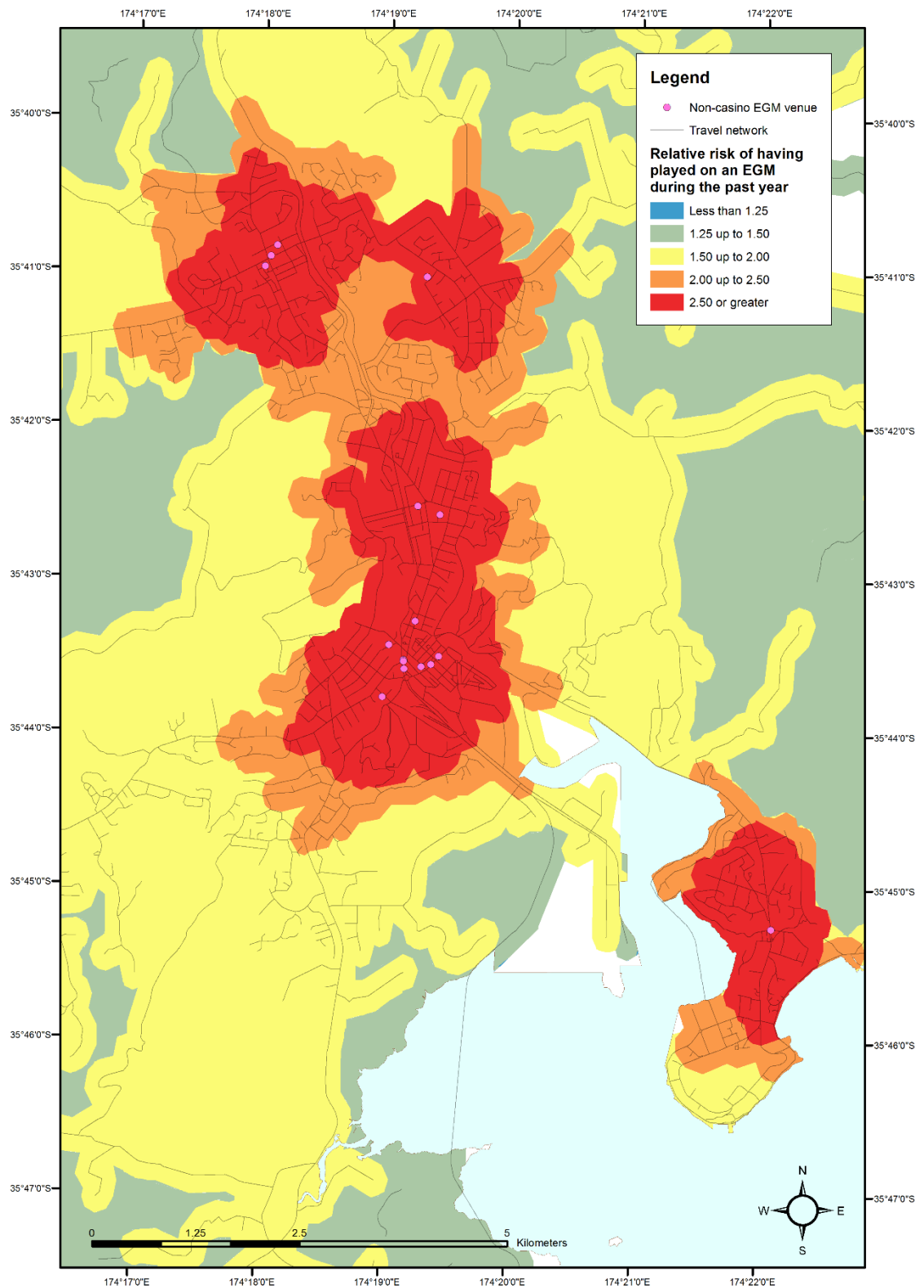


Figure 79. Map of relative risk of having played on an EGM during the past year in the Whangarei urban area.

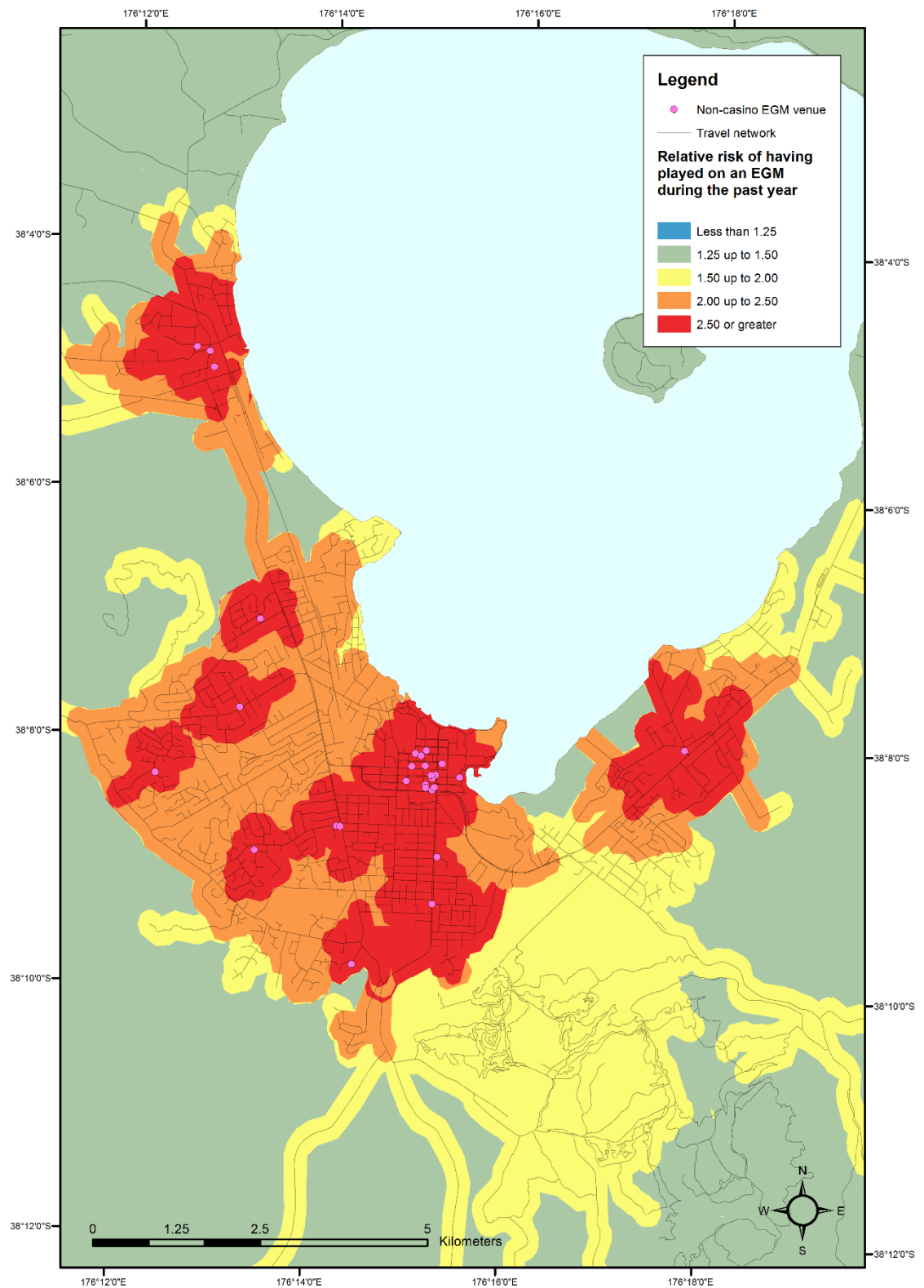


Figure 80. Map of relative risk of having played on an EGM during the past year in the Rotorua urban area.

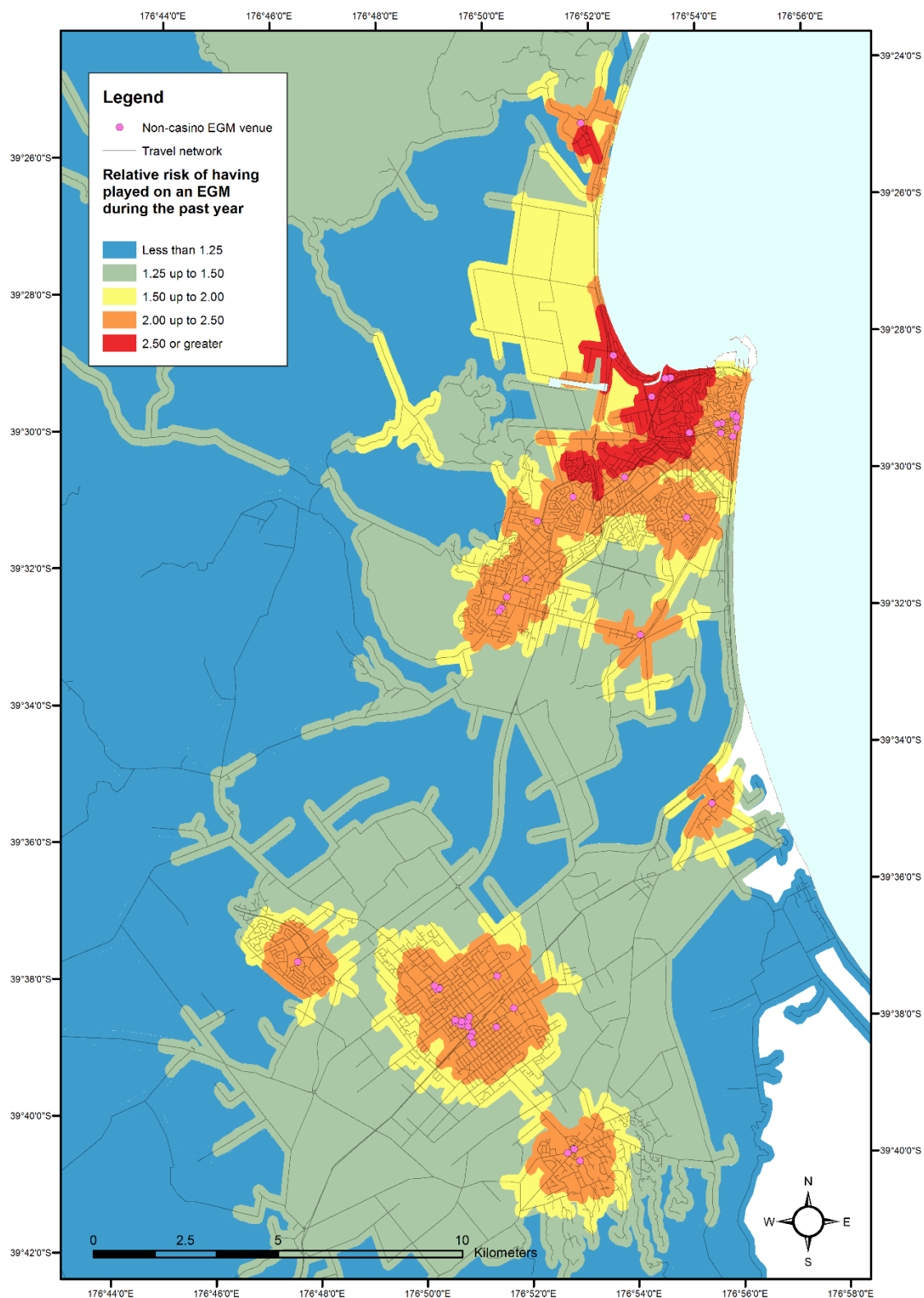


Figure 81. Map of relative risk of having played on an EGM during the past year in the Napier-Hastings urban area.

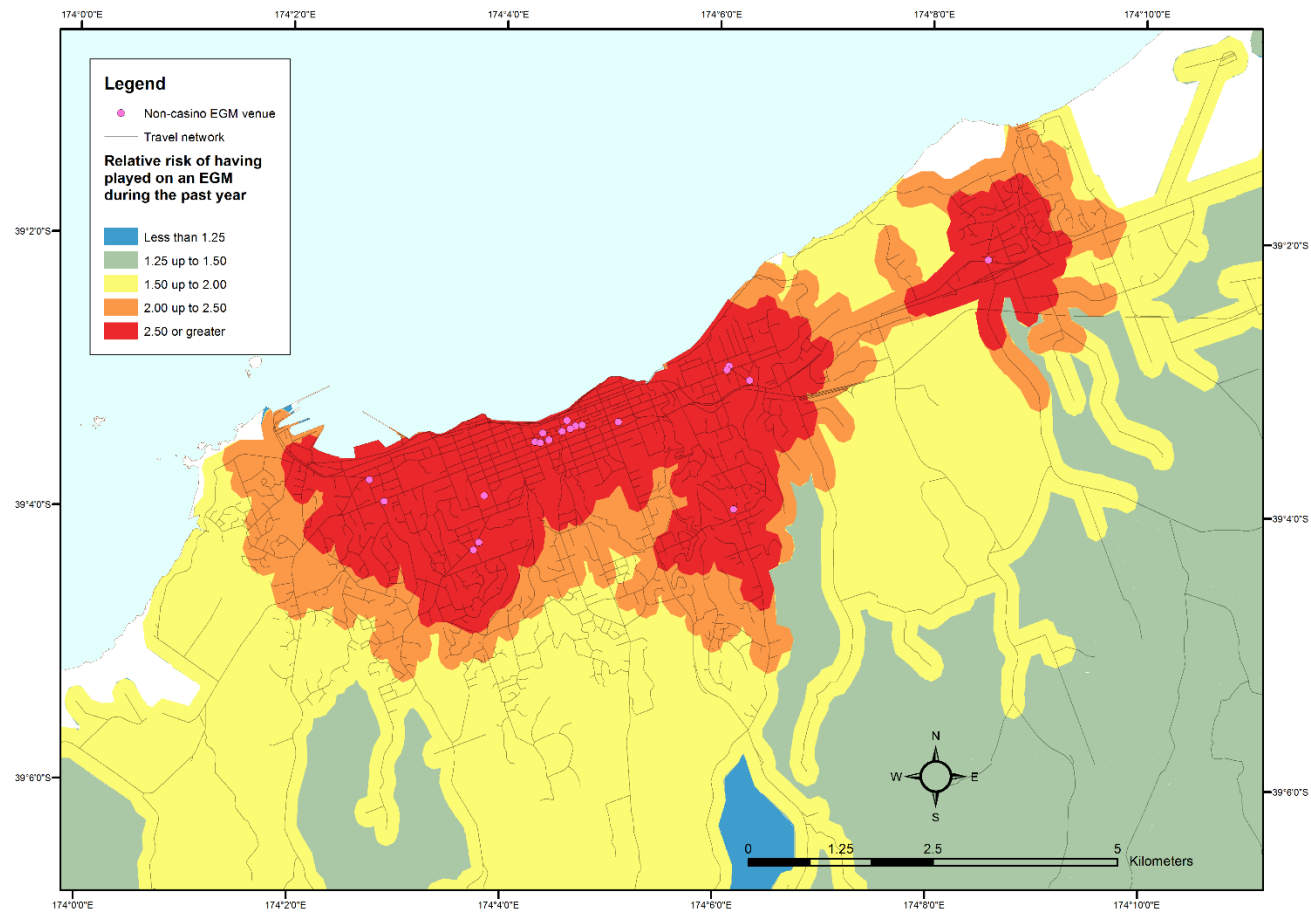


Figure 82. Map of relative risk of having played on an EGM during the past year in the New Plymouth urban area.

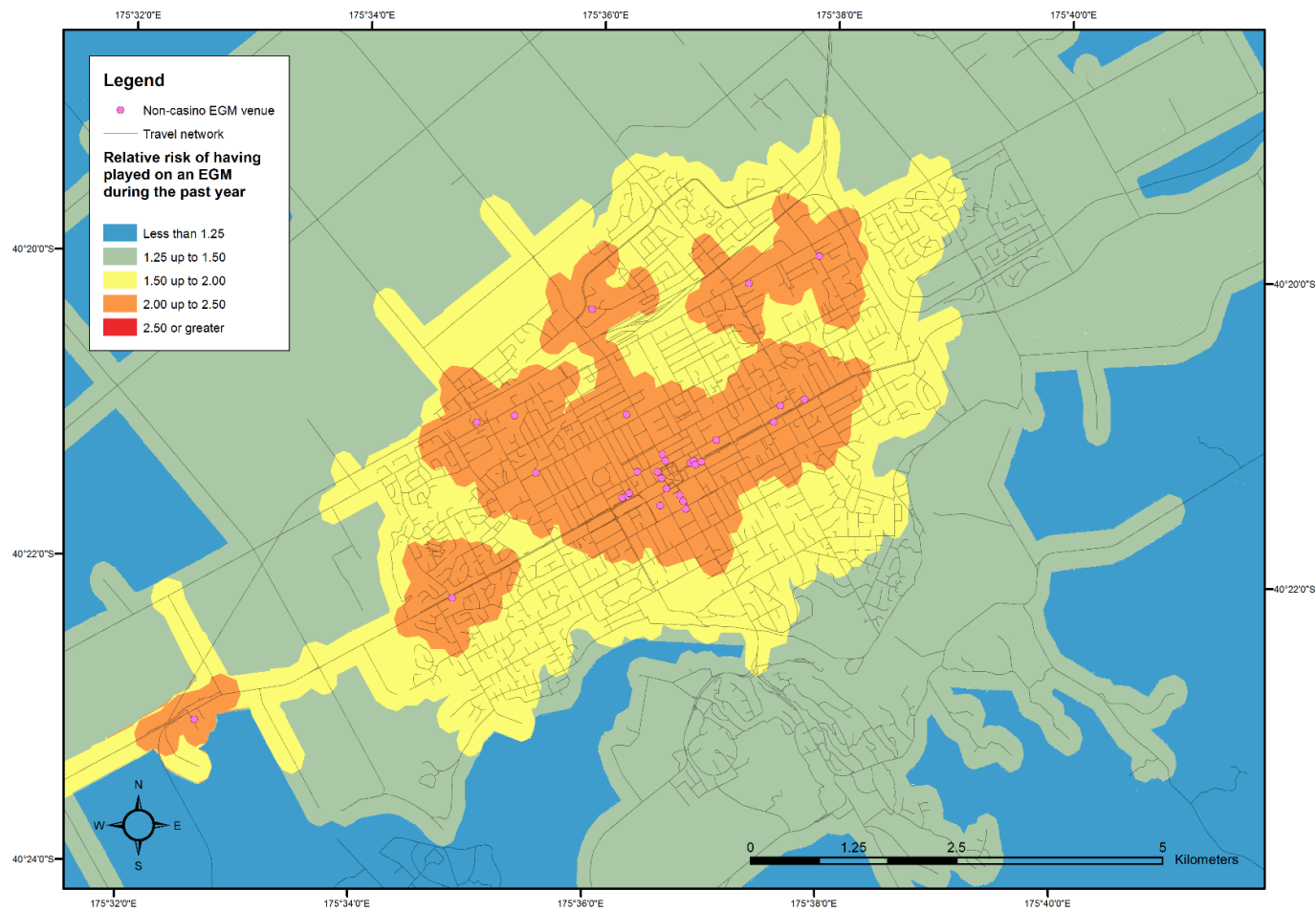


Figure 83. Map of relative risk of having played on an EGM during the past year in the Palmerston North urban area.

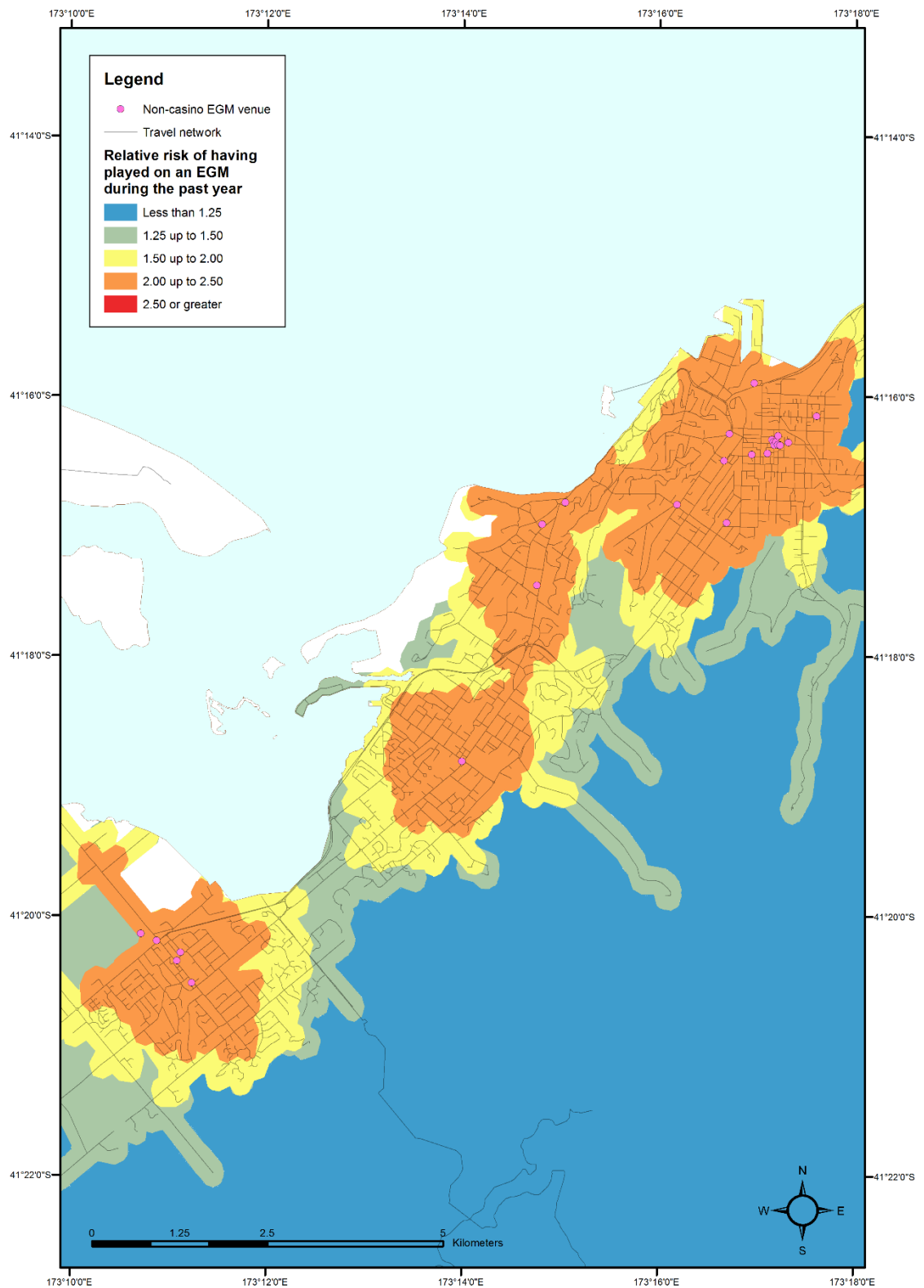


Figure 84. Map of relative risk of having played on an EGM during the past year in the Nelson-Richmond urban area.

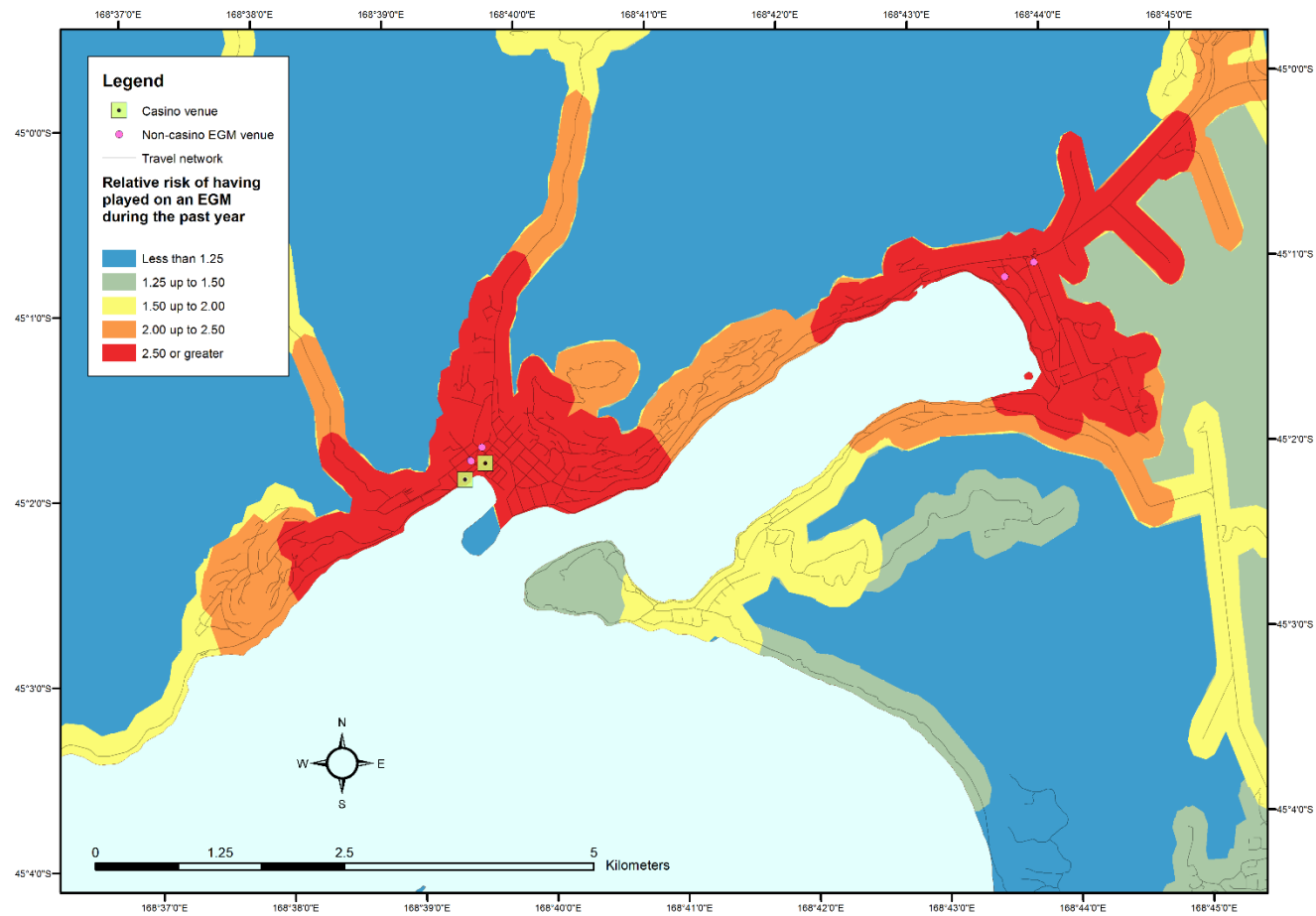


Figure 85. Map of relative risk of having played on an EGM during the past year in the in the Queenstown urban area.

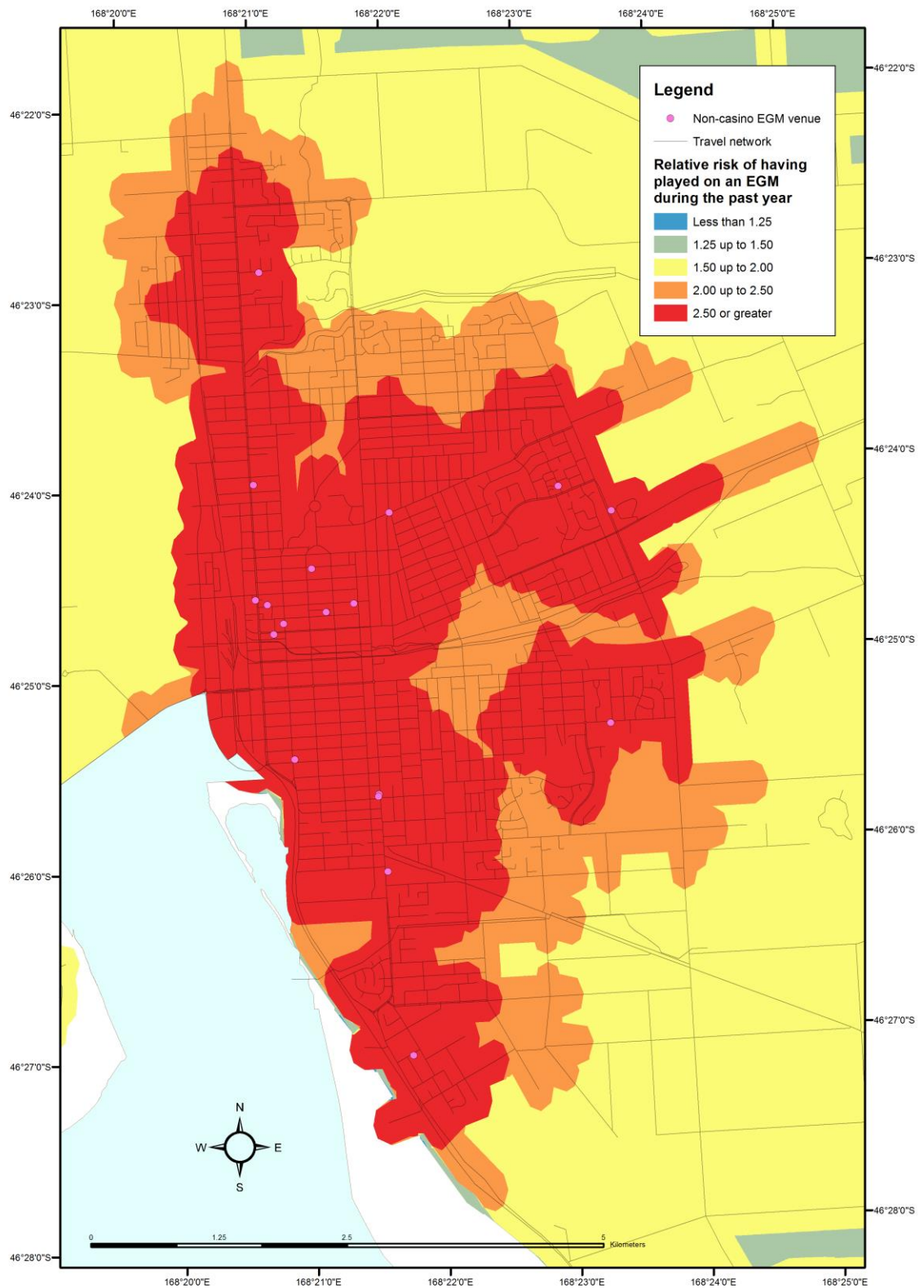


Figure 86. Map of relative risk of having played on an EGM during the past year in the Invercargill urban area.

Appendix G: Maps showing the relative risk of gamblers being at risk of problem gambling in the past year for various New Zealand cities.

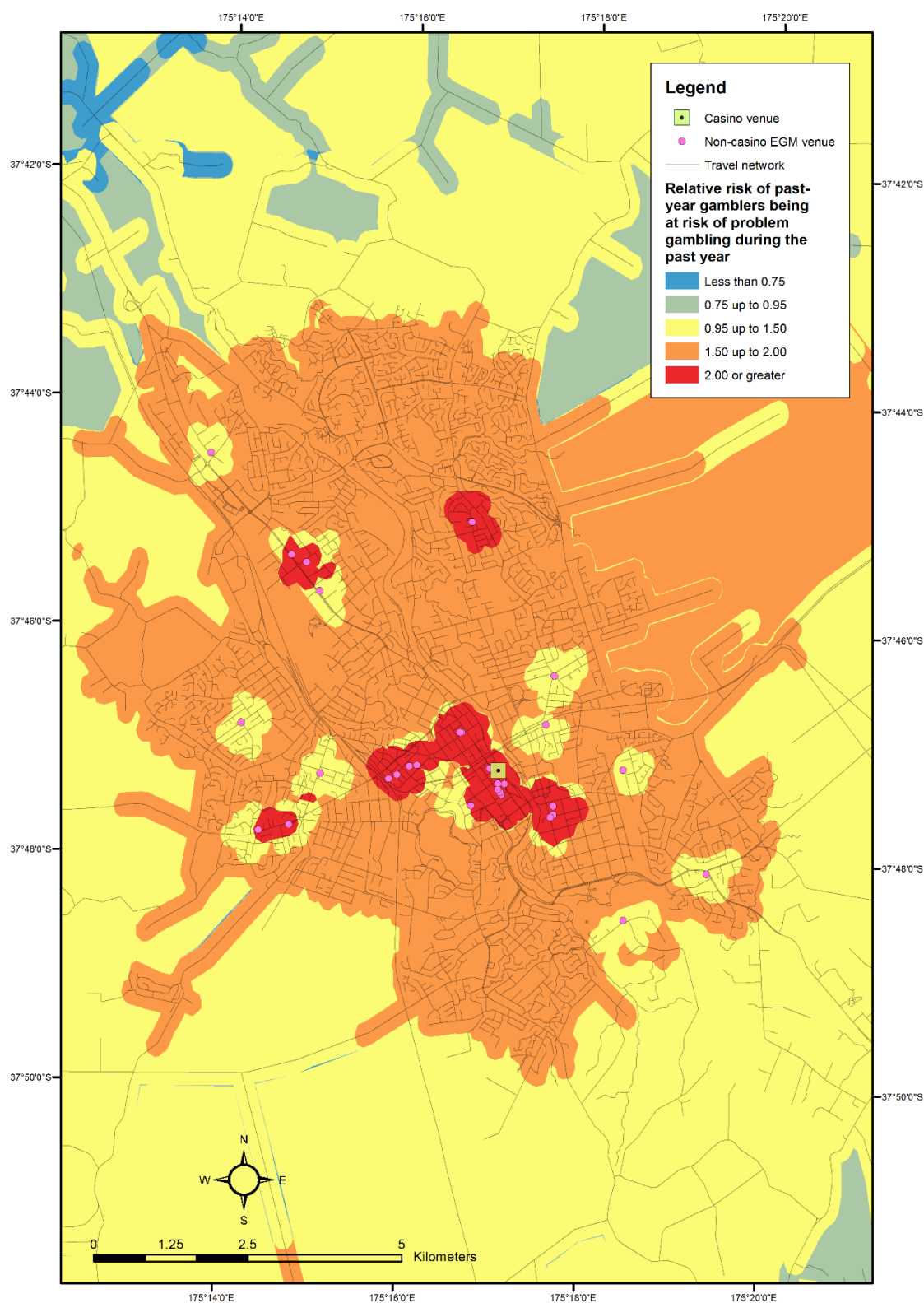


Figure 87. Map of relative risk of past-year gamblers being at risk of problem gambling during the past year in the Hamilton urban area.

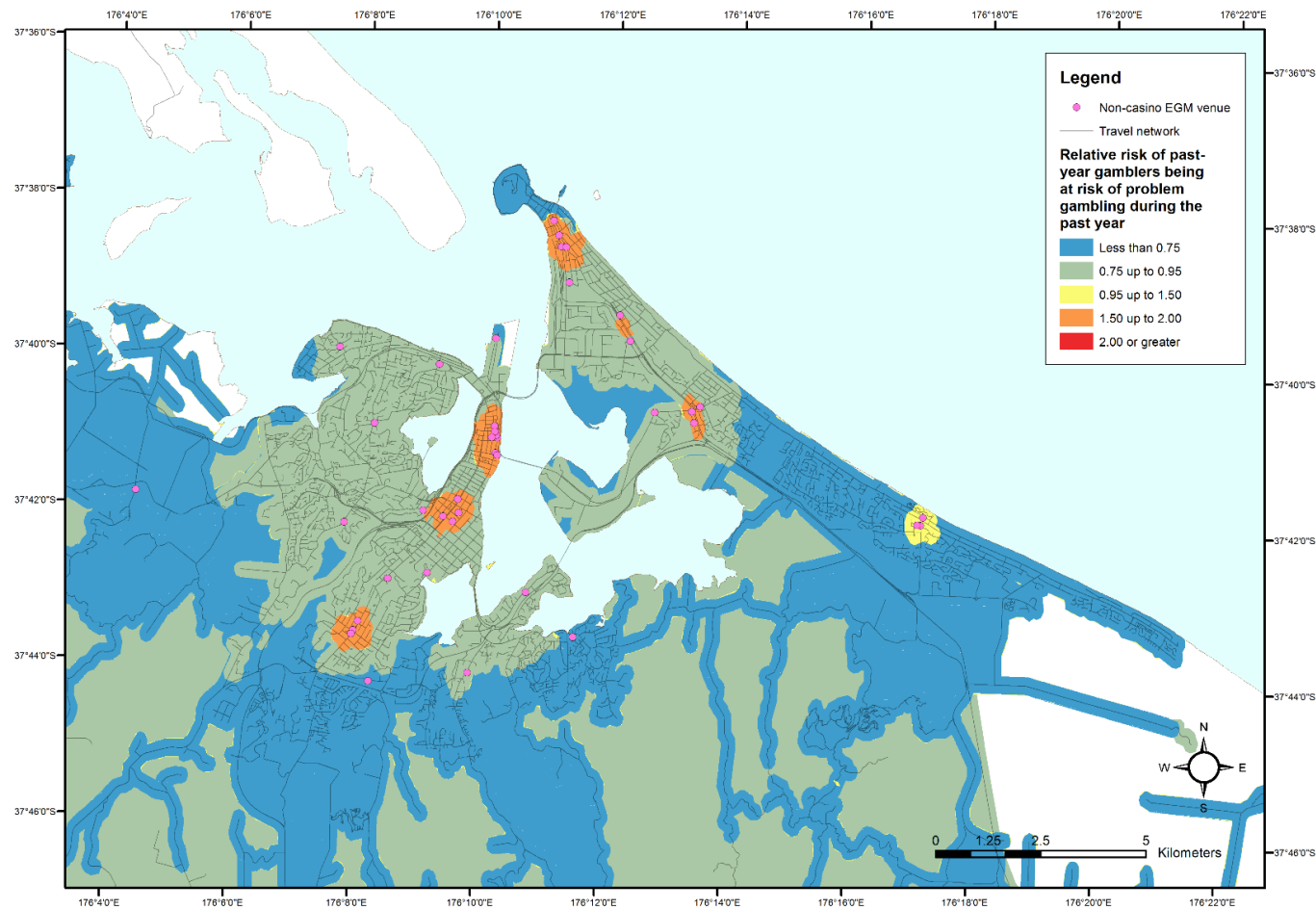


Figure 88. Map of relative risk of problem gambling for past-year gamblers in the Tauranga urban area.

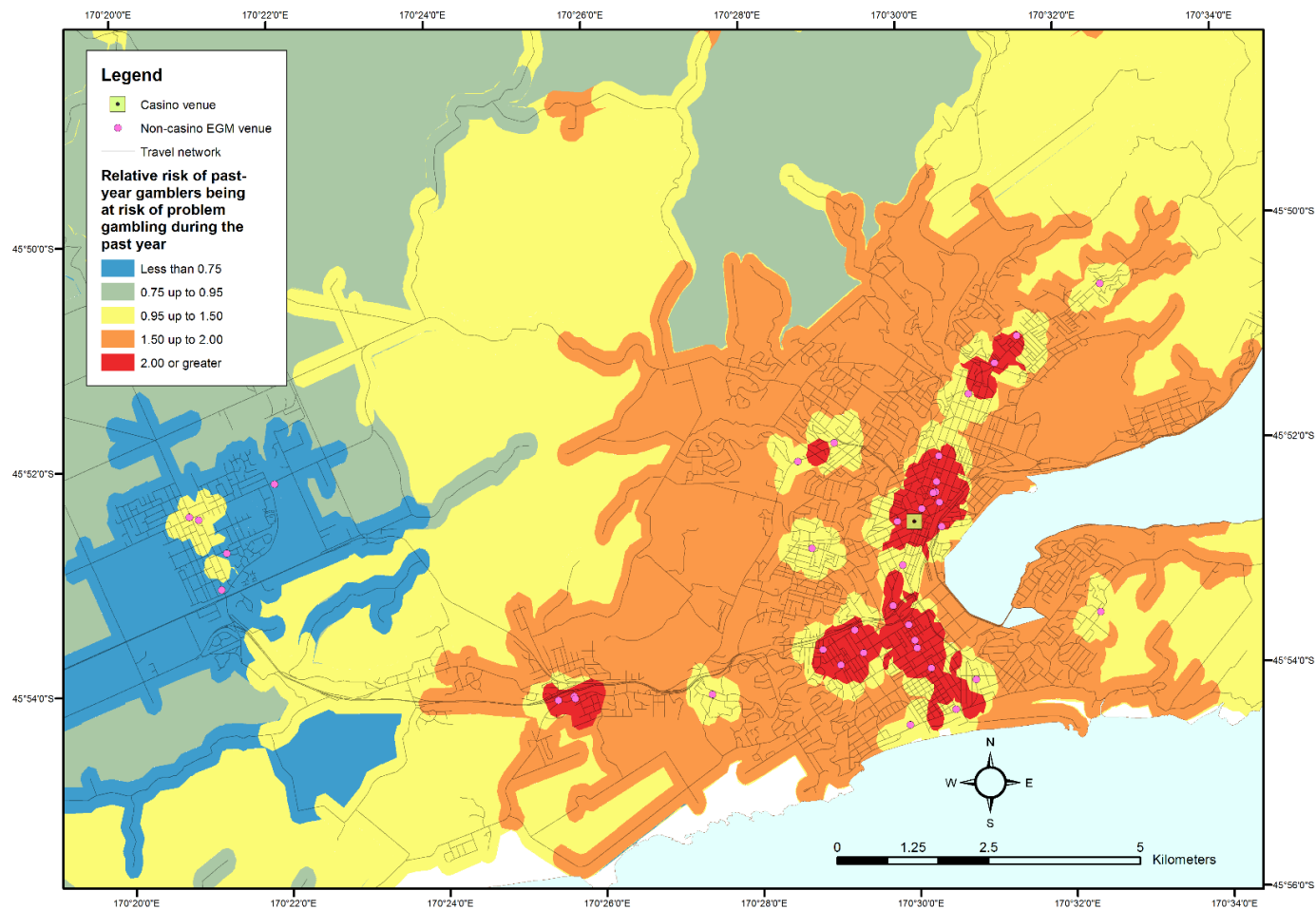


Figure 89. Map of relative risk of problem gambling for past-year gamblers in the Dunedin urban area.

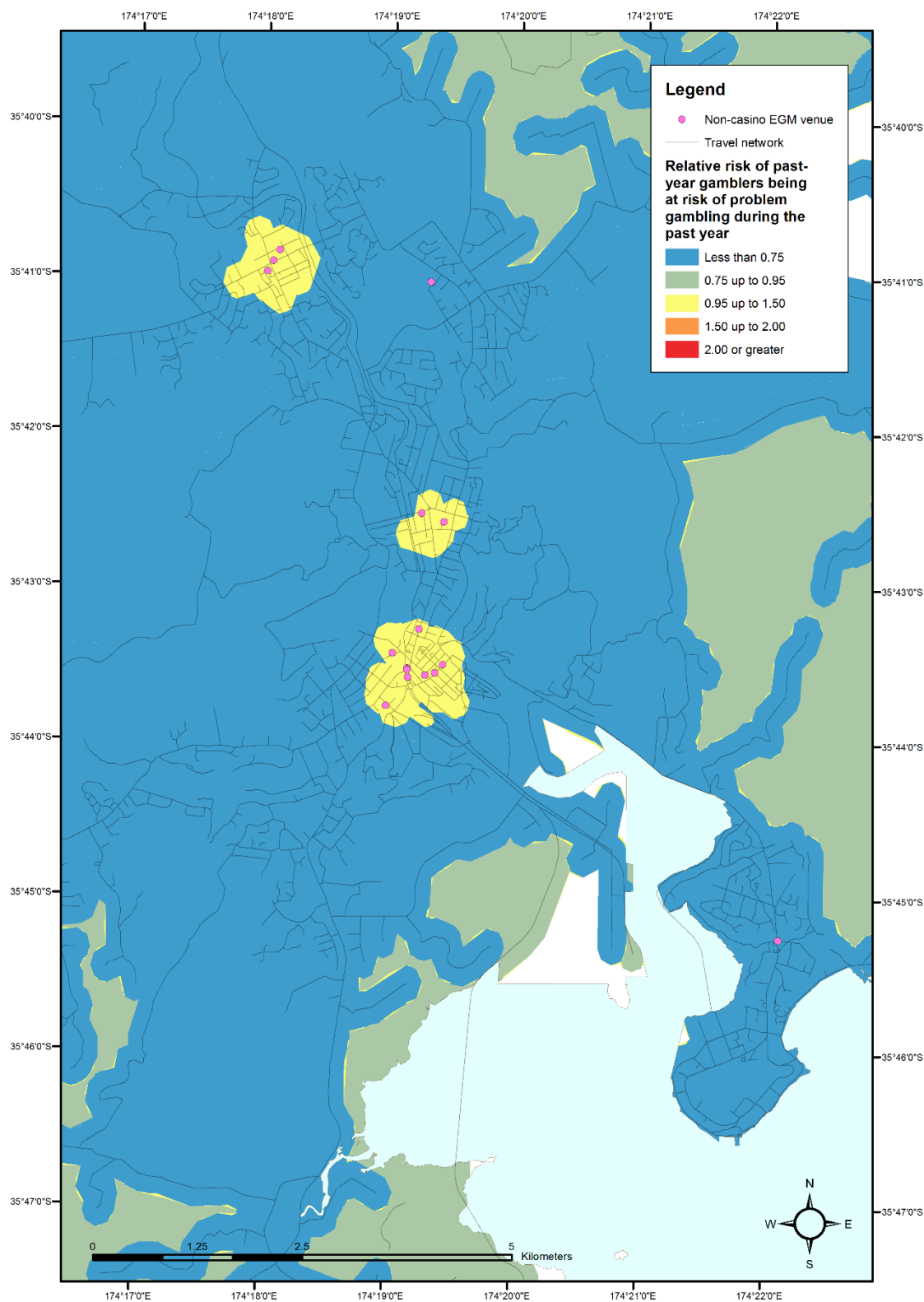


Figure 90. Map of relative risk of problem gambling for past-year gamblers in the Whangarei urban area.

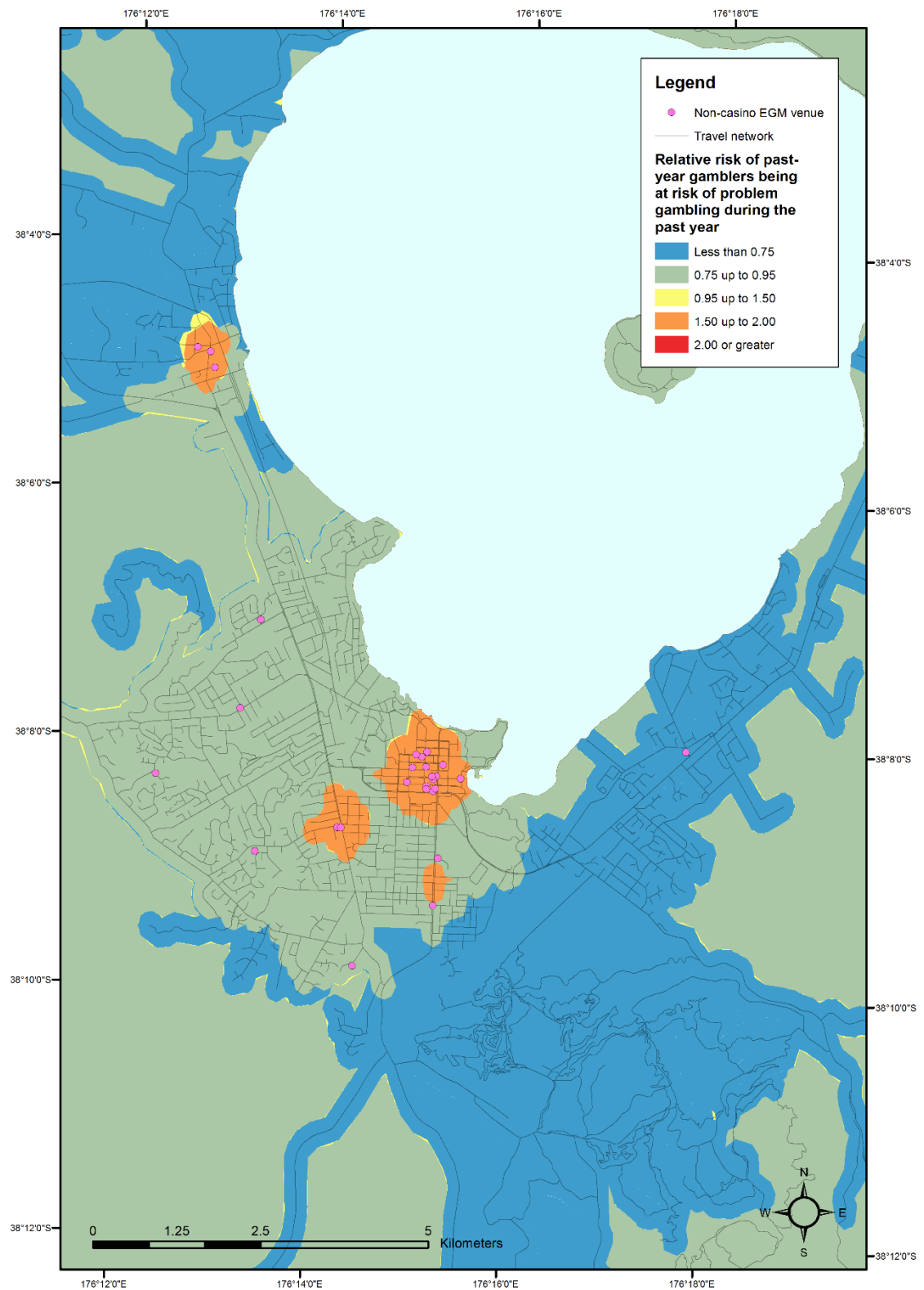


Figure 91. Map of relative risk of problem gambling for past-year gamblers in the Rotorua urban area.

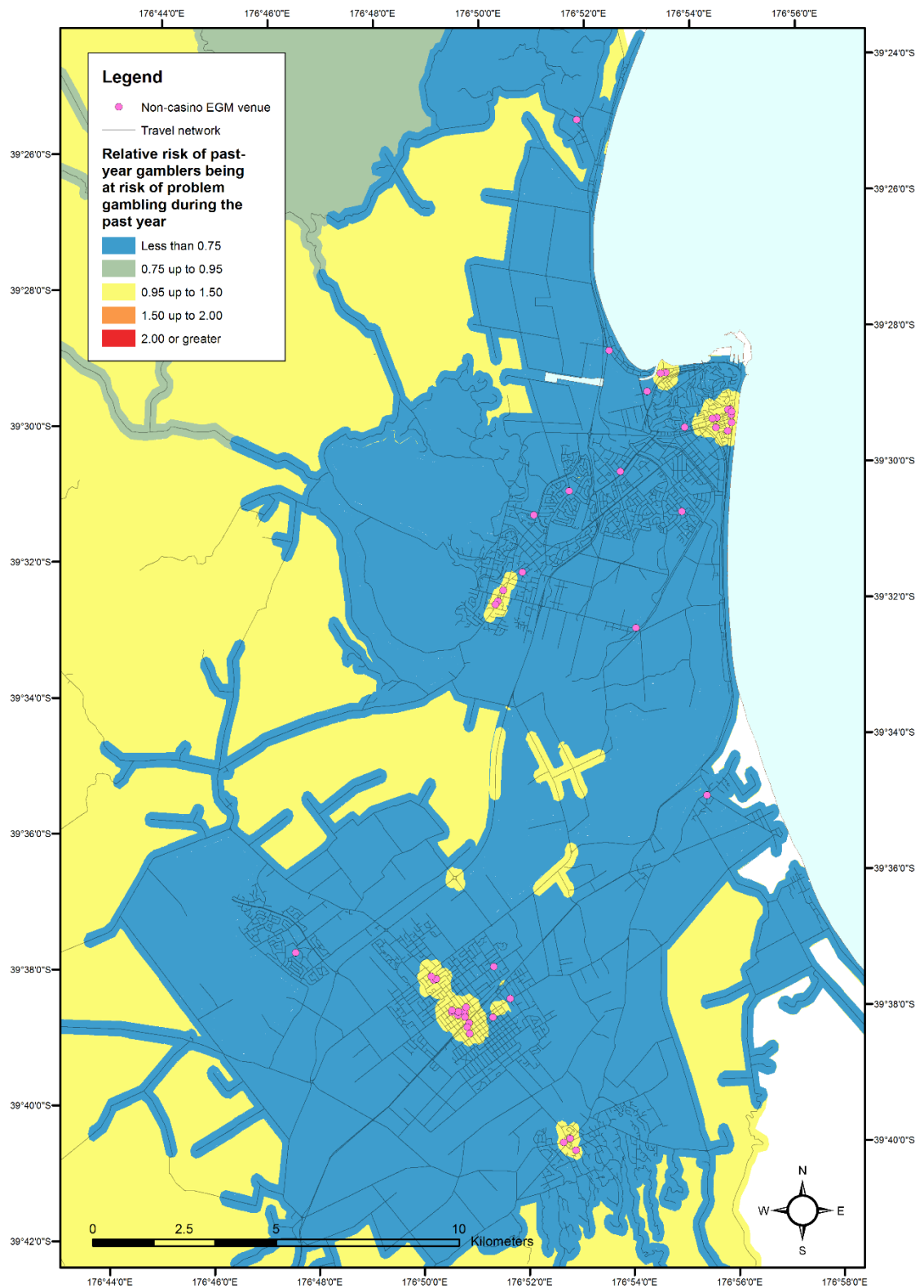


Figure 92. Map of relative risk of problem gambling for past-year gamblers in the Napier-Hastings urban area.

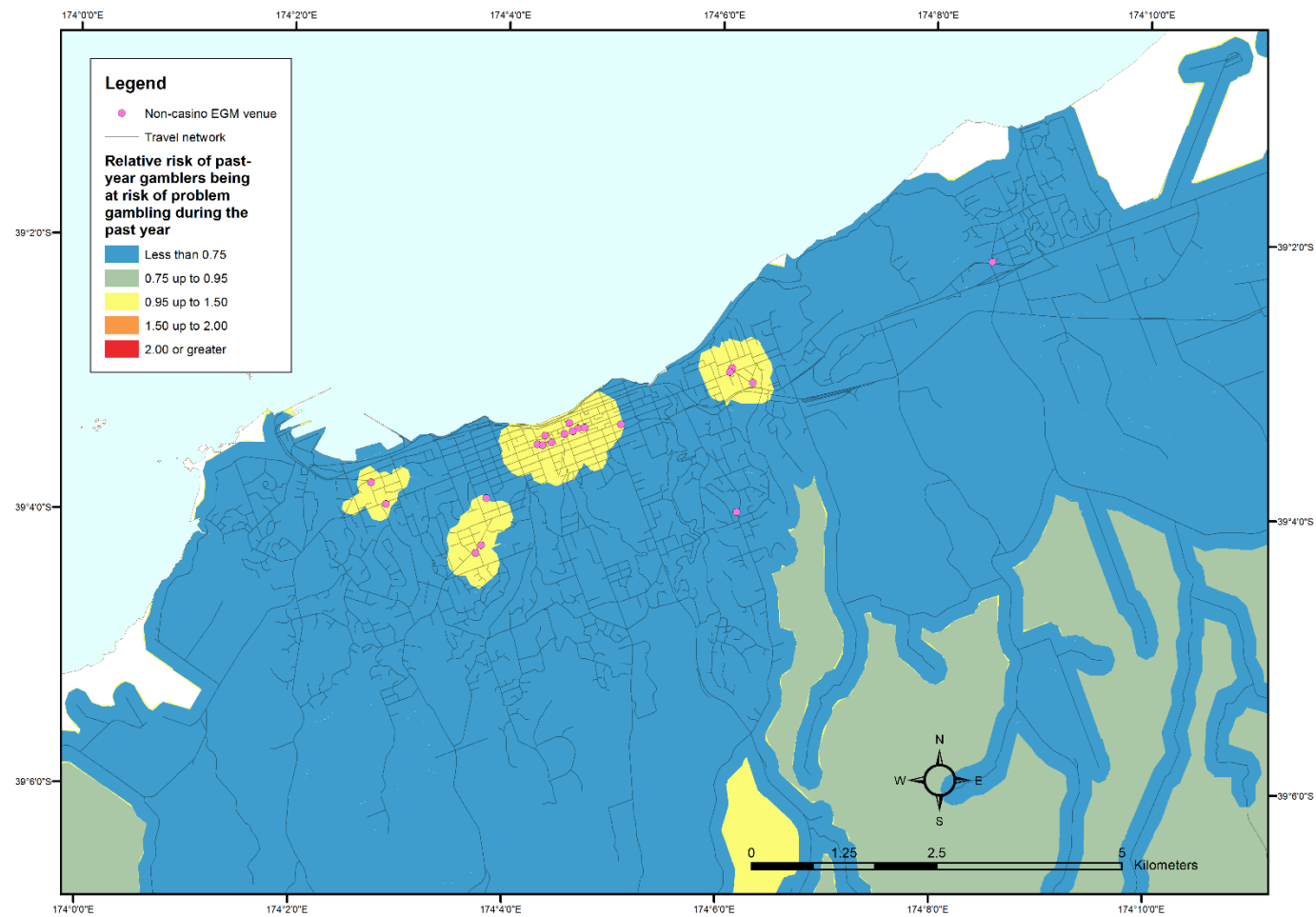


Figure 93. Map of relative risk of problem gambling for past-year gamblers in the New Plymouth urban area.

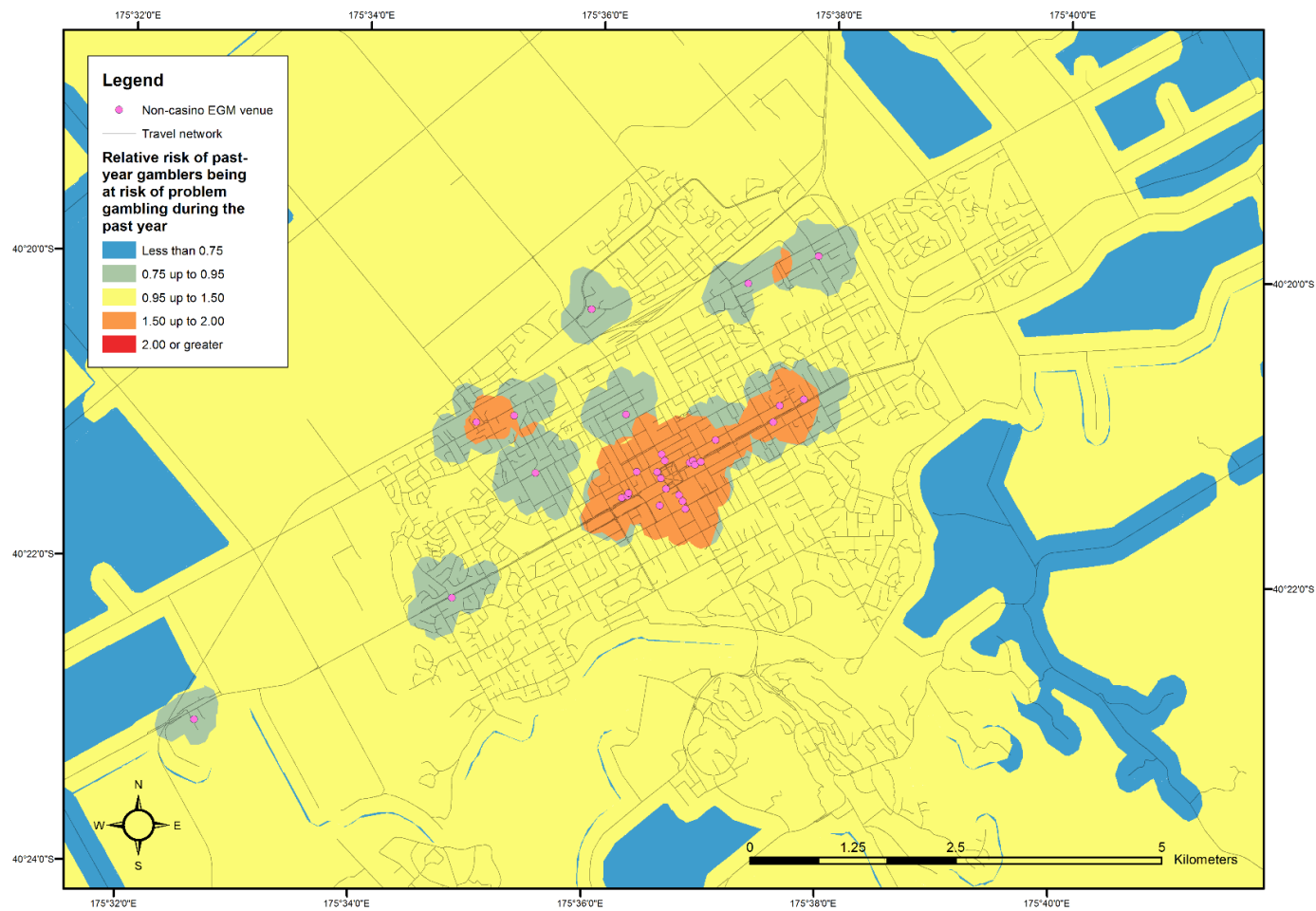


Figure 94. Map of relative risk of problem gambling for past-year gamblers in the Palmerston North urban area.

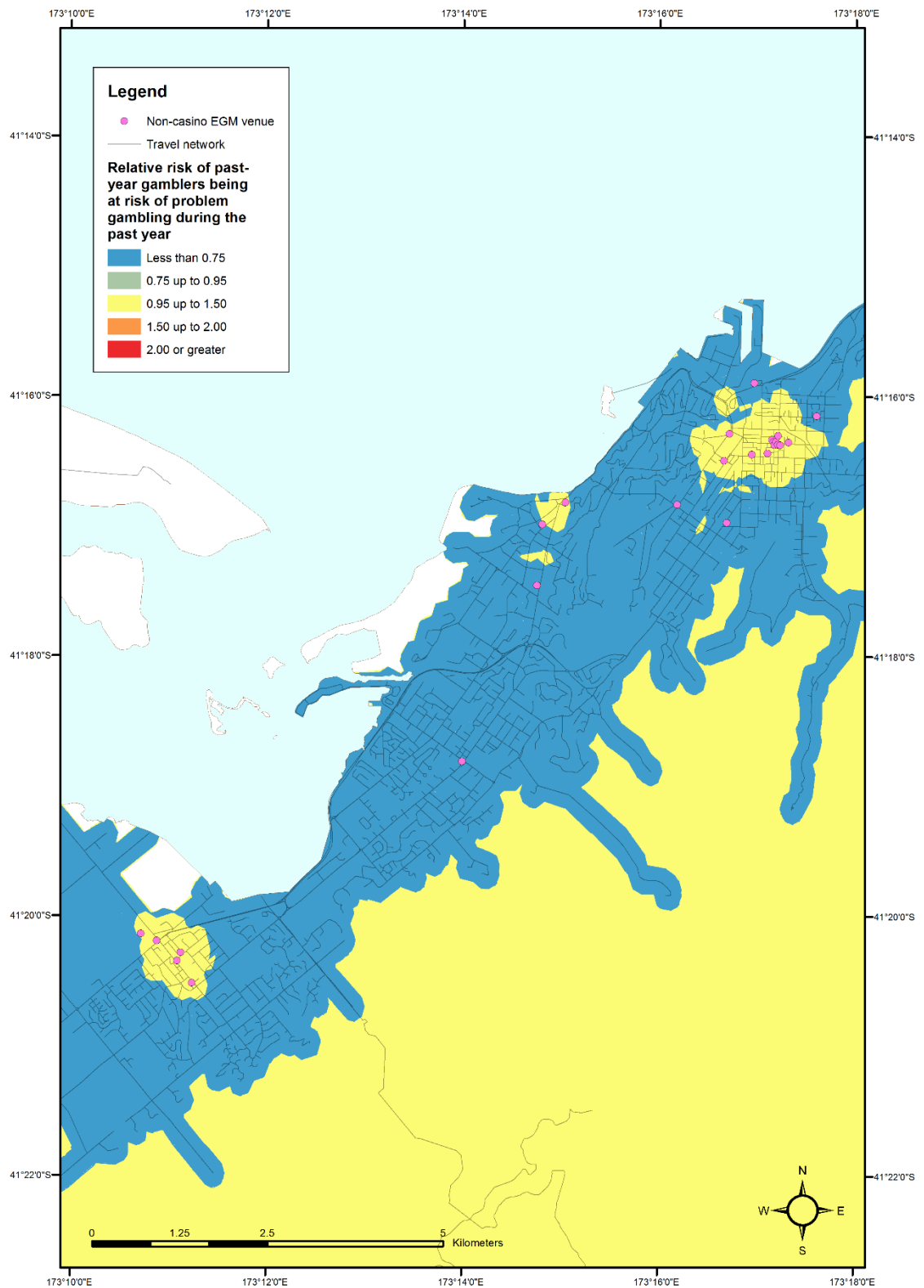


Figure 95. Map of relative risk of problem gambling for past-year gamblers in the Nelson-Richmond urban area.

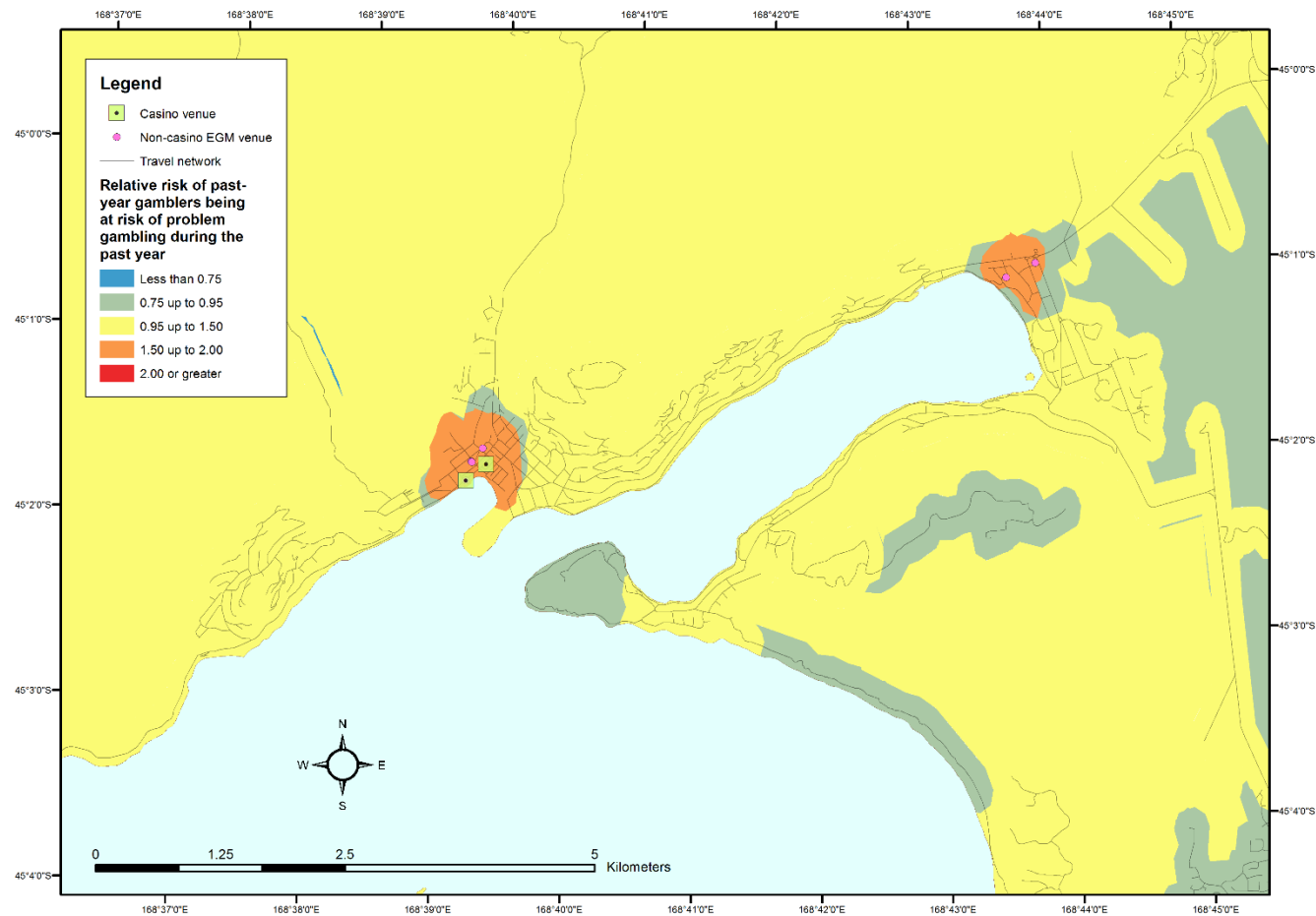


Figure 96. Map of relative risk of problem gambling for past-year gamblers in the Queenstown urban area.

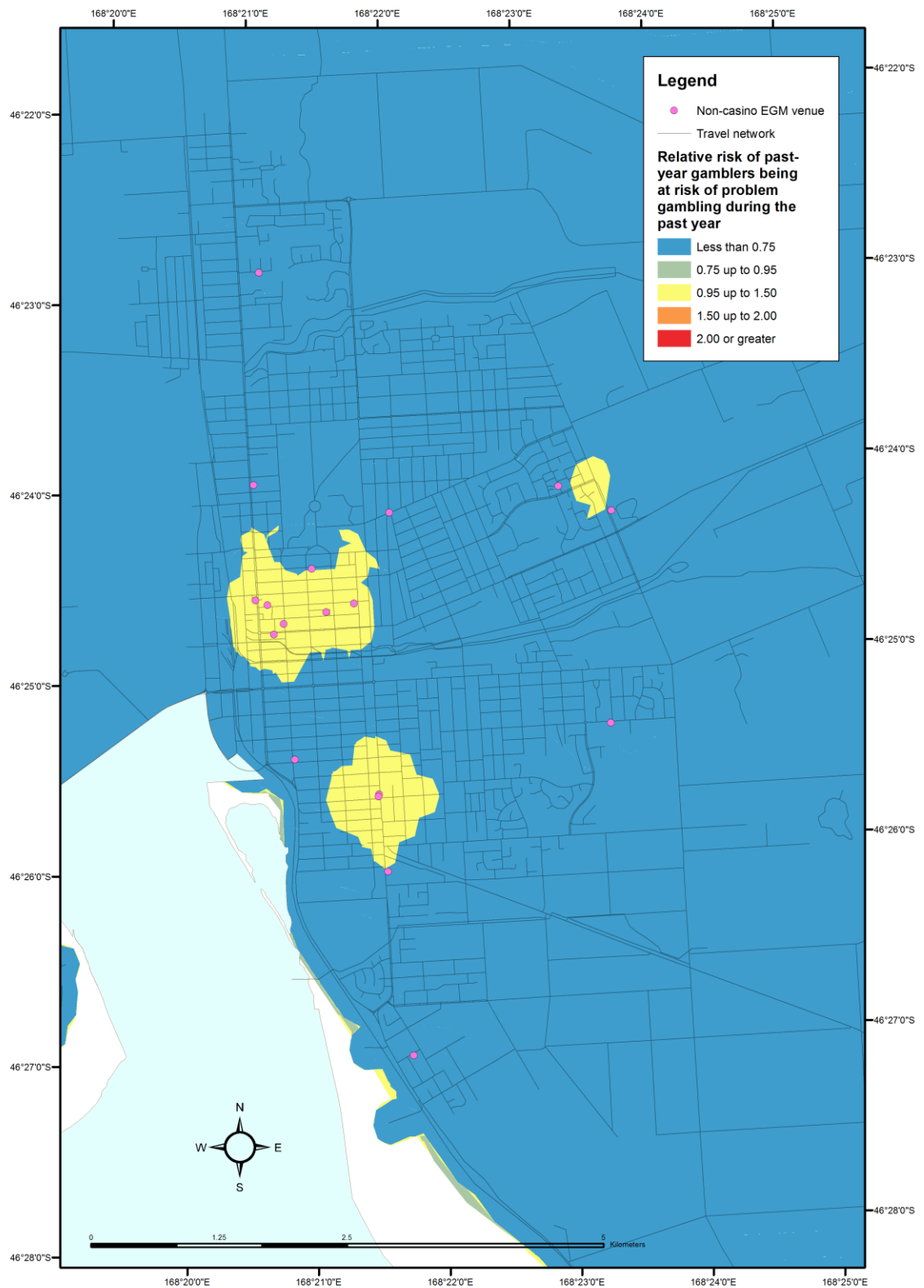


Figure 97. Map of relative risk of problem gambling for past-year gamblers in the Invercargill urban area.