Mapping the Values of New Zealand's Coastal Waters. 5. A Meta-analysis of Economic Values.

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1 Introduction

New Zealand's indigenous biodiversity – native species, their genetic diversity, and the habitats and ecosystems that support them – is essential to the quality of life of New Zealand's citizens and their sense of identity as a nation. New Zealand's high level of endemic biodiversity makes a unique contribution to global biodiversity and places an obligation on New Zealanders to ensure its continued existence.

An estimated 65,000 marine species and associated ecosystems around New Zealand deliver a wide range of environmental services that sustain considerable fishing, aquaculture and tourism industries as well as drive major biogeochemical processes. However, New Zealand's marine ecosystems are increasingly at risk of, or already experiencing, threat from anthropogenic impacts. One of the greatest threats is the introduction of non-indigenous species.

The extent of the threat imposed by an actual or potential incursion of a non-indigenous marine species will vary depending on species identity, available habitat(s), and ecosystem characteristics. New Zealand's ability to assess and manage these risks is significantly hampered by a lack of information on the resources that should be protected.

To better identify, understand and manage the risks that non-indigenous species pose to the marine environment, MAF Biosecurity New Zealand (MAFBNZ) initiated a research programme in 2006 to map components of four core values around New Zealand's coastline: environmental (e.g. habitat types, protected areas, threatened and endangered species), economic (e.g. coastal land value, commercial fishing), social (e.g. recreation, amenity value) and cultural values (e.g. taonga, Mataitai). This report focuses on the outputs from the Economic Value Mapping project and documents the meta-analysis of the coastal economic value information.

1.1 OBJECTIVES

The overall objective of this project was to explore and describe the distribution and spatial patterns of marine economic values to improve MAFBNZ's risk analysis and risk management capabilities, allowing for more effective decision-making and biosecurity delivery.

1.1.1 Specific objectives

1. To describe the spatial distribution of selected attribute values;[1]
2. To identify any potential limitations and/or biases associated with the data;
3. To determine areas of coincidence among high-value attributes.

[1] Refer to Table 1 for selected attributes.

2 Economic Value Mapping Project

Outputs from the Economic Value Mapping project comprises of Geographic Information System (GIS) layers that represent three sub-components associated with the marine coastal environment – commercial fisheries, residential land value, and industry productivity.

2.1 SUB-COMPONENTS

This section briefly describes the three sub-components discussed in this project. These sub-components represent 30 different attributes of marine economic value (Table 1).[2]

Table 1: Economic Value Mapping GIS layers

Dataset	Dataset layer(s)	Attribute(s)
Fisheries	Finfish and shellfish	Value at risk
	Rock lobster	
	Eels	
Residential land value	Residential land value	Total Capital Value (TCV)
		TCV – land only component
		TCV – improvements component
		Average land value
		Average land area
		Missing land area
		Land value standard deviation
Coastal industry added-value	Employment by District	Value added ($) by:
		Rock lobster fishing
		Finfish trawling
		Squid jigging
		Line fishing
		Marine fishing NEC. (not elsewhere classified)
		Aquaculture
		Ship building
		Boat building
		Fish wholesaling
		Marine equipment retailing
	Employment by Area Unit	Value added ($) by:
		Marine fishing
		Aquaculture
		Oil and gas extraction
		Construction material mining
		Exploration
		Cafes and restaurants
		Pubs, taverns and bars
		Accommodation
		Water transport
		Clubs (hospitality)
		All industries (including non-coastal)[3]
		Services to water transport

[2] Refer to Mapping the Values of New Zealand's Coastal Waters: 2. Economic Values (MAFBNZ) report, for more information on the identification and selection of subcomponents and associated datasets and the calculation methods of deriving the data attributes in each dataset.

[3] Reported in Appendix B.

2.1.1 Fisheries value at risk

The fisheries 'value at risk' attribute is an indicator of the value of the finfish and shellfish, rock lobster and eel fisheries within the 200 nautical mile New Zealand Exclusive Economic Zone (EEZ). The indicator was developed using quota share prices and export prices (free on board, FOB) derived from data provided by the Ministry of Fisheries, based on prices prevailing at the time of the 2006 census. Fisheries value at risk represents pure rent, and is an estimate of the present value of future income streams over an indefinite period of time.

This sub-component reported value at risk for each species by Fisheries Statistical Area (FSA), which were defined differently for species groups. For finfish and shellfish, the FSA were defined similarly, while the rock lobster and eel species were reported by unique FSAs.

2.1.2 Residential land value

Residential land value is an indicator of amenity values associated with coastal locations, on the basis that proximity to the coast increases property values. Values for all residential properties within 1 km of the coastline of New Zealand were derived from Quotable Value New Zealand Ltd at Statistics New Zealand (SNZ) area unit level. For the analysis in this project, total residential land value and average residential land value were selected from the sub-component attributes. Both land values exclude the value of any improvements and were adjusted to 2007 prices. The reported total residential land value represents the aggregated residential land value of each area unit, not the per hectare land value. Therefore, the value is not reported against a consistent land area. In addition, the residential land value data layer includes 'Average Land Value', which presents the average land value per property in each area unit (not the per hectare value).[4]

2.1.3 Coastal industry added-value

Annual added value of commercial activity that is reliant on coastal or marine resources (directly or indirectly) was utilised as an indicator of the value added for commercial activities of selected industries associated with the coast. Value added comprises the returns to management (entrepreneurship), labour, capital, and natural resources used in a particular year. The added value (dollars/year) for each industry was derived based on the industry productivity data and employment data from SNZ. Employment data were from the 2006 Census of Population and Dwellings, based on the area of usual residence. Industry productivity data were sourced from the National Accounts' Inter-Industry Study 1996 (Statistics New Zealand 2001). The total value added in a given industry was allocated to area units on the basis of the share of that industry's employees who reside in a given area unit.[5] Two sets of coastal industry added value data were reported and they differ in their geographic descriptions and the level of industry aggregation. One industry group is mapped at the territorial local authority (TLA) scale while, the other layer is defined at the SNZ area unit scale. The differences arise through confidentiality rules applied to data access by SNZ.

[4] Land values per area unit; the per hectare values were not available in the data layers.
[5] See section 2.3 of the report 'Mapping the Values of New Zealand's Coastal Waters: 2. Economic Values (MAFBNZ)', for more details on calculation methods.

3 Meta-Analysis

Meta-analysis involved two different approaches: summary and overlay analyses. Summary analyses describe the overall trend and spatial distribution of the data attributes. Overlay analysis involved assessing coincidences among the data layers.

3.1 SUMMARY ANALYSIS

This section describes the overall trend and spatial distribution of each of the datasets described in the previous section. In addition, high value areas (hotspots) were defined and discussed for each of the data attributes.[6] The definition criterion for hotspots was chosen as the 95th percentile (i.e. the top 5%) of the values of each attribute with zero values excluded in the analysis to get a conditional percentile. In cases where the same value is repeated and the 95th percentile is not defined, the next closest percentile was used to identify the high value areas. For example, the high value areas were defined as the top 5% of the values for total residential land value, while the hotspots were defined as the top 7.5% for rock lobster industry added values and clubs industry hotspots were the top 2.6% of all values.

3.1.1 Fisheries value at risk

For finfish, the hotspot was represented by the top 4.6% of all values (Figure 1), while the shellfish hotspot was the top 3.8% of the values (Figure 2). In both datasets, one FSA area has distinctly higher value than the other hotspot values. For the finfish dataset, the selected hotspot values are closely followed by another cluster of high values (Figure 1). The spatial distribution of value at risk for total finfish species by FSA (Figure 3) show hotspots occurring off the West Coast of South Island, Canterbury, and the sub-Antarctic Islands. Shellfish hotspots (Figure 4) are found off Marlborough and Southland (including parts of Stewarts Island). The total finfish and total shellfish hotspots correspond to areas with high values for arrow squid, ling, hake, hoki, warehou, and black paua and yellowfoot paua species.

The overall trend in value at risk for rock lobster species (Figure 5) shows two FSA units with significantly high values. The rock lobster value at risk hotspots were identified as the top 5% of the values, with the value in one FSA area markedly higher than the other values defined as hotspots. Figure 5 also shows a cluster of values closely following the defined hotspots. The hotspots for rock lobster species are found along the Wairarapa and Southland coastal areas (Figure 6).

The top 4.6% was chosen as the hotspot for value at risk for eel species (Figure 7), with hotspots occurring in Lake Ellesmere Migration Area and, the Northland coastal area (Figure 8).

[6] The terms ‘high value area’ and ‘hotspot’ are used interchangeably throughout the report.

Figure 1: Overall trend of value at risk for finfish species by Fisheries Statistical Areas (Ministry of Fisheries data).

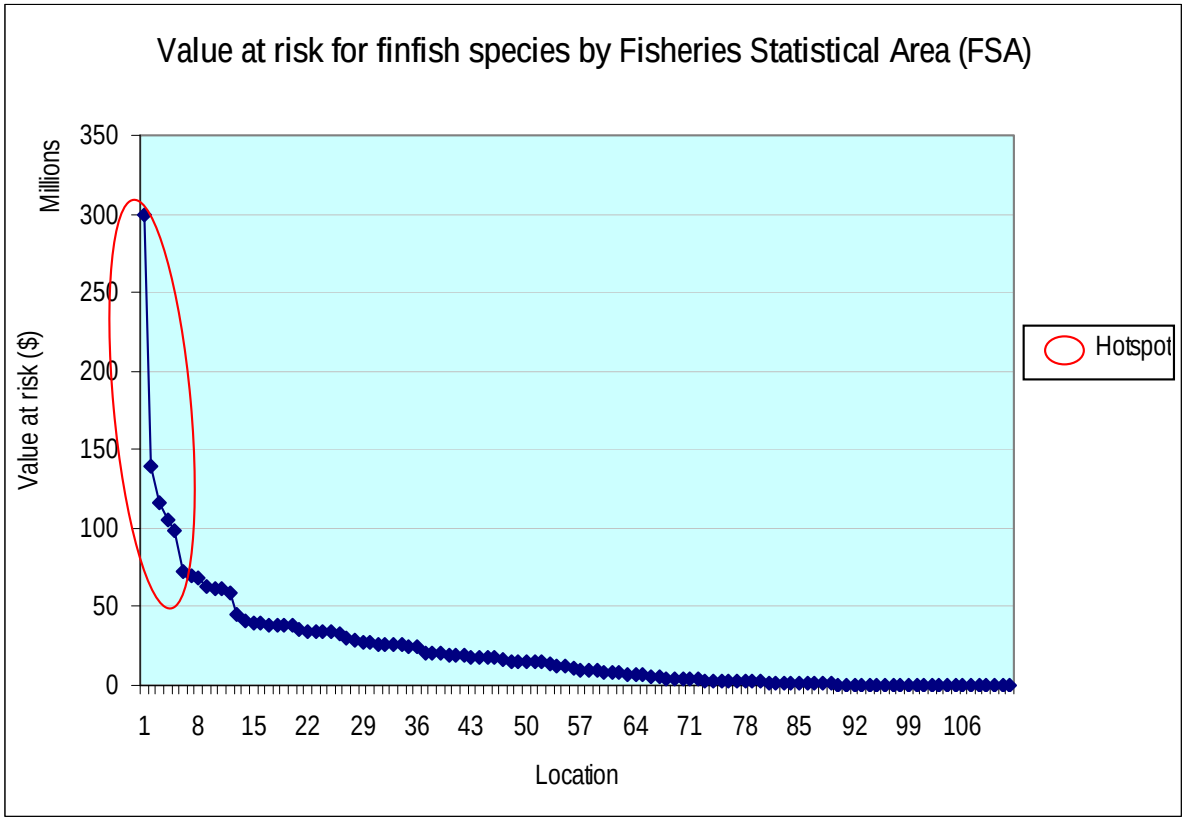


Figure 2: Overall trend of value at risk for shellfish species by Fisheries Statistical Areas (Ministry of Fisheries data).

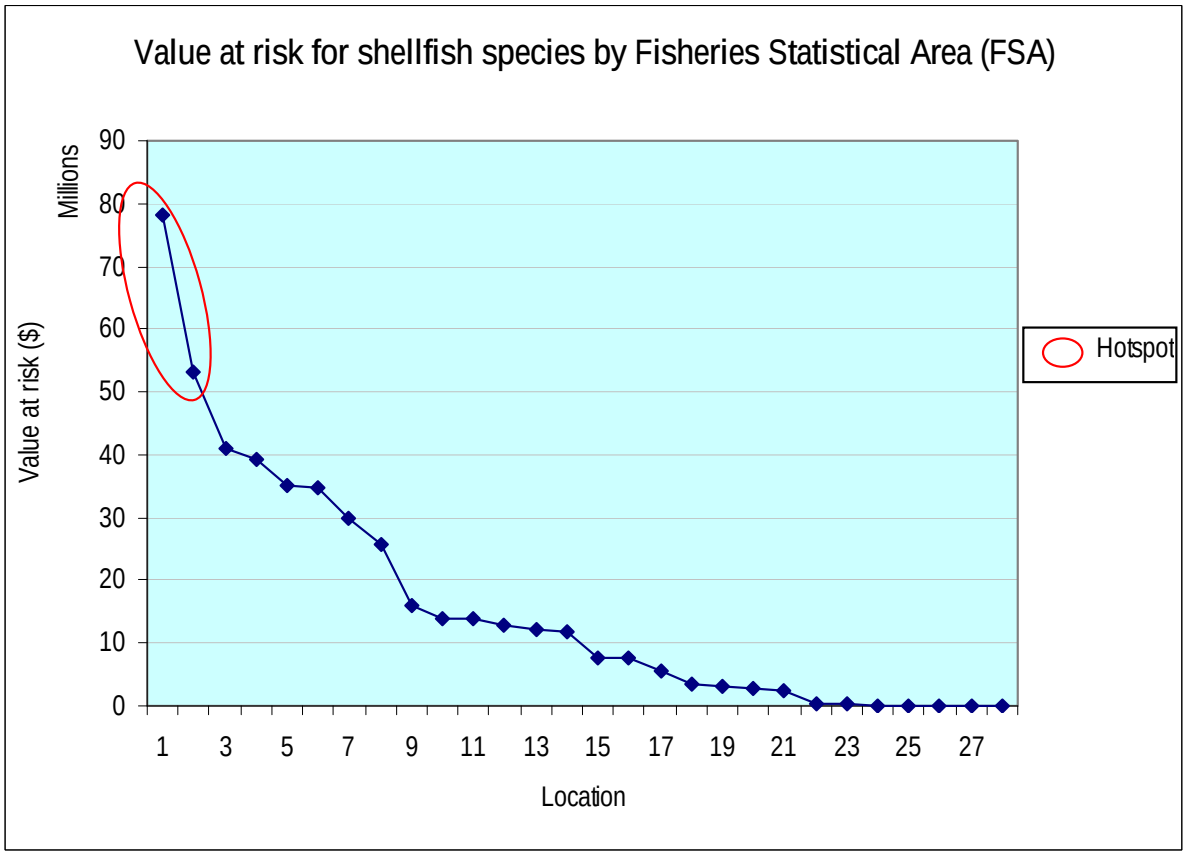


Figure 3: Value at risk for total finfish species based on the statistical areas to which catches are reported (Ministry of Fisheries data).

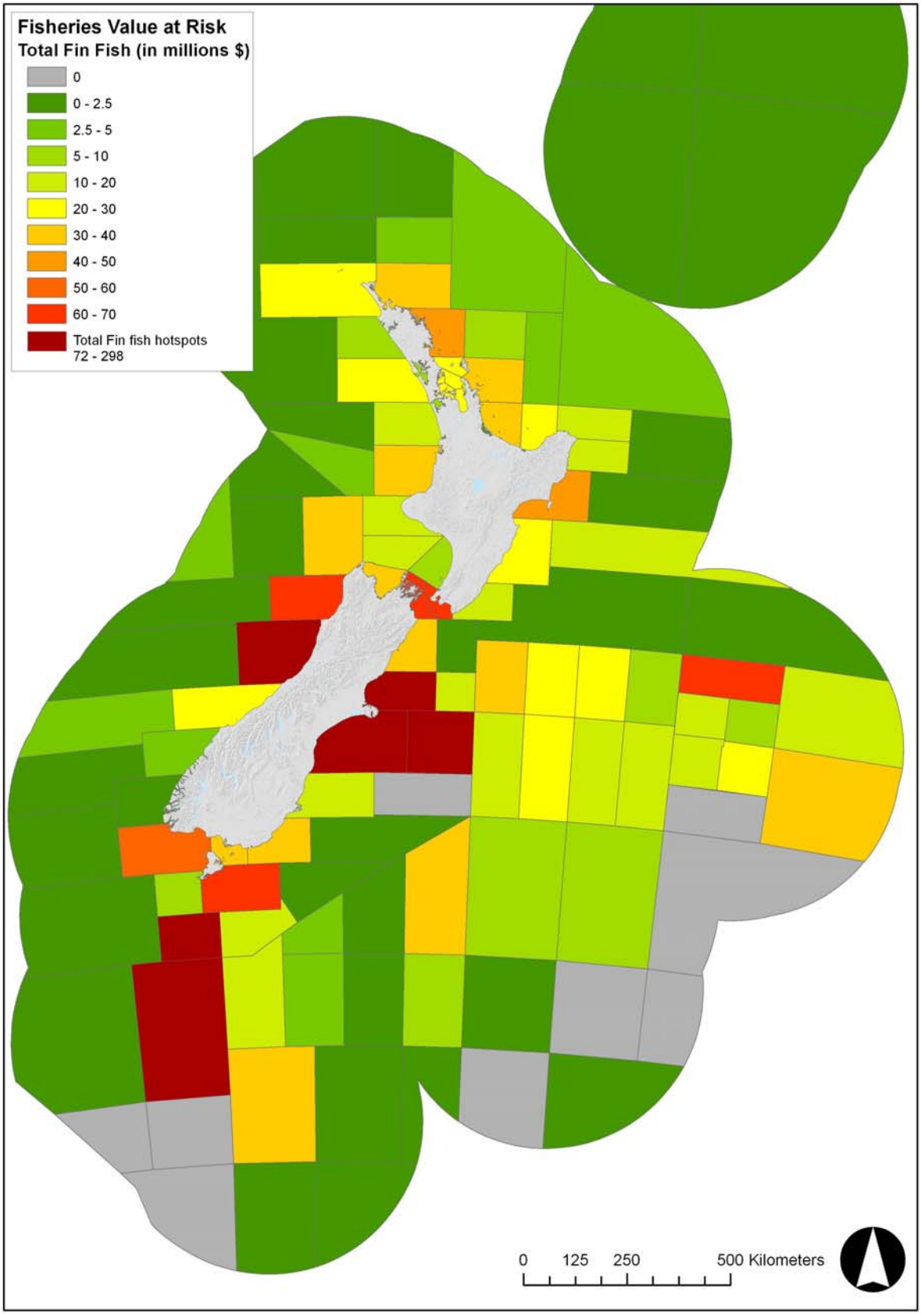


Figure 4: Value at risk for total shellfish species based on the statistical areas to which catches are reported (Ministry of Fisheries data).

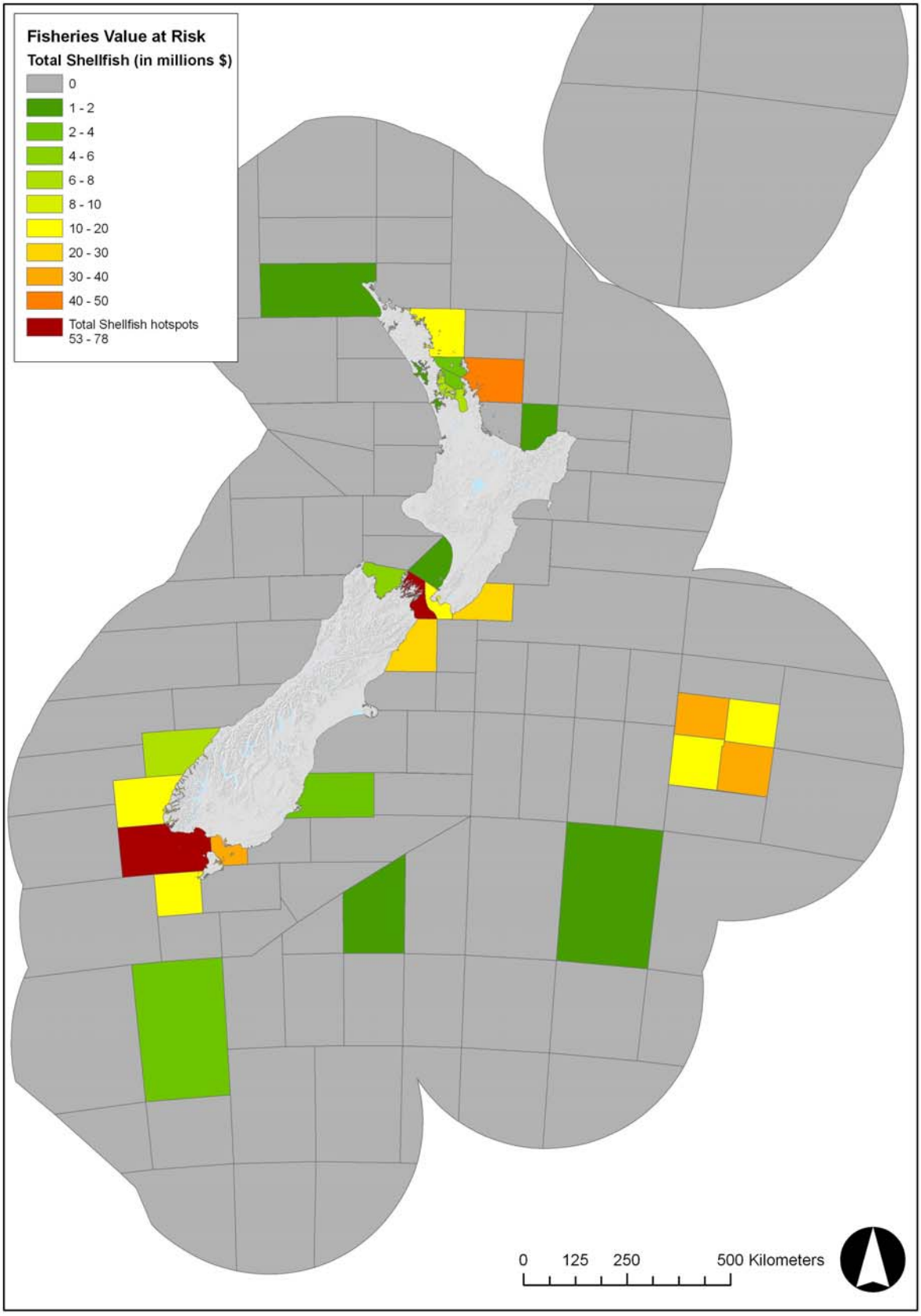


Figure 5: Overall trend of value at risk for rock lobster species by Fisheries Statistical Areas (Ministry of Fisheries data).

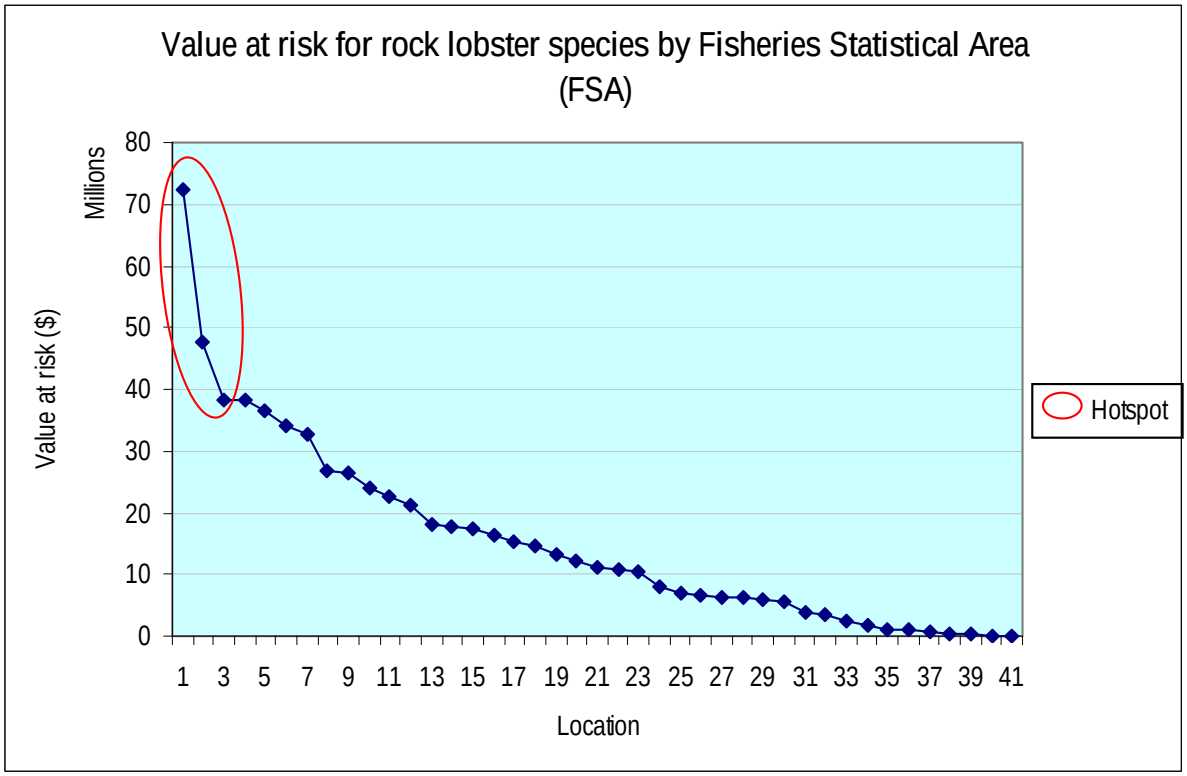


Figure 6: Value at risk for rock lobster species based on the statistical areas to which catches are reported (Ministry of Fisheries data).

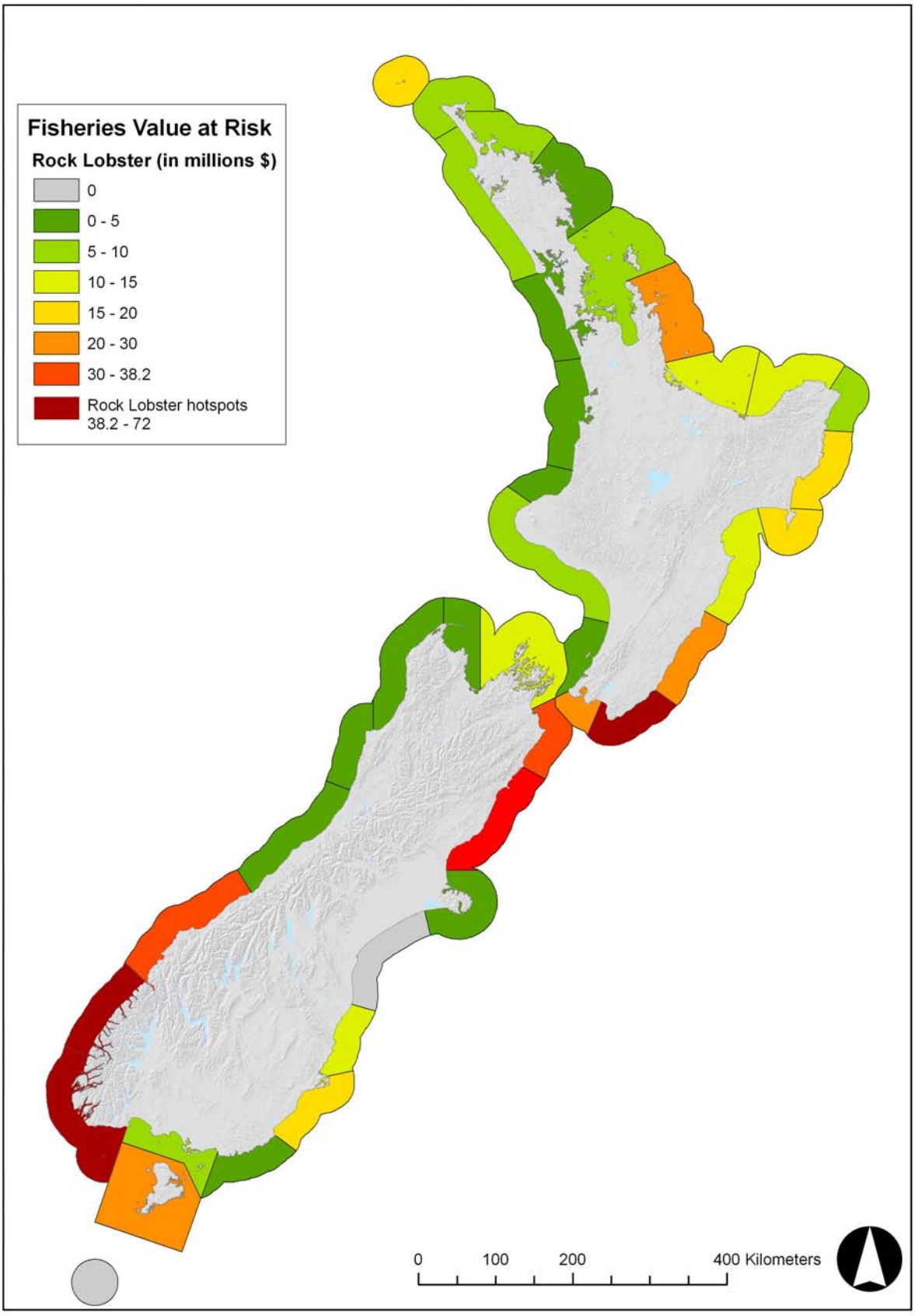


Figure 7: Overall trend of value at risk for eel species by Fisheries Statistical Areas (Ministry of Fisheries data).

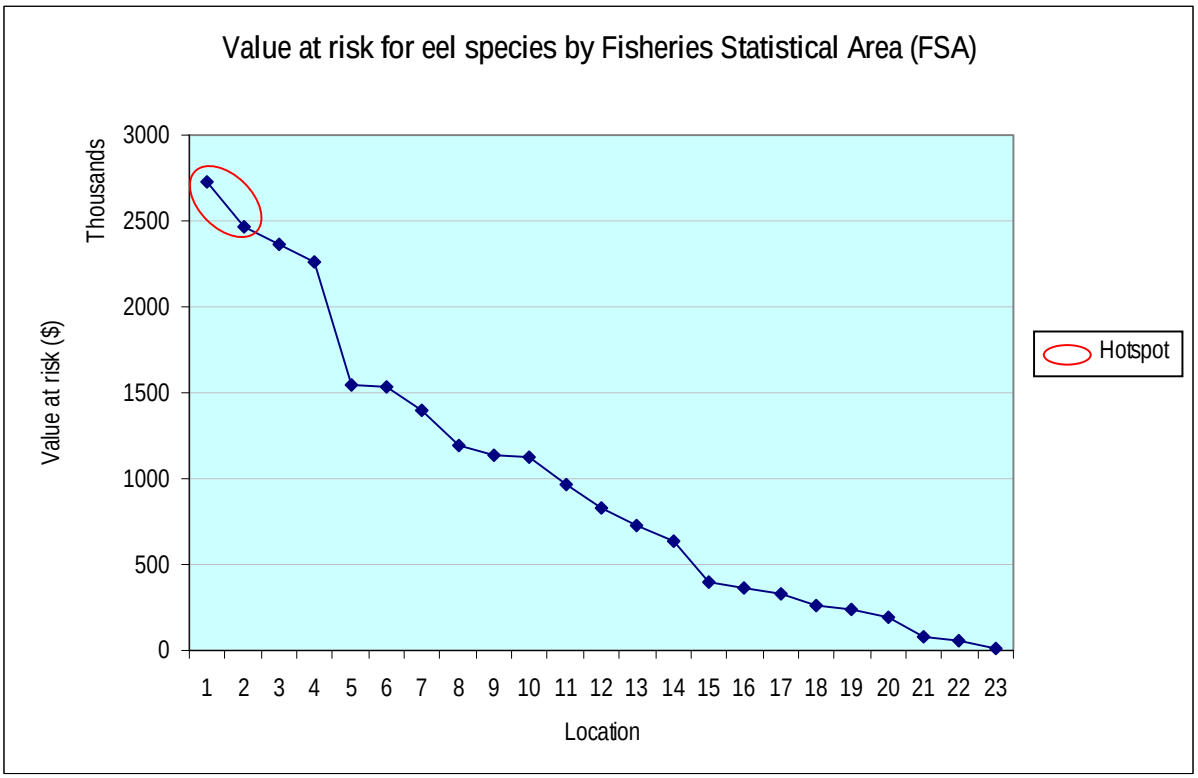
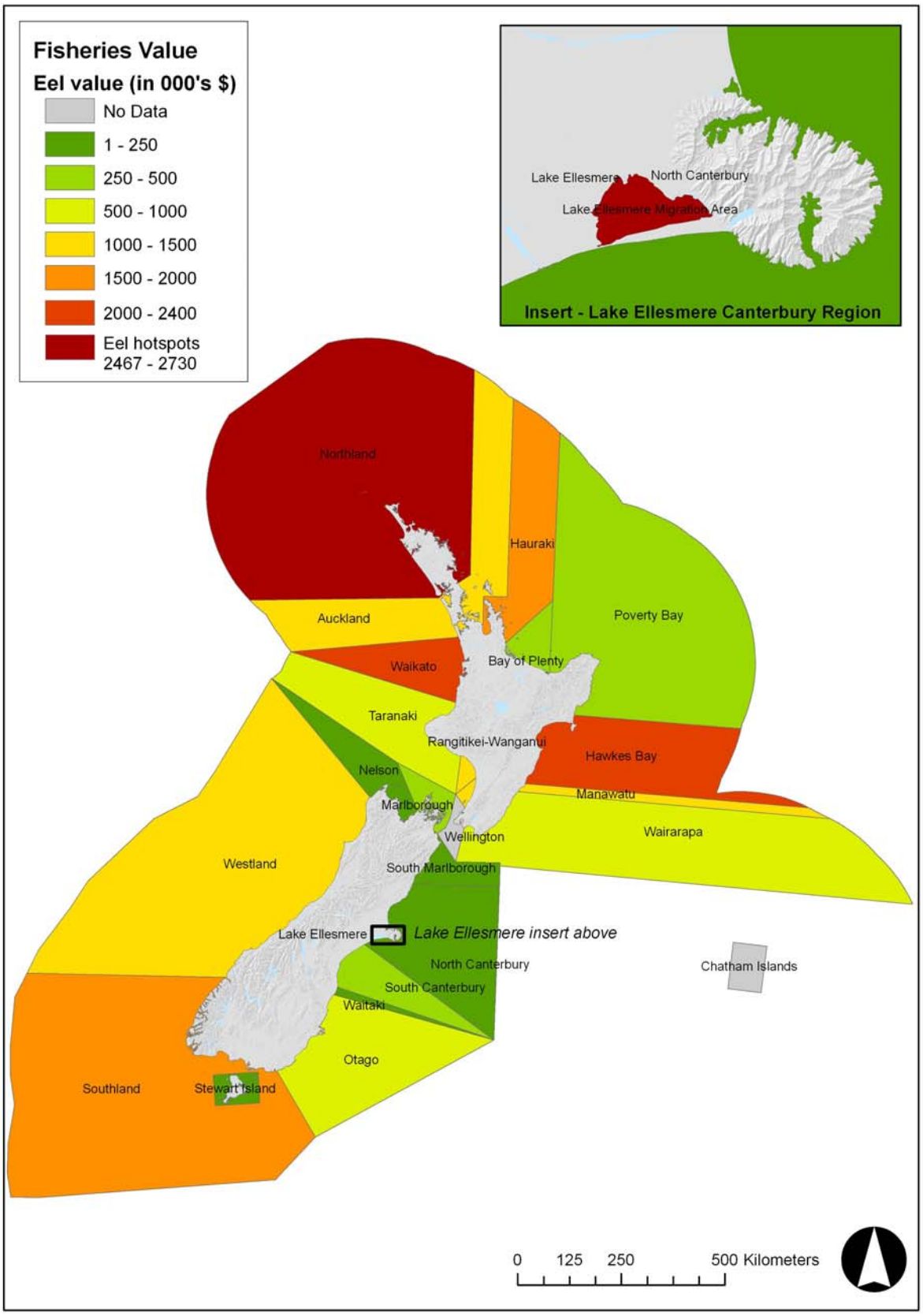


Figure 8: Value at risk for eel species based on the statistical areas to which catches are reported (Ministry of Fisheries data).



3.1.2 Residential land value

For the total capital value data of all residential and life style properties within 1 km of the coast at area unit level, high value areas were defined as the top 5% of the values (Figures 9 and 10).

The overall trends in the total residential land value data and average residential land value data for coastal areas (all residential land within 1 km of the coast) show one area unit with a significantly higher value and two more area units with relatively high values (Figures 11 and 12). Total residential land value is the land only component of the total capital value. For both attributes the hotspots were identified as the top 5% of all values.

The highest total residential land values are mainly clustered in area units around the Whangarei, Auckland, Tauranga, Thames-Coromandel, and Marlborough Sounds regions (Figure 13). The average land value hotspots are mainly found in area units around the Far North, Whangarei, Auckland and, Gisborne regions (Figure 14). Also noticeable are the high value area units of Milford in the Southland district, and Oceanic-Tararua Constituency in the Tararua district. Note that, land value was given only for land within 1 km of the coast; however, in the figures, shading has been applied to the entire area unit (Figures 10, 13 and, 14).

Even though these GIS maps give a visual interpretation of the data, it should be noted that residential land values are aggregated at the SNZ area unit levels, which vary significantly in size.

Figure 9: Overall trend of total capital value for all residential and lifestyle properties within 1 km of the coast at area unit level (Quotable Value Ltd data).

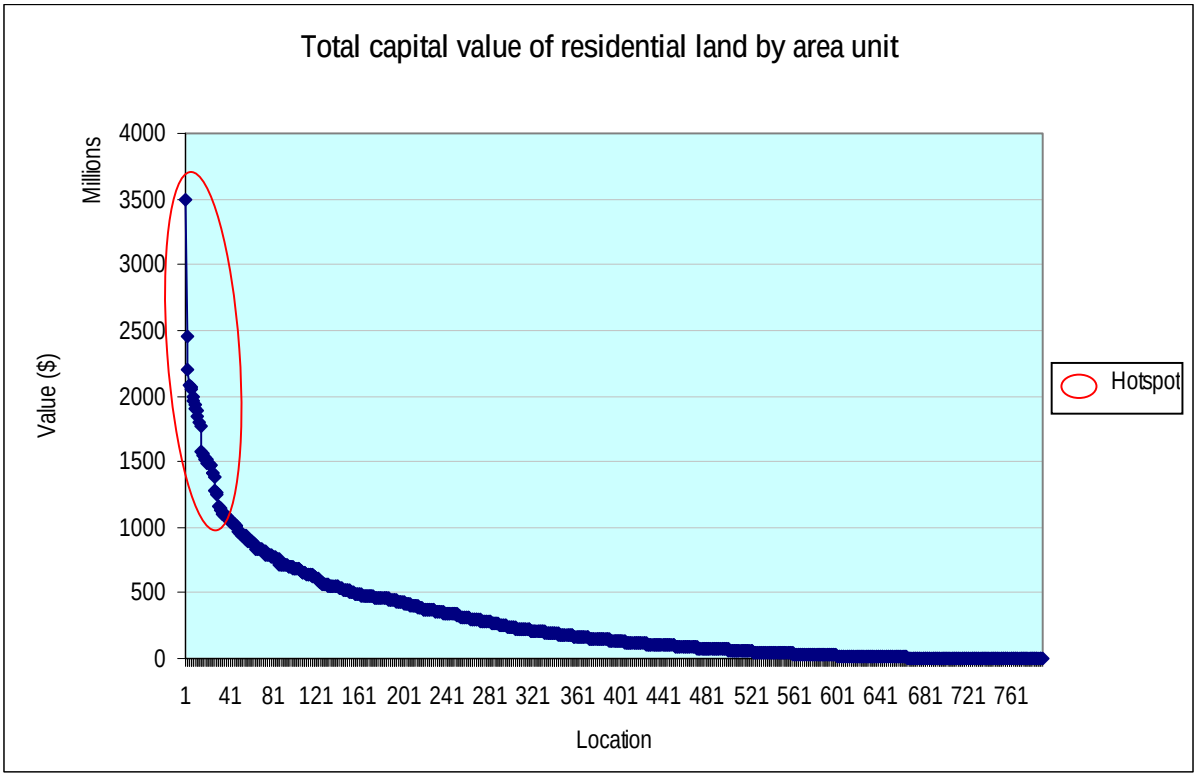


Figure 10: Total capital value for all residential and lifestyle properties within 1 km of the coast at area unit level (Quotable Value Ltd data).

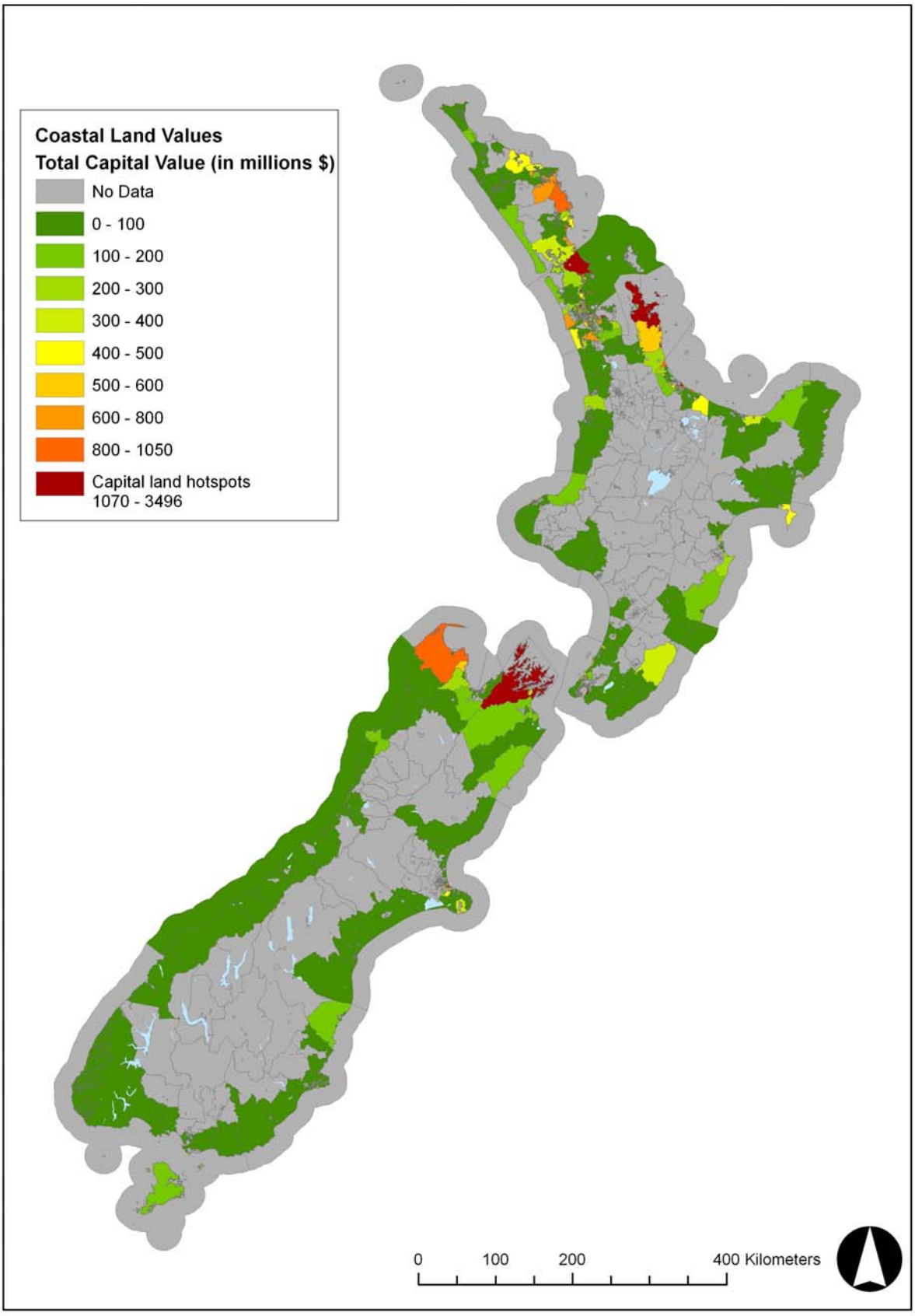


Figure 11: Overall trend of total residential land value for all residential and lifestyle properties within 1 km of the coast at area unit level (Quotable Value Ltd data).

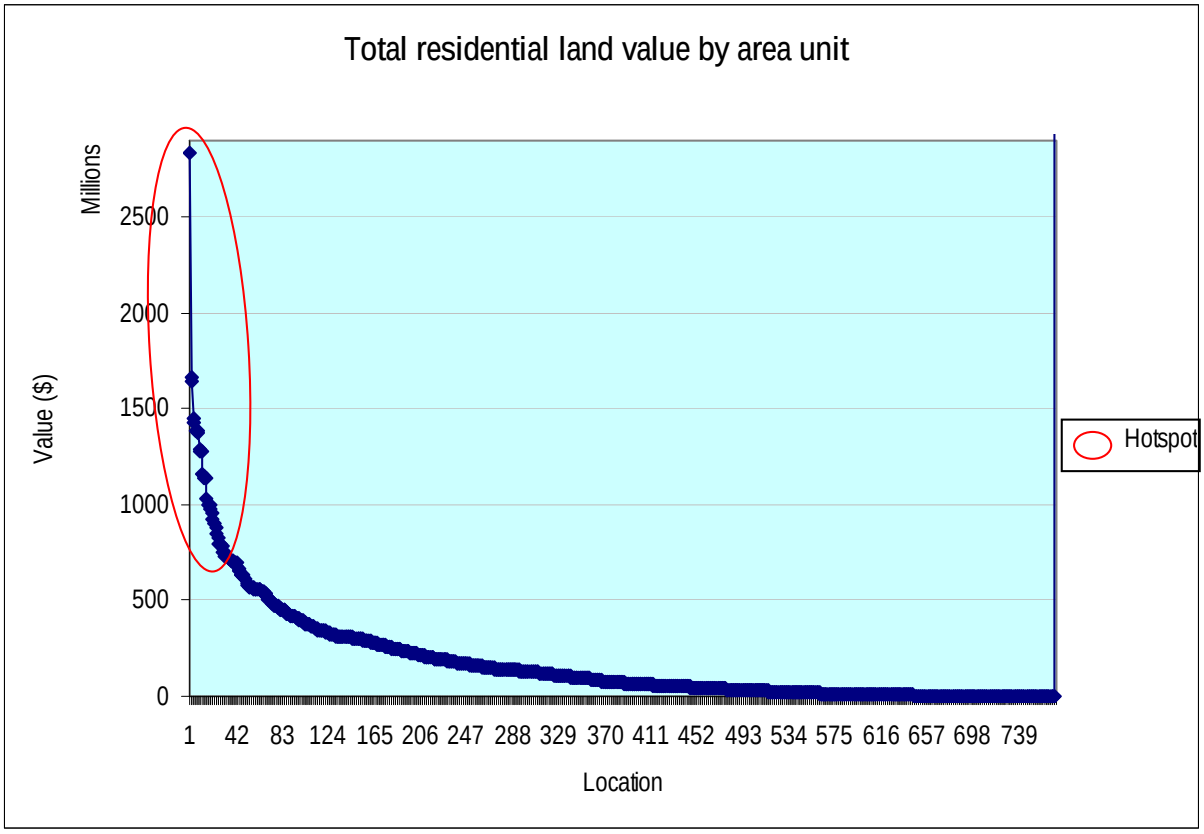


Figure 12: Overall trend of average residential land value for residential or lifestyle property within 1 km of the coast at area unit level (Quotable Value Ltd data).

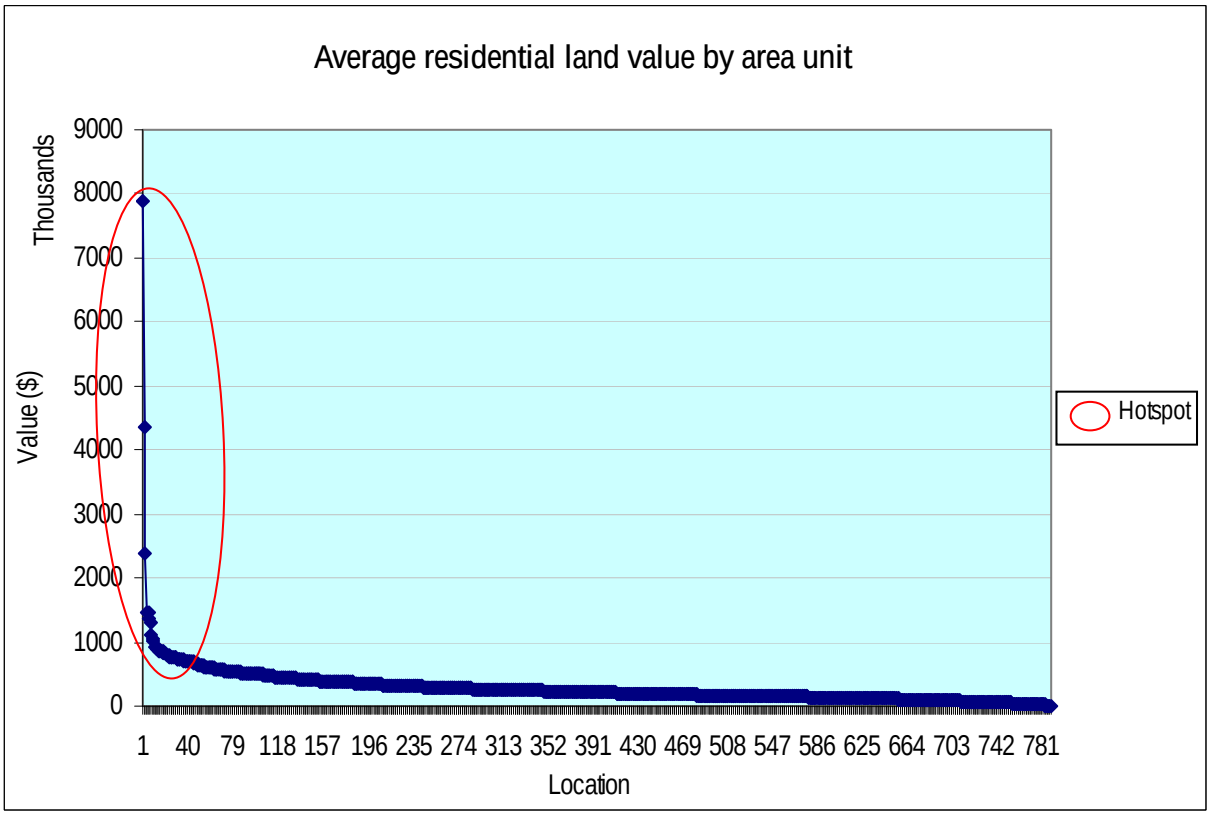


Figure 13: Total land value for all residential and lifestyle properties within 1 km of the coast at area unit level (Quotable Value Ltd data).

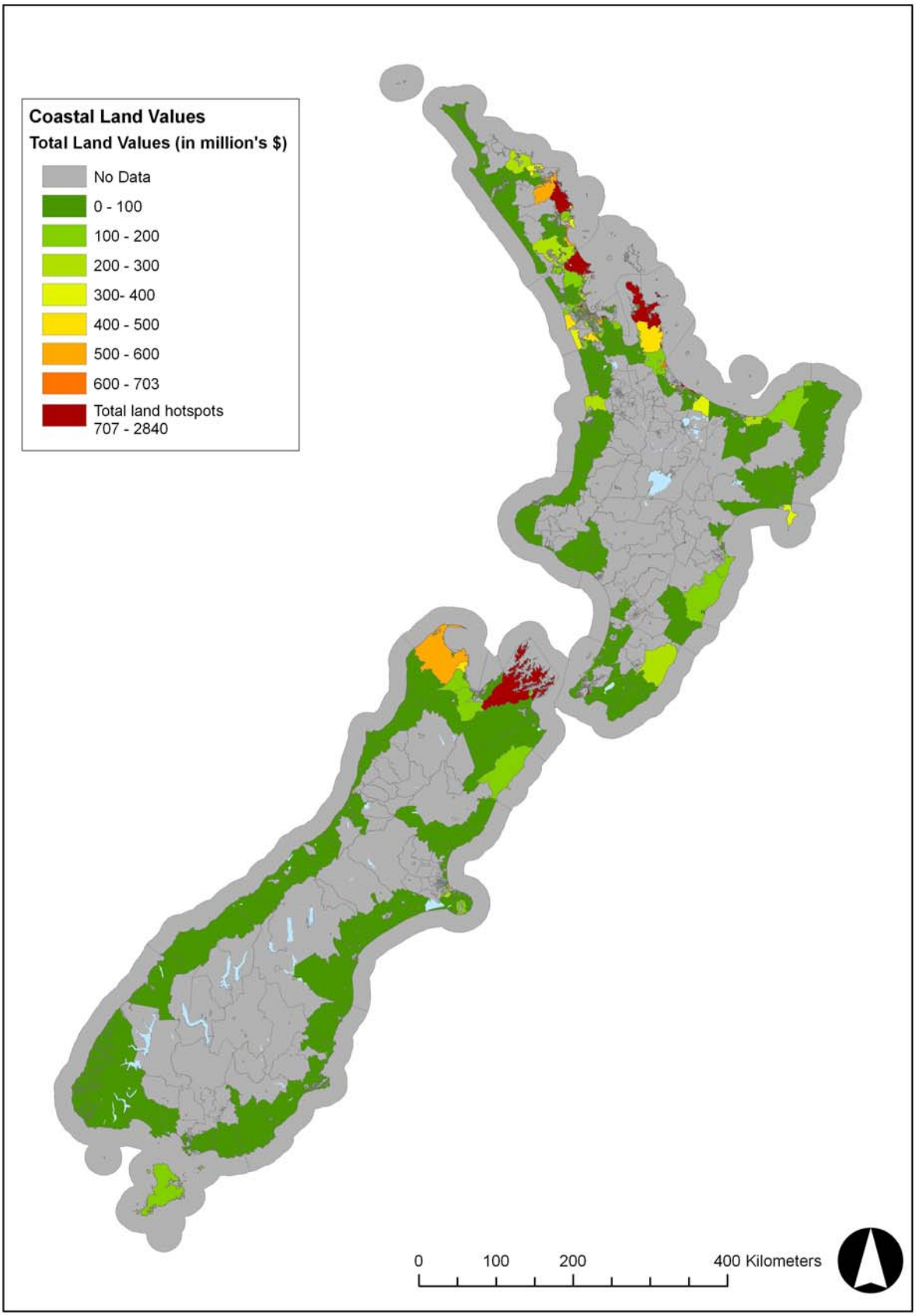
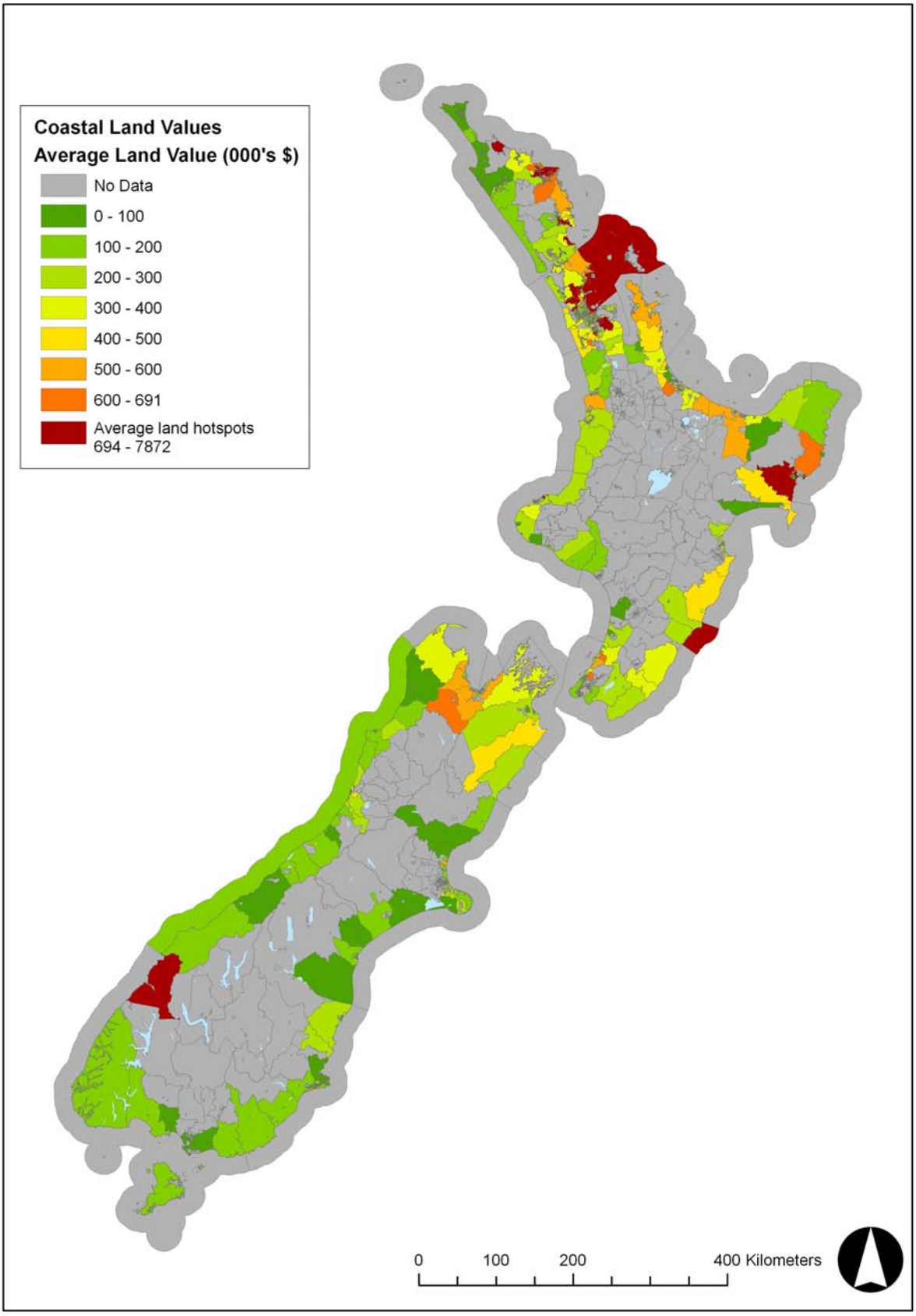


Figure 14: Average land value per property for residential or lifestyle property within 1 km of the coast at area unit level (Quotable Value Ltd data).



3.1.3 Coastal industry added-value

Added value for coastal industry groups at territorial local authority (TLA) scale were derived from aggregating employment data by summing the totals for each area unit within a TLA (Figures 15–32). It should be noted that this indicator was derived based on the census data and does not represent the annual employment patterns.

Overall trend for the value added by rock lobster fishing and line fishing industries show similar patterns (Figures 15 and 16). High value areas were defined as the top 7.5% of all values for rock lobster industry, while the top 5.2% of the values were identified as the line fishing high value areas. Rock lobster fishing high value areas occur in Invercargill city, and the Marlborough and Masterton district areas (Figure 17). Line fishing industry hotspots occur in Tauranga city, Christchurch city and Whangarei district areas (Figure 18).

Finfish trawling industry hotspots were defined as the top 4.4% of all values where the selected hotspot values are significantly larger than the remaining values (Figure 19) and found in the Timaru district, Nelson city and Tasman district areas (Figure 20).

Added values for marine fishing industry NEC (not elsewhere classified) and fish wholesale industry demonstrate similar trends to the above (Figure 21–22). The top 4.5% of all the values were identified as the high value areas for marine fishing industry and they are found in the Far North district, Invercargill city and Marlborough district (Figure 23). Fish wholesale industry hotspots were defined as the top 4.8% of the values, and the selected hotspots occur in Auckland city, Christchurch city and Manukau city (Figure 24). These high value areas represent the three most populated cities in New Zealand.

For aquaculture industry, hotspots were represented by the top 5.7% of the values where the highest value is significantly larger than rest of the values selected as hotspots (Figure 25). Geographical distribution of the values reveals the hotspots in Marlborough district, Thames-Coromandel district, Nelson city and the Far North district (Figure 26).

The overall trend in value added by ship building industry shows three TLAs with significantly high values compared with the rest of the areas (Figure 27). However, the top 4.2% of the values were identified as the hotspots under the 95th percentile cut-off criterion, excluding one of the TLAs exhibiting higher values. Spatial distribution of the data illustrates the hotspots occurring in Whangarei district and North Shore city, closely followed by Christchurch city (Figure 28).

High value areas were defined as the top 5.8% of all values for marine equipment retailing industry (Figure 29), and the top 5.5% was identified as boat-building industry high value areas (Figure 30). Both industries seem to thrive in the Auckland region (Figures 31 and 32). Highest values occur in Auckland city, followed by North Shore city, Manukau city and Christchurch city for marine equipment retailing (Figure 31), while Waitakare city, North Shore city, Rodney district and Auckland city are found to have the highest added values in boat building industry (Figure 32).

Figure 15: Overall trend of value added by rock lobster industry at territorial local authority level (Statistics New Zealand data).

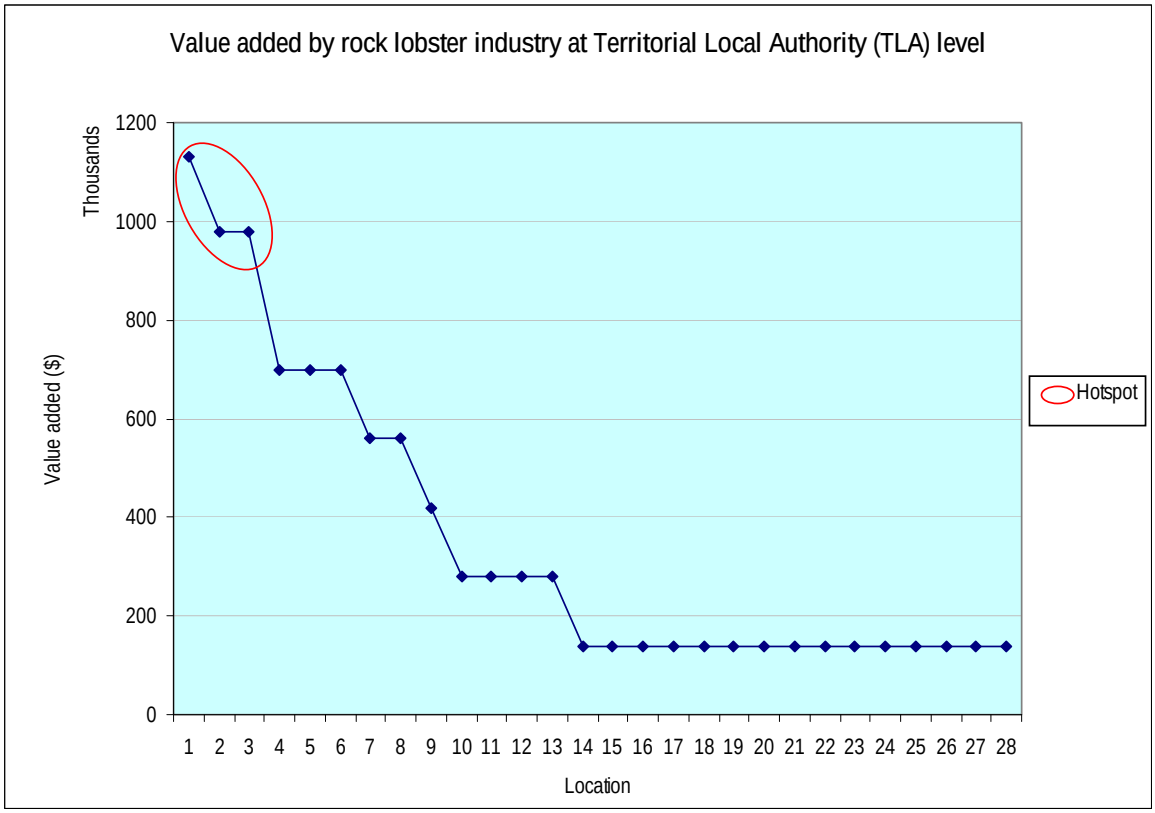


Figure 16: Overall trend of value added by line fishing industry at territorial local authority level (Statistics New Zealand data).

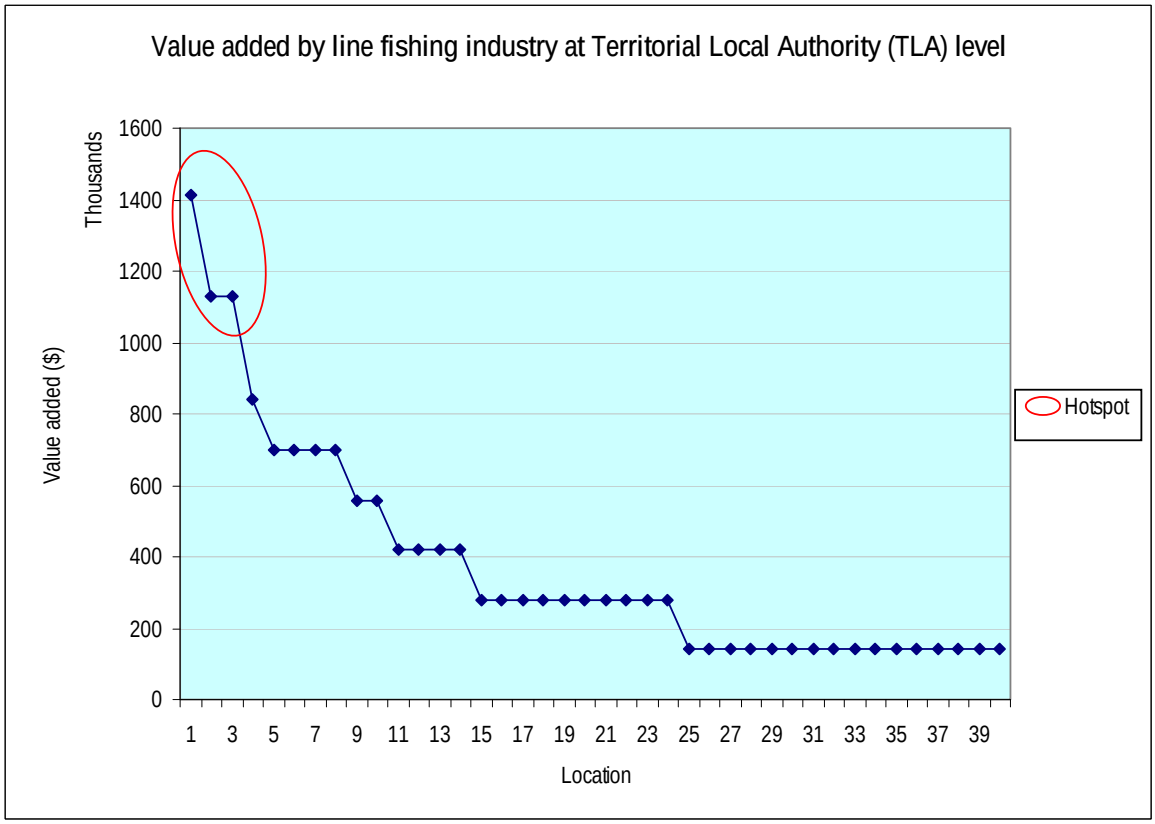


Figure 17: Economic value added by rock lobster industry, based on employment as at 2006 census by territorial local authority (Statistics New Zealand data).

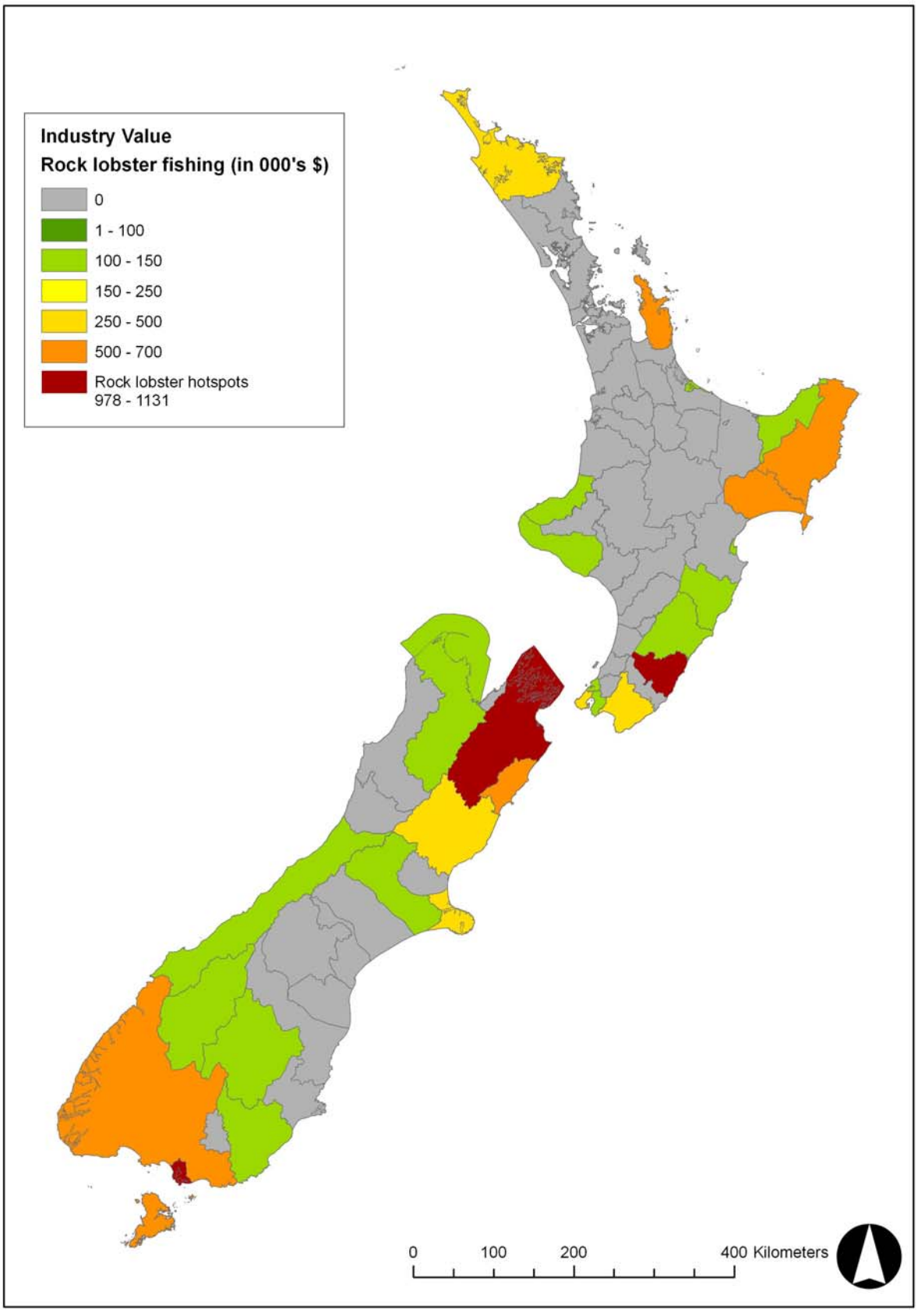


Figure 18: Economic value added by line fishing industry, based on employment as at 2006 census by territorial local authority (Statistics New Zealand data).

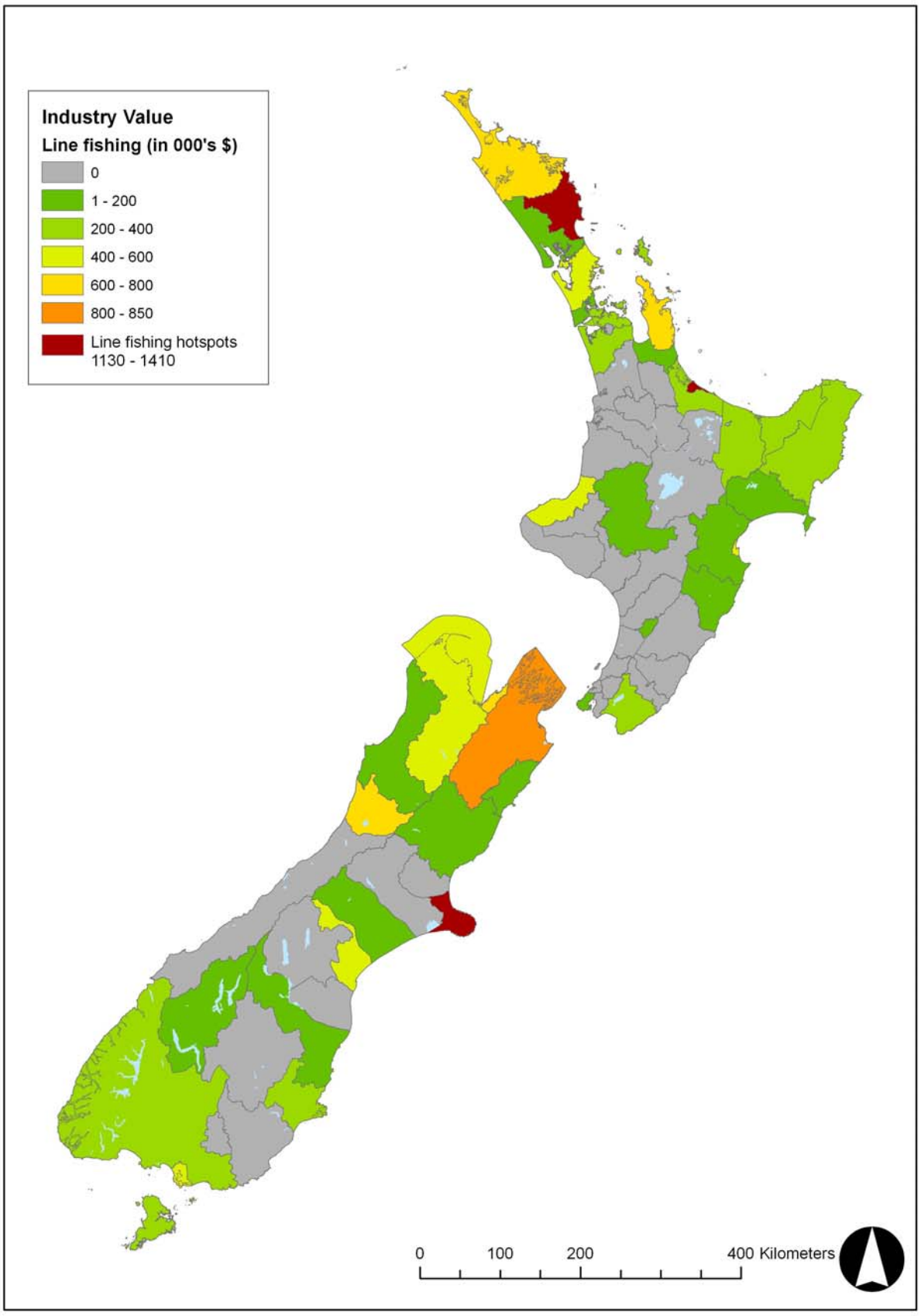


Figure 19: Overall trend of value added by finfish trawling industry at territorial local authority level (Statistics New Zealand data).

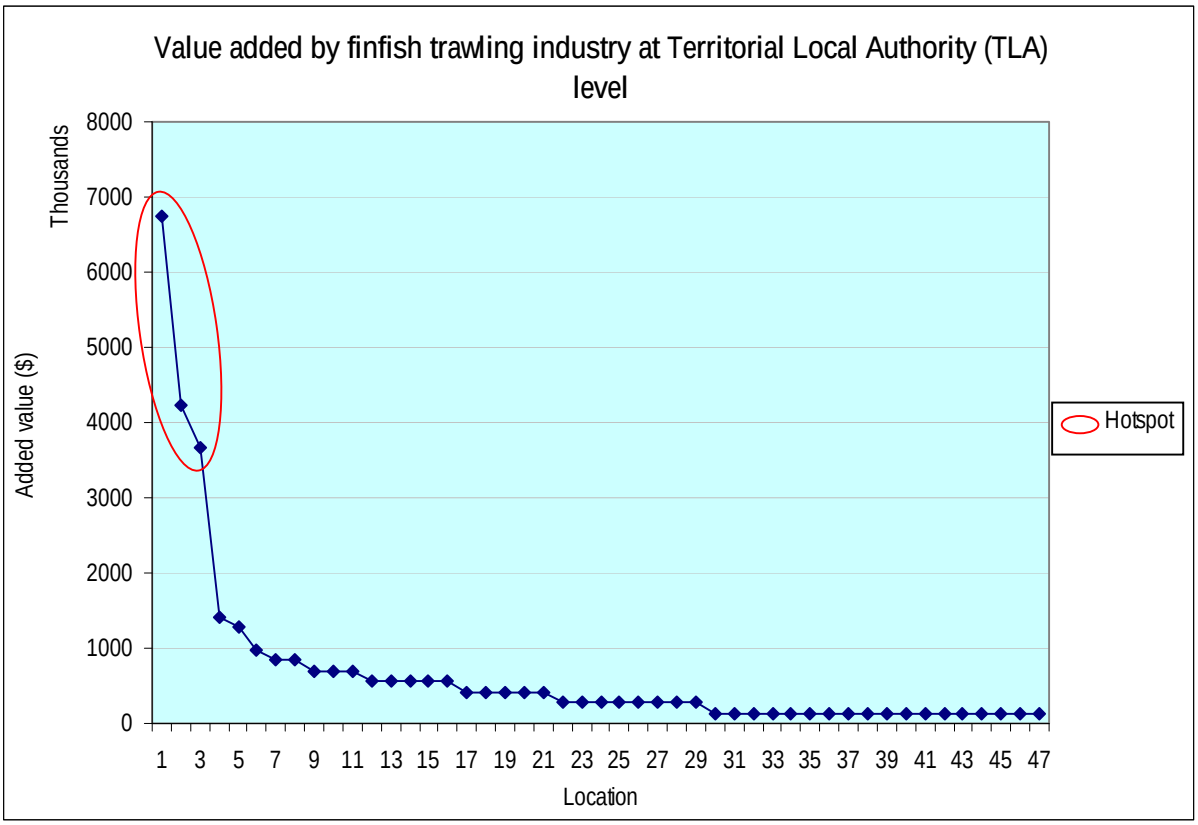


Figure 20: Economic value added by finfish trawling industry, based on employment as at 2006 census by territorial local authority (Statistics New Zealand data).

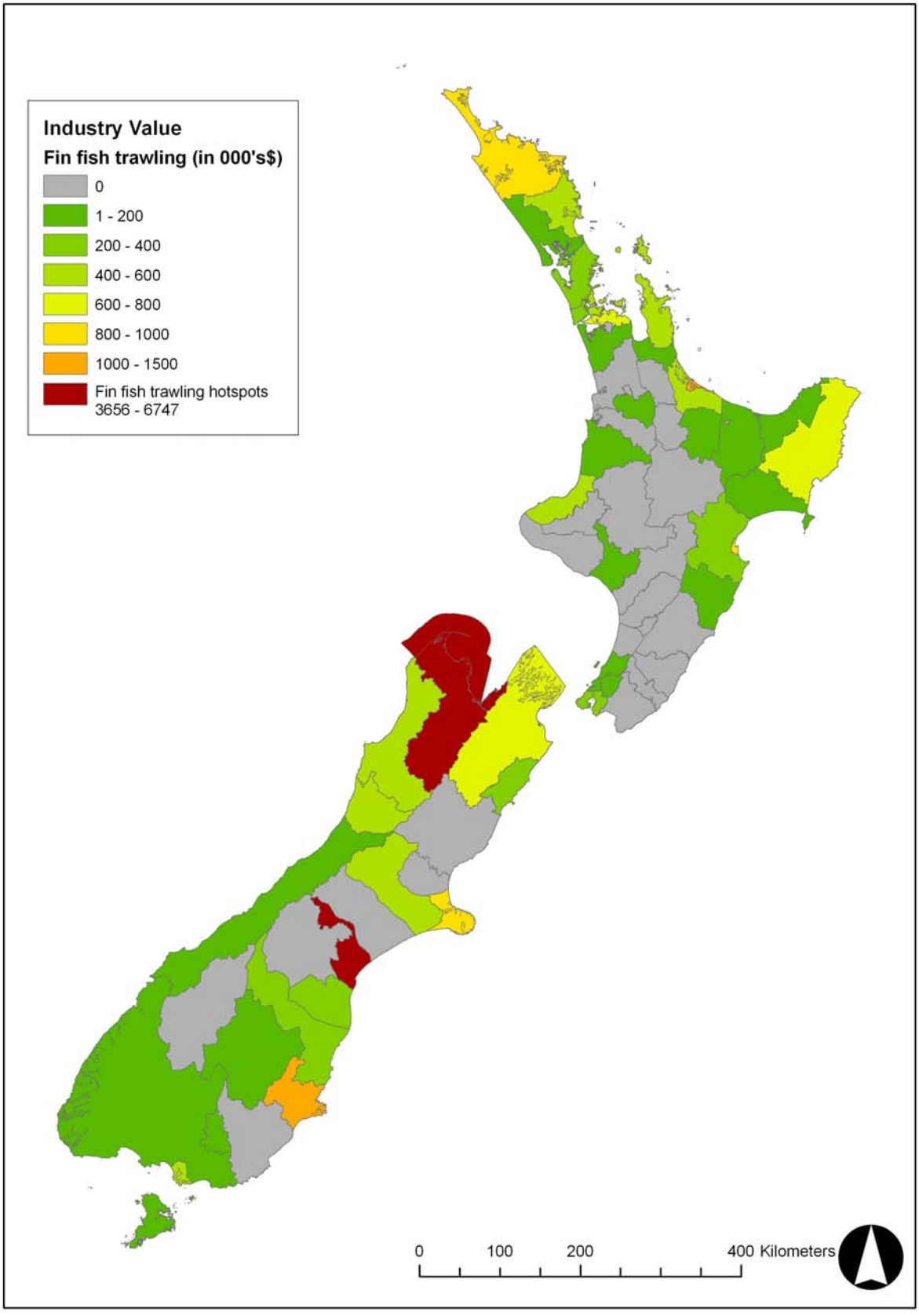


Figure 21: Overall trend of value added by marine fishing NEC (not elsewhere classified) industry at territorial local authority level (Statistics New Zealand data).

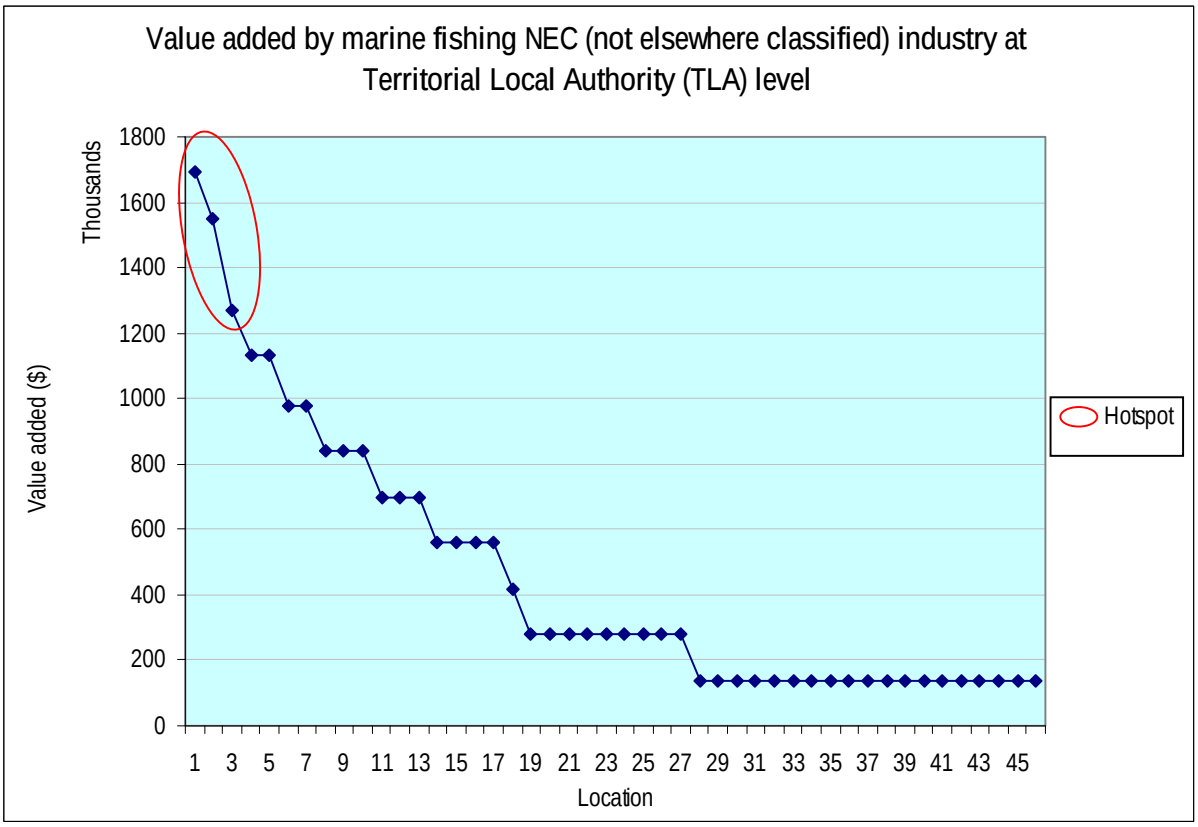


Figure 22: Overall trend of value added by fish wholesale industry at territorial local authority level (Statistics New Zealand data).

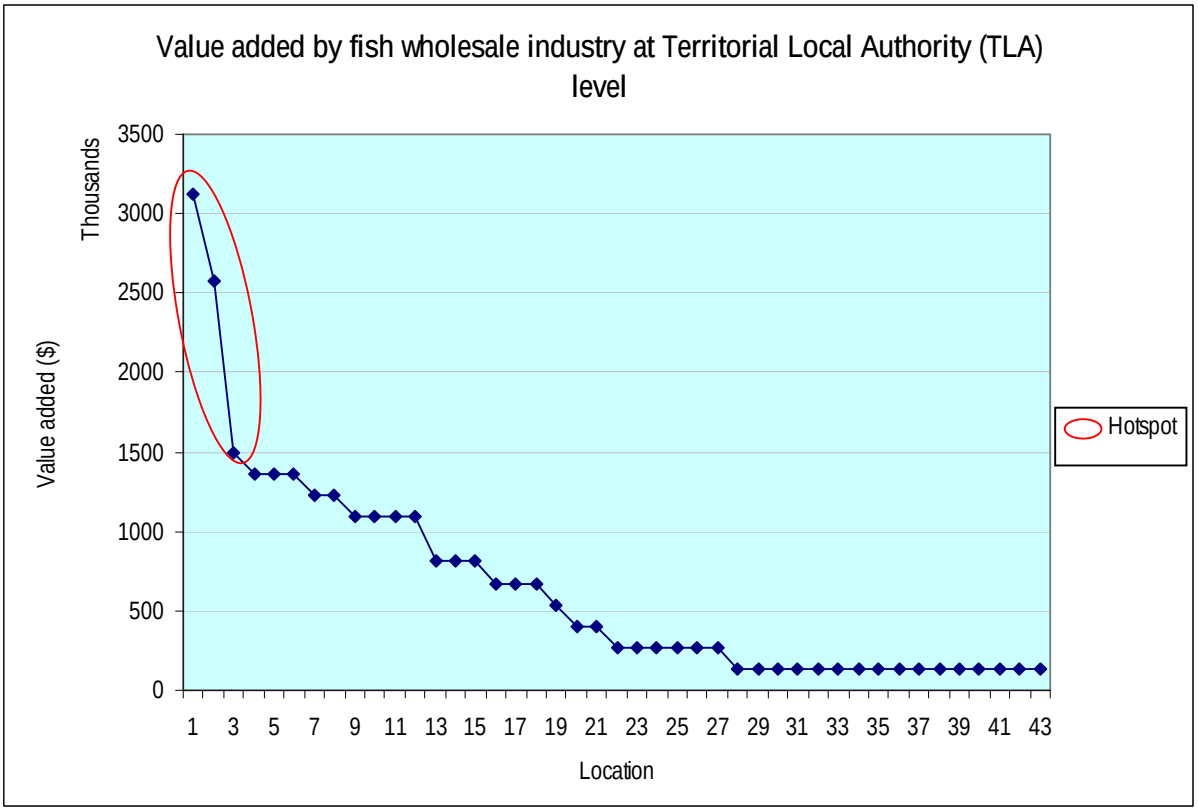


Figure 23: Economic value added by marine fishing NEC (not elsewhere classified) industry, based on employment as at 2006 census by territorial local authority (Statistics New Zealand data).

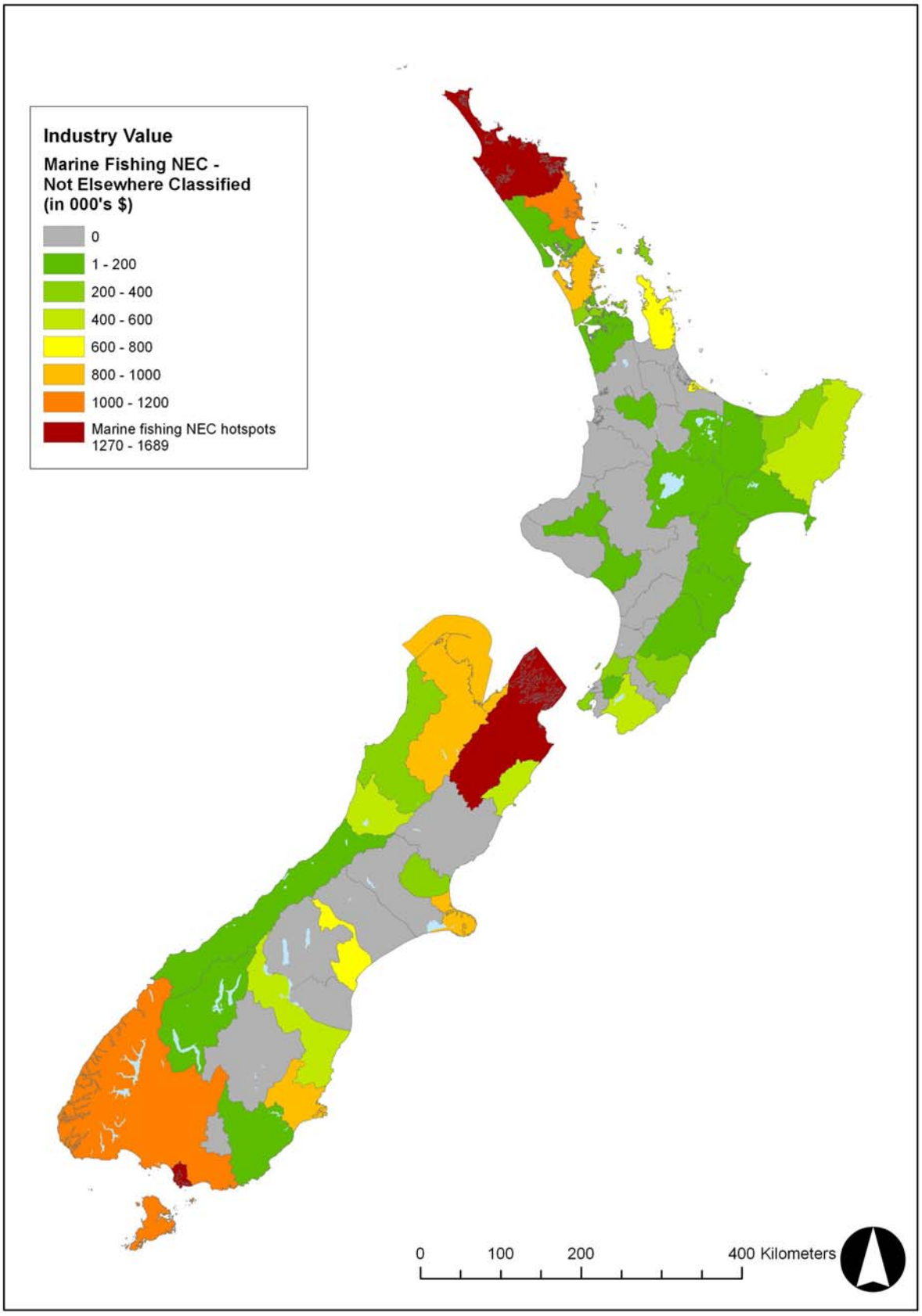


Figure 24: Economic value added by fish wholesale industry, based on employment as at 2006 census by territorial local authority (Statistics New Zealand data).

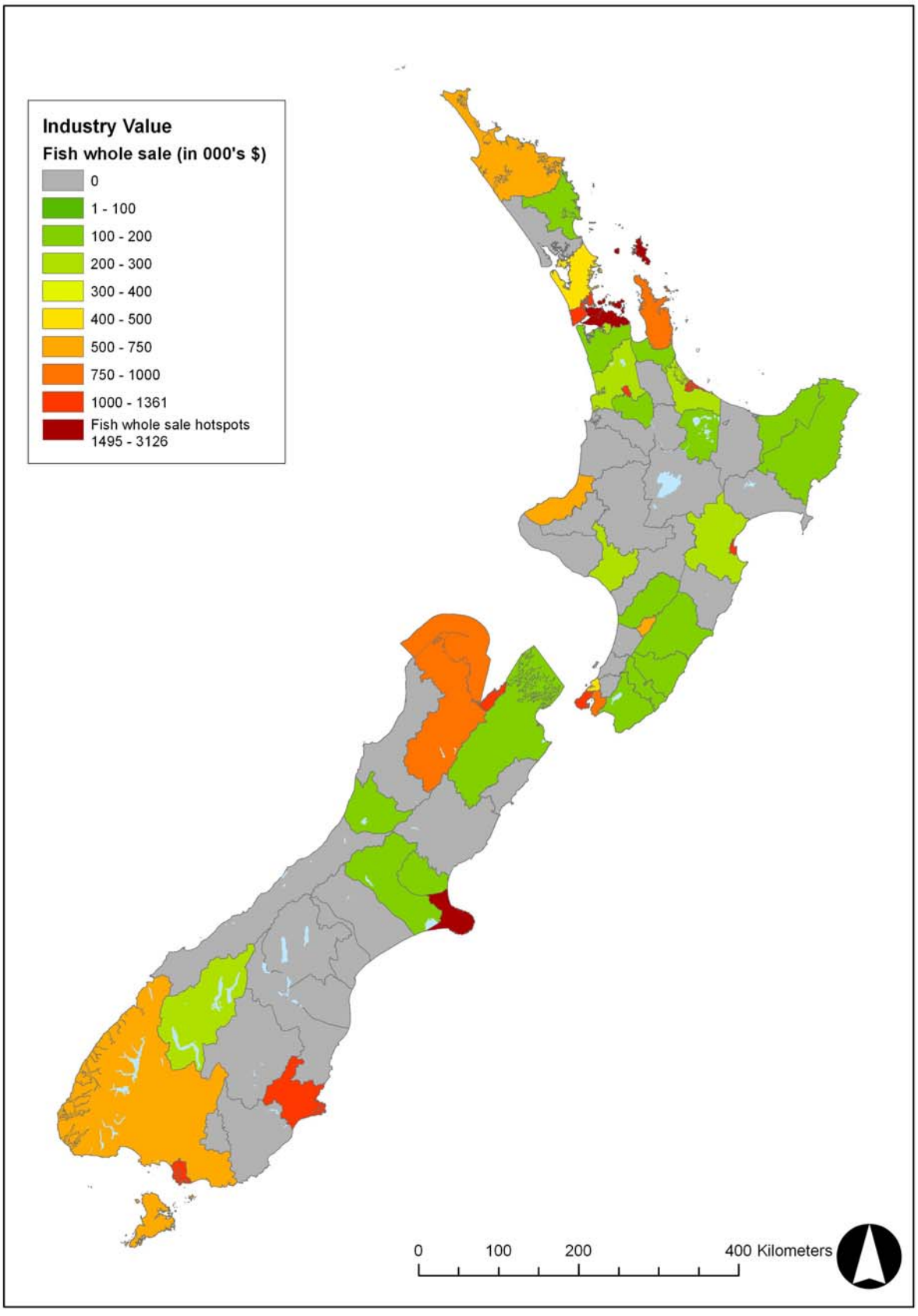


Figure 25: Overall trend of value added by aquaculture industry at territorial local authority level (Statistics New Zealand data).

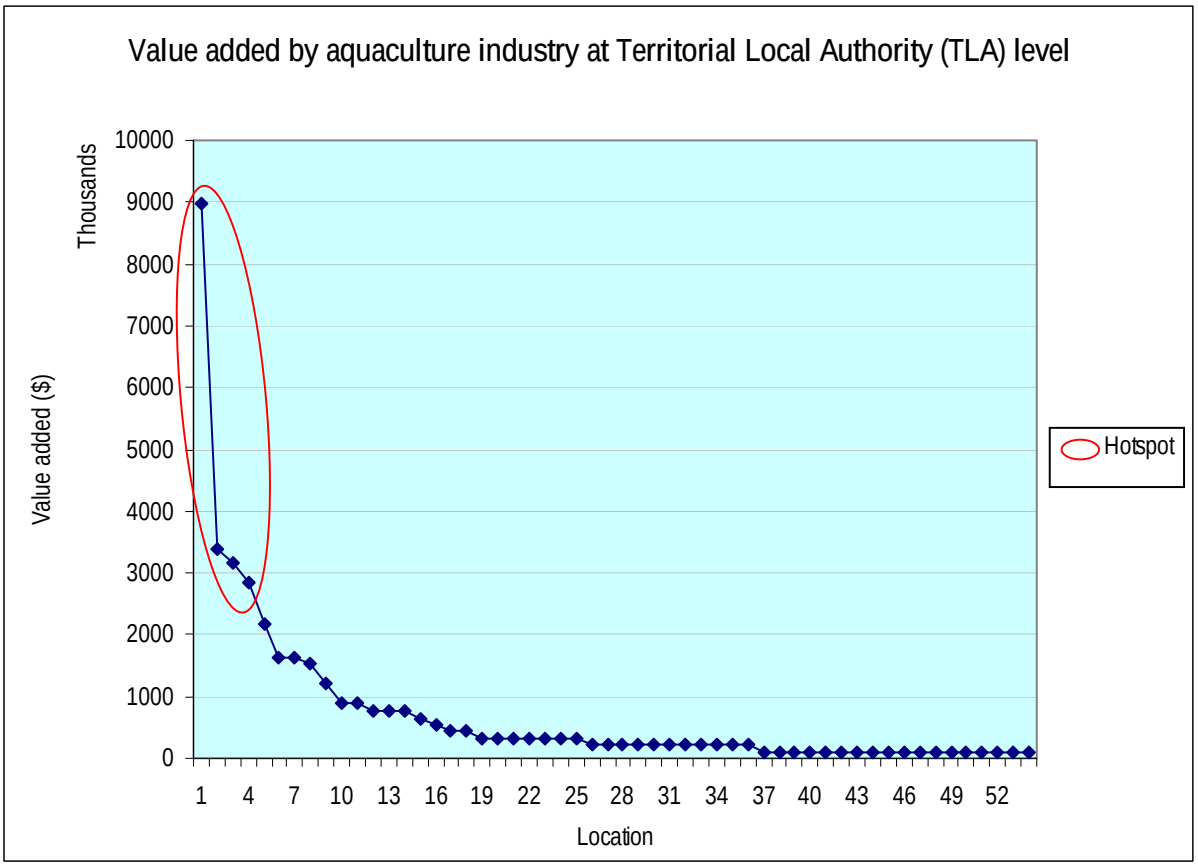


Figure 26: Economic value added by aquaculture industry, based on employment as at 2006 census by territorial local authority (Statistics New Zealand data).

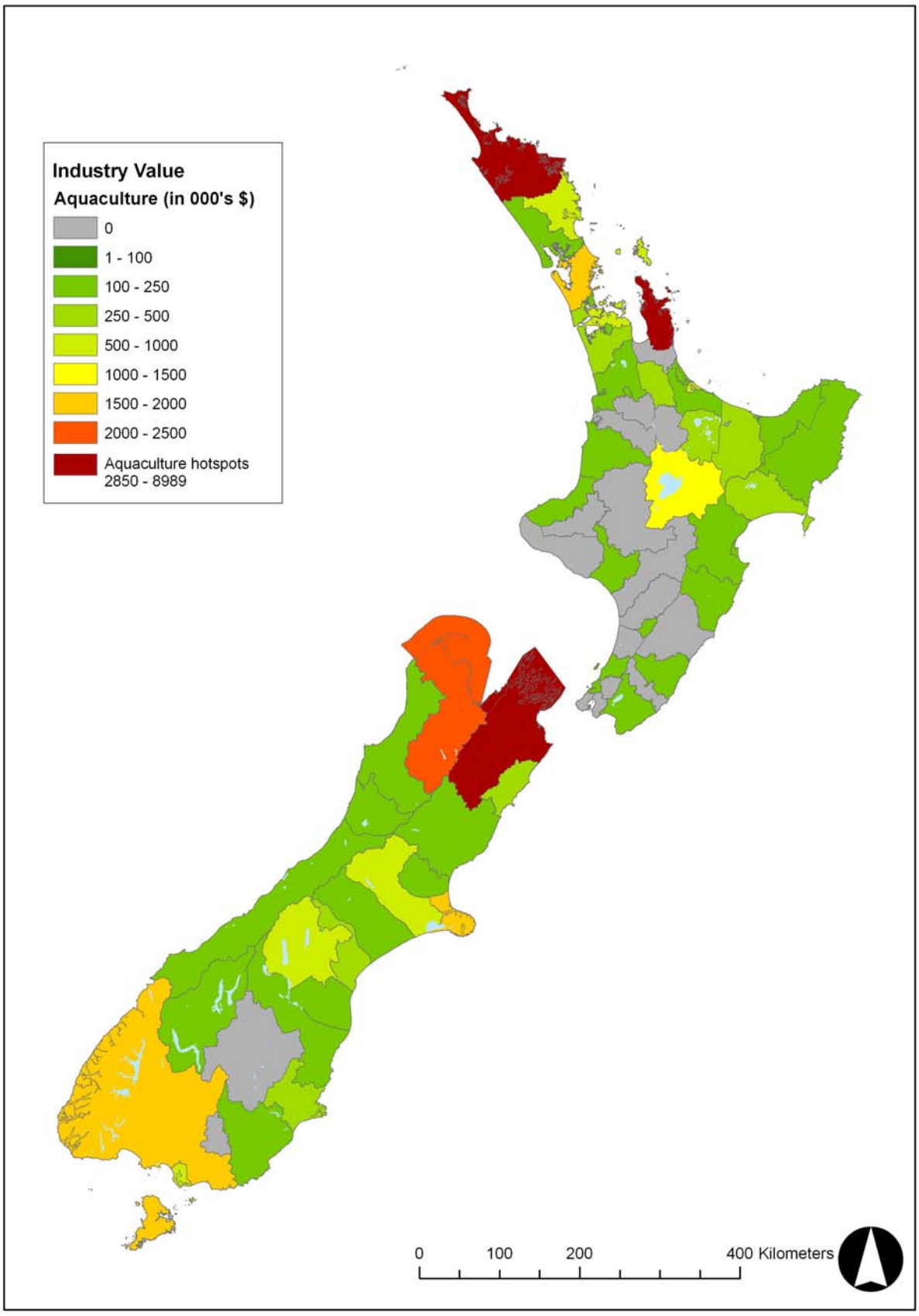


Figure 27: Overall trend of value added by ship building industry at territorial local authority level (Statistics New Zealand data).

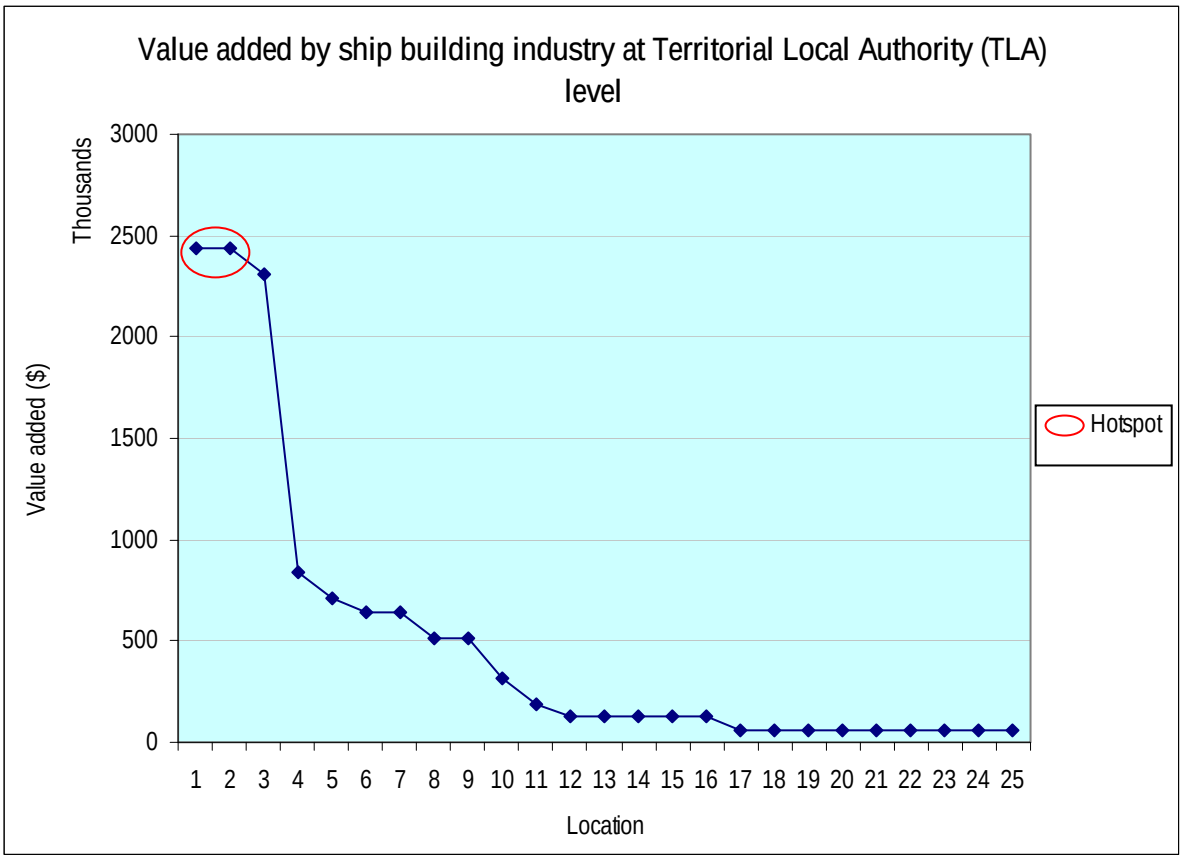


Figure 28: Economic value added by ship building industry, based on employment as at 2006 census by territorial local authority (Statistics New Zealand data).

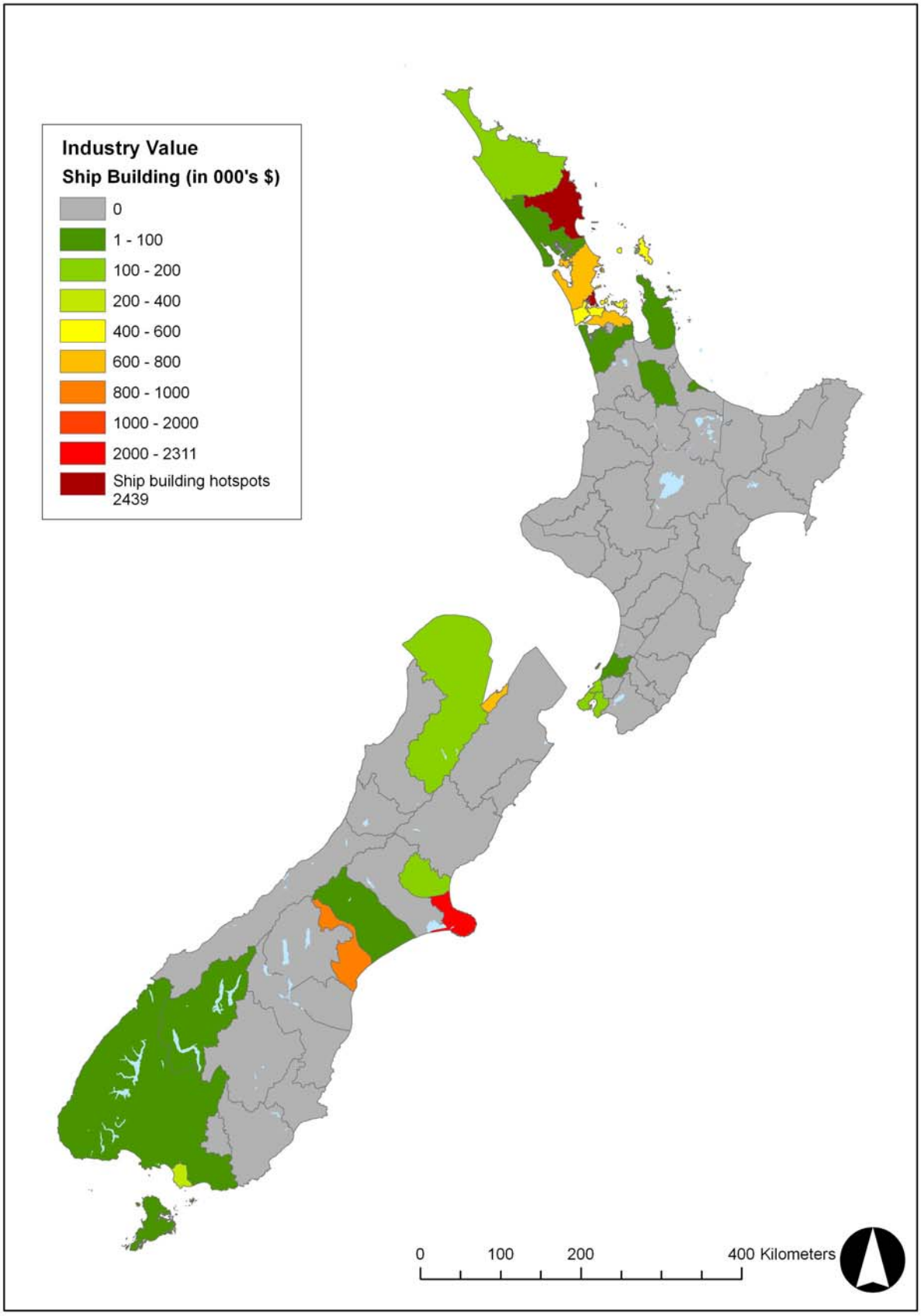


Figure 29: Overall trend of value added by marine equipment retailing industry at territorial local authority level (Statistics New Zealand data).

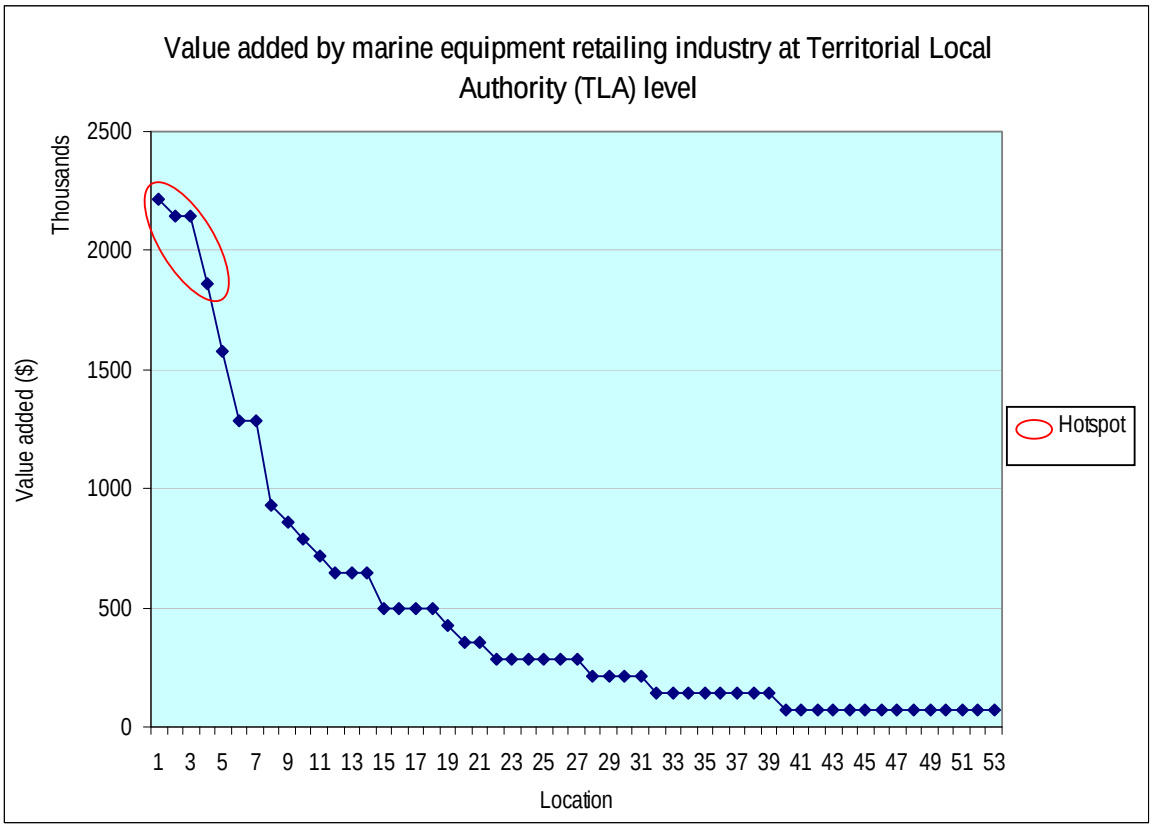


Figure 30: Overall trend of value added by boat building industry at territorial local authority level (Statistics New Zealand data).

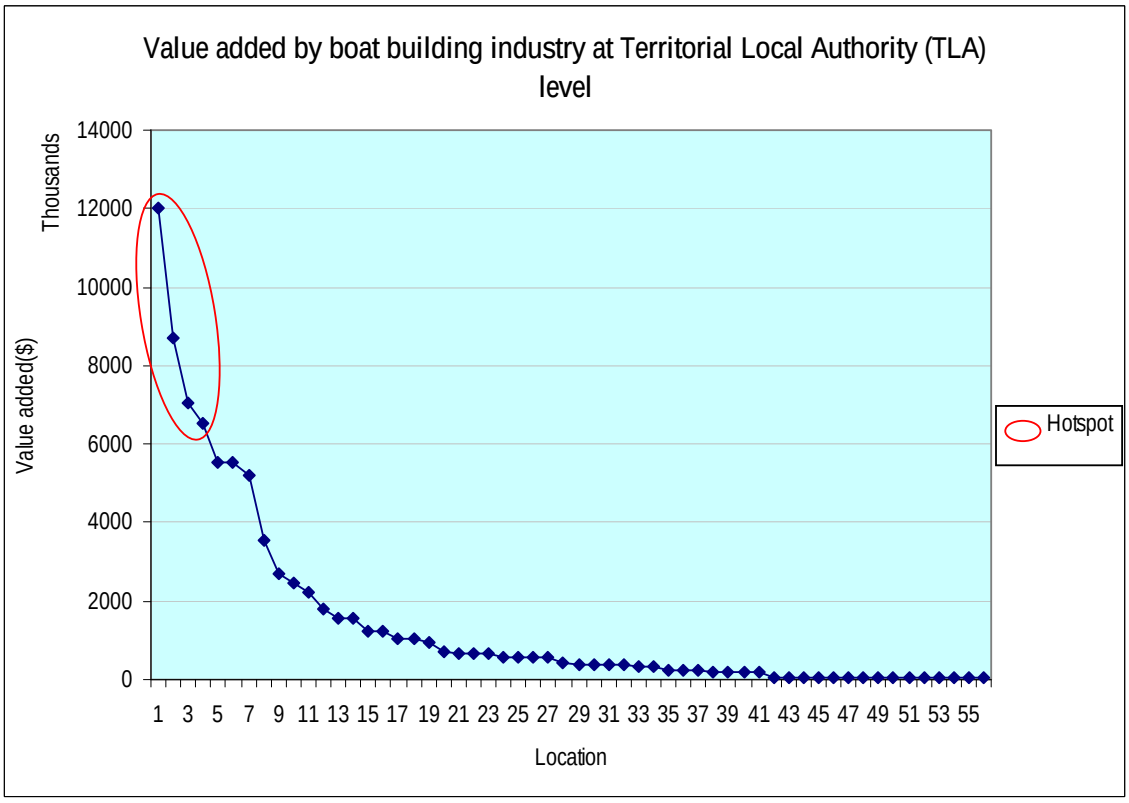


Figure 31: Economic value added by marine equipment retailing industry, based on employment as at 2006 census by territorial local authority (Statistics New Zealand data).

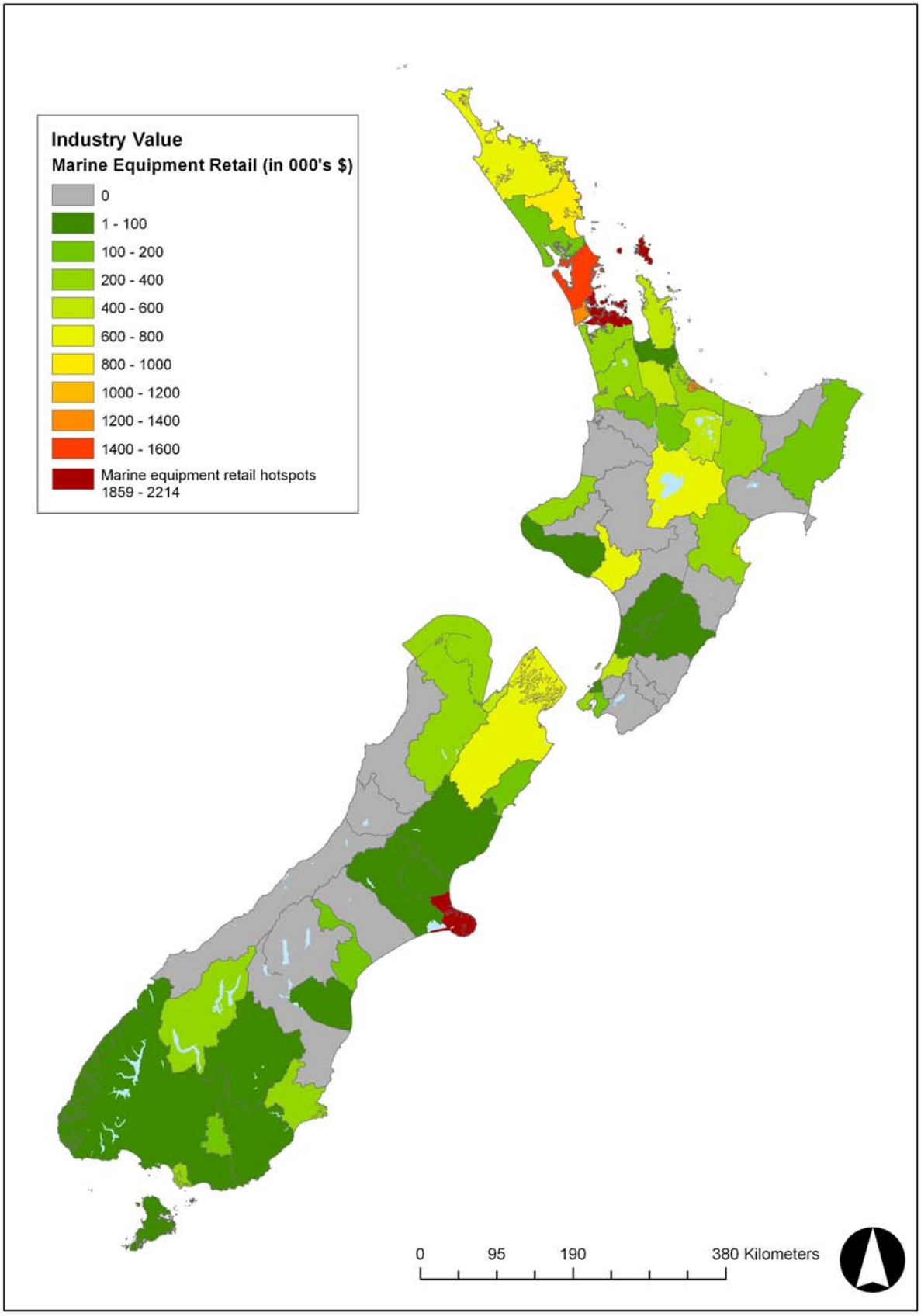
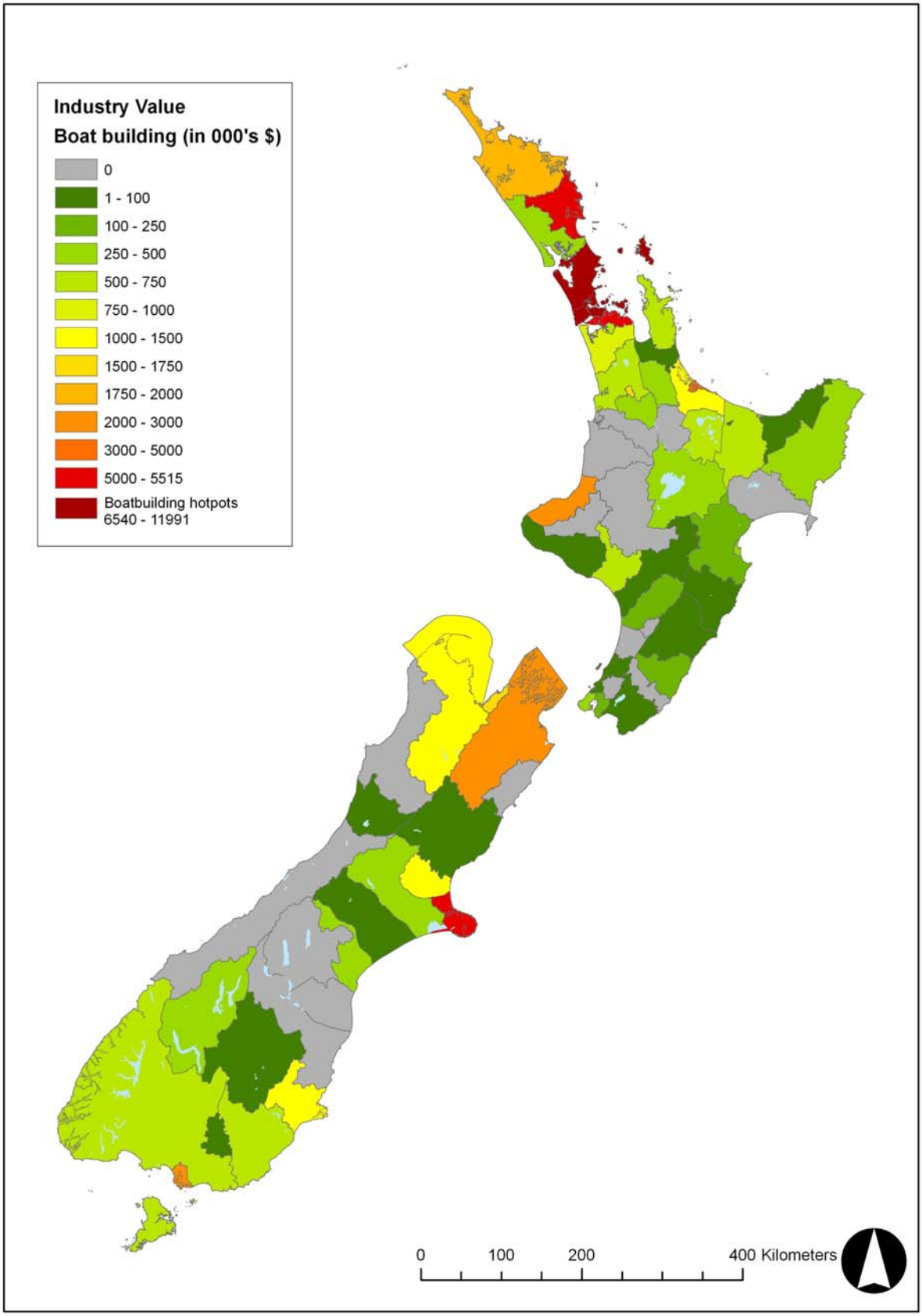


Figure 32: Economic value added by boat building industry, based on employment as at 2006 census by territorial local authority (Statistics New Zealand data).



Added value for coastal industry groups at area unit scale were derived from employment data at SNZ area unit level.

The top 3.9% of all values were identified as the hotspots for marine fishing industry, where one area unit shows distinctly higher value compared with the rest of the hotspot areas (Figure 33). Aquaculture industry data demonstrates a similar trend (Figure 34). The top 5.7% of the values were defined as high value areas where two area units display significantly higher values. The spatial distribution of marine fishing data reveals the geographical location of the hotspots (Figure 35). The highest industry added values for marine fishing occur in Bluff, Cape Rodney, Thames-Coromandel, Mahia, Marlborough Sounds Terrestrial, Golden Bay and, Kaikoura among other areas. Aquaculture high value areas are shown in North Cape, Thames-Coromandel, Marlborough Sounds Terrestrial, Golden Bay and, Stewart Island area units (Figure 36).

The overall pattern in oil and gas extraction industry data outlines three area units with significantly higher values than the remaining area units and, the high value areas were defined as the top 3.6% of all values (Figure 37). Oil and gas exploration industry grouping includes petroleum and mineral exploration industries. For the value added by exploration industry the top 3.5% of all values were selected as hotspots (Figure 38). The selected hotspots demonstrate noticeably higher values than the remaining values. Oil and gas extraction and exploration industry high value areas are both concentrated around the Taranaki region (Figures 39 and 40). Extraction industry high value areas are found in the Struan Park, Oakura and, Fitzroy area units, while the exploration hotspots are found in Waitara East, Bell Block, Fitzroy, Spotswood and Waihi area units.

Added value by construction material mining industry shows a similar pattern in the overall trend for, to oil and gas exploration industry (Figure 41). This industry grouping includes gravel and sand mining and, construction material mining (not elsewhere classified) industries. For this attribute, high values were represented by the top 4.6% of all values. The highest values are mainly located in the North Island, clustered in area units around the Northland and, Hawke's Bay regions, Kaipara, and Hauraki districts, and Wahikehe Island (Figure 42).

Figure 33: Overall trend of value added by marine fishing industry at area unit level (Statistics New Zealand data).

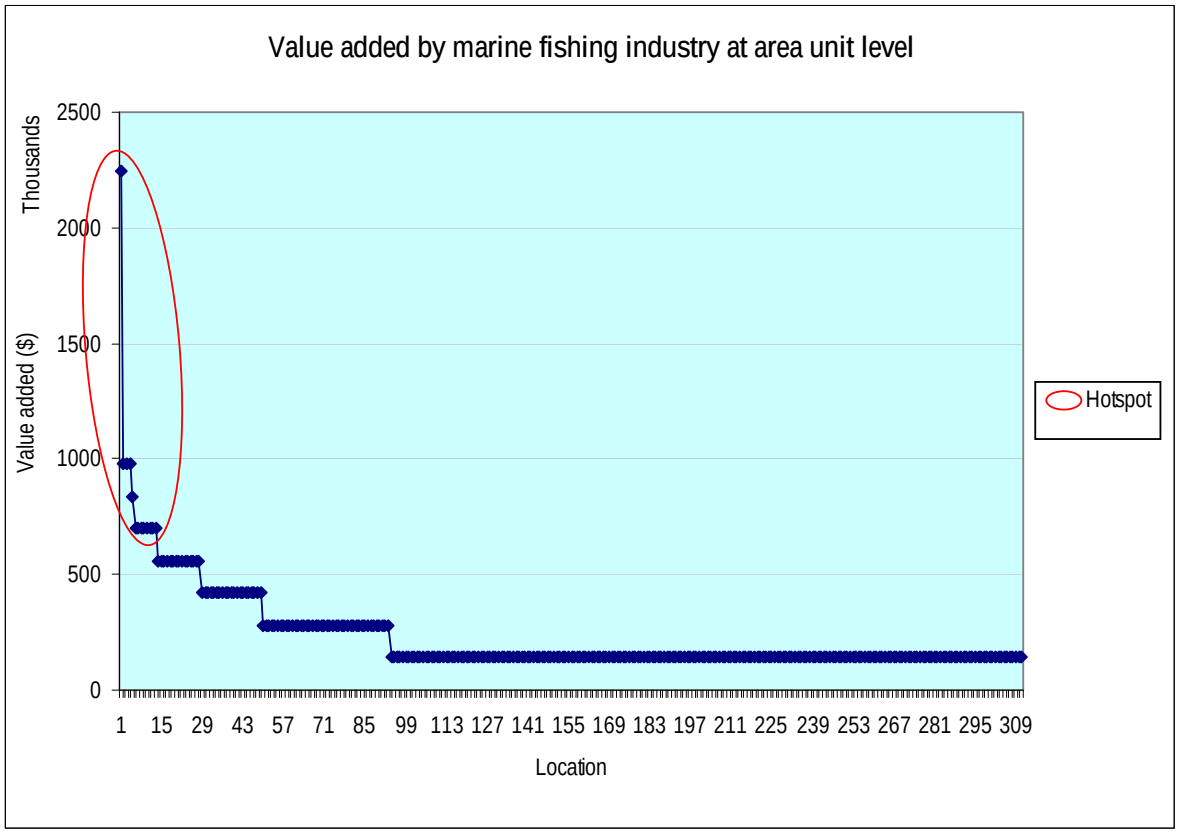


Figure 34: Overall trend of value added by aquaculture industry at area unit level (Statistics New Zealand data).

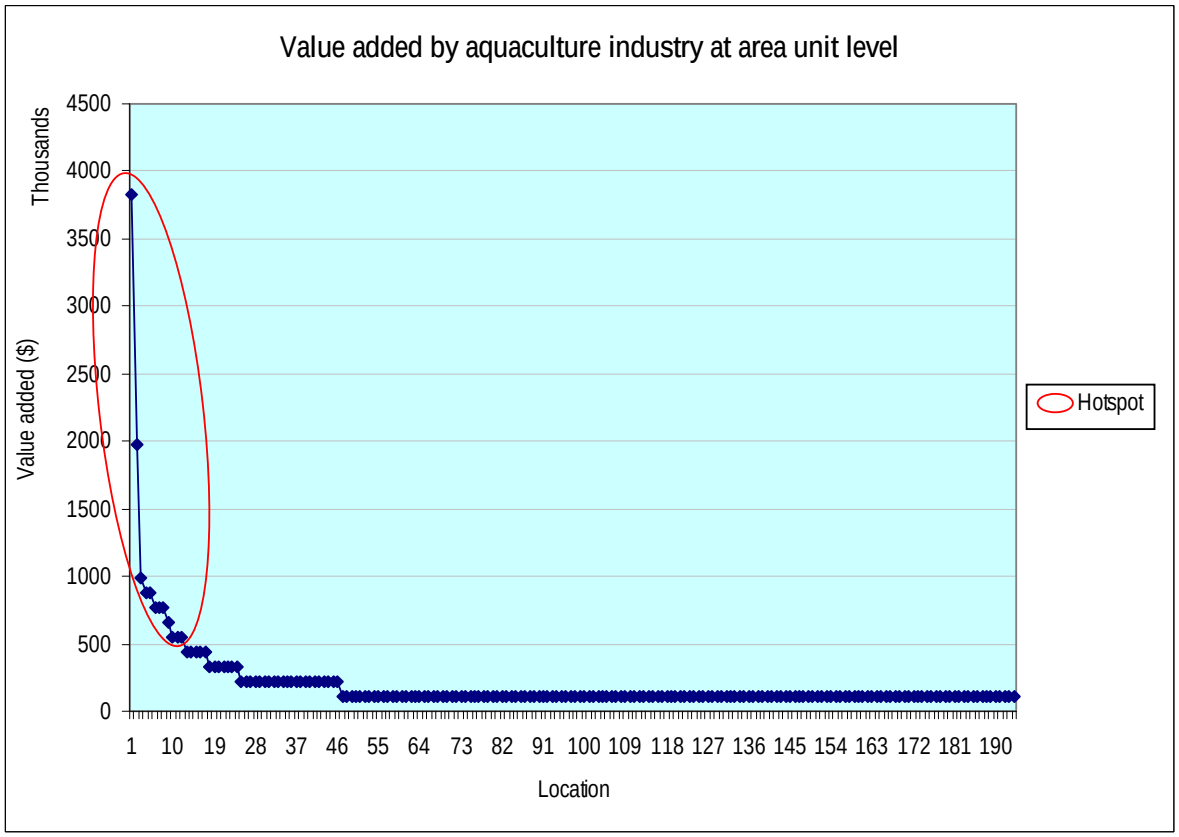


Figure 35: Economic value added by marine fishing industry, based on employment as at 2006 census by area unit level (Statistics New Zealand data).

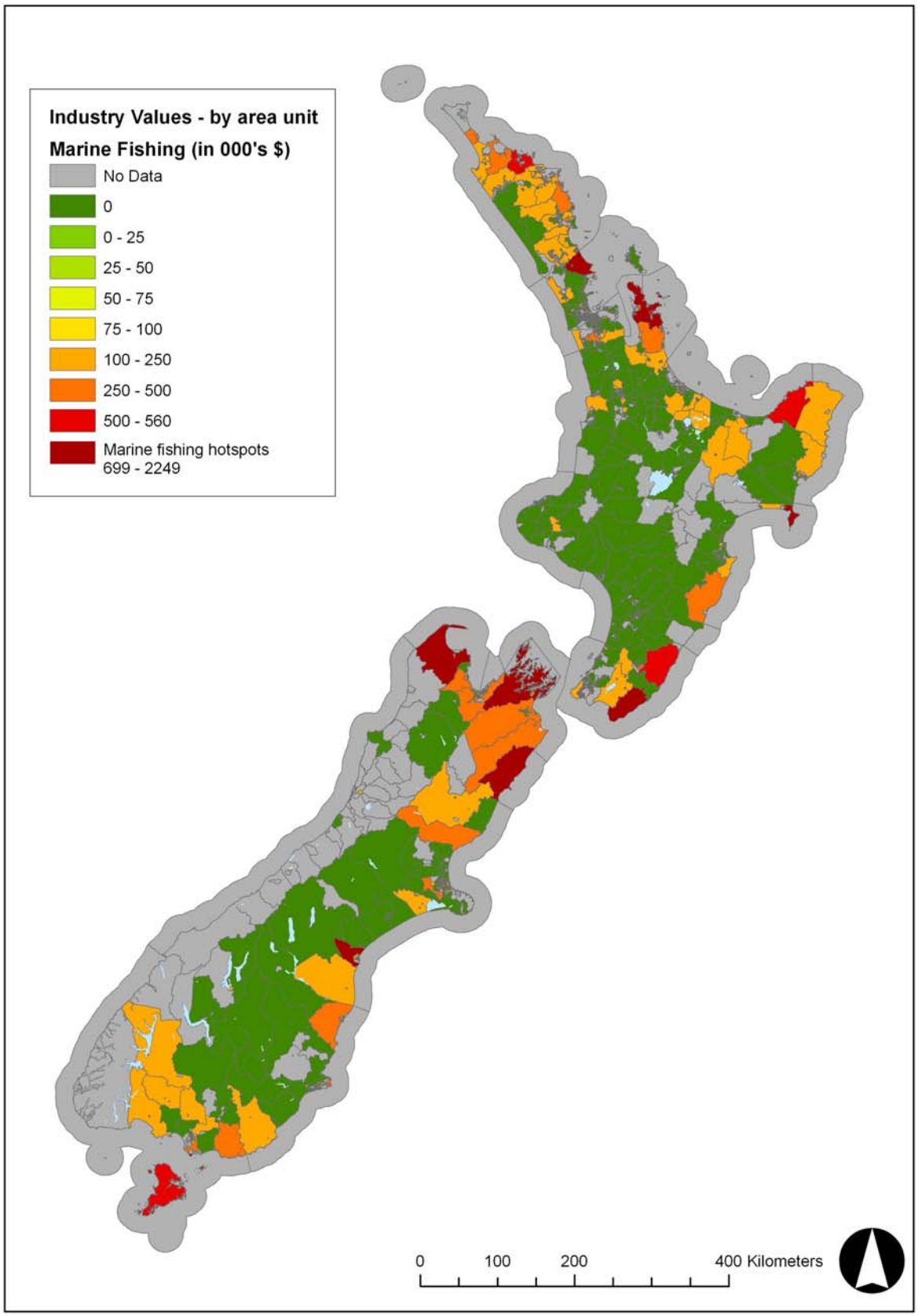


Figure 36: Economic value added by aquaculture industry, based on employment as at 2006 census by area unit level (Statistics New Zealand data).

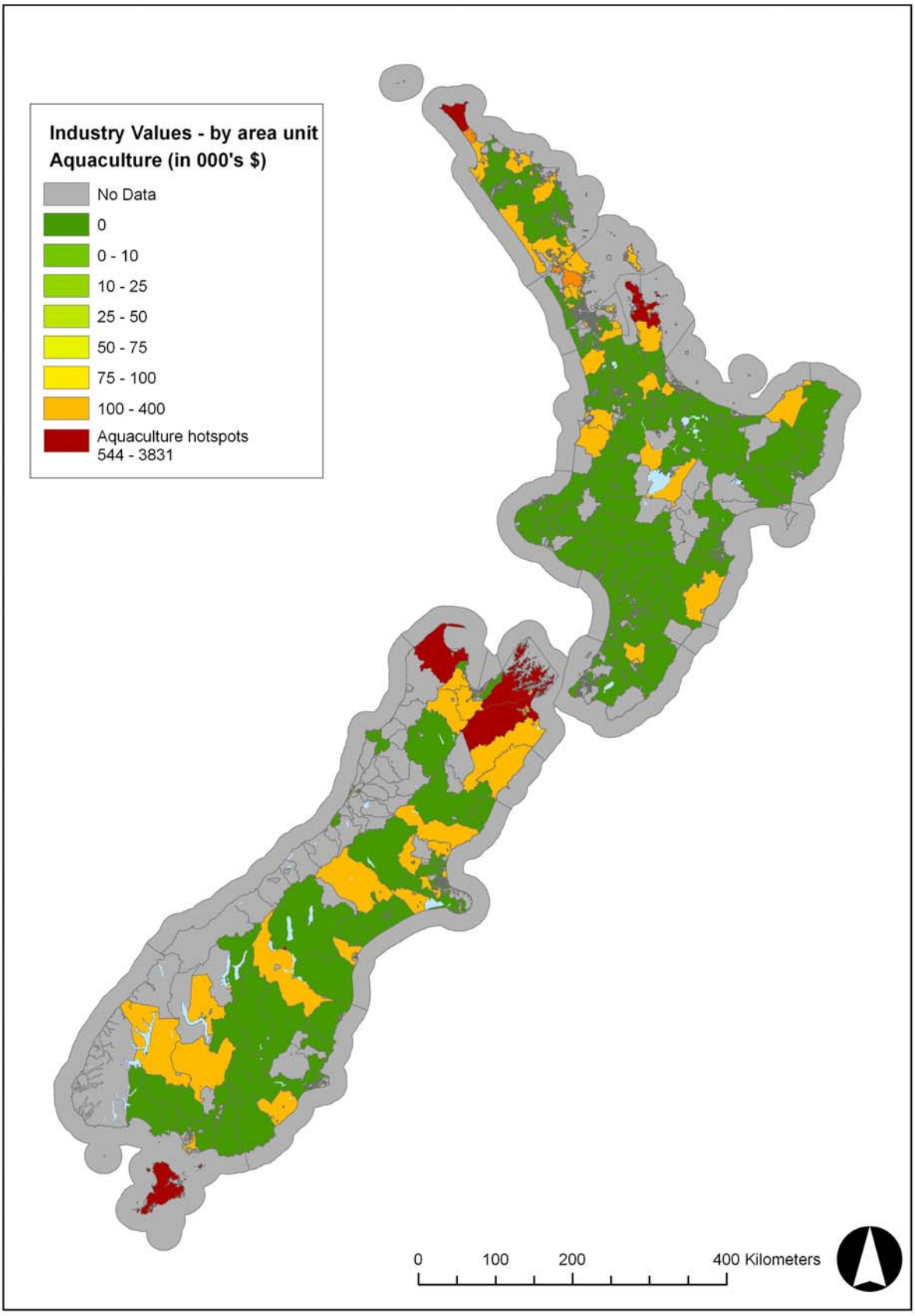


Figure 37: Overall trend of value added by oil and gas extraction industry at area unit level (Statistics New Zealand data).

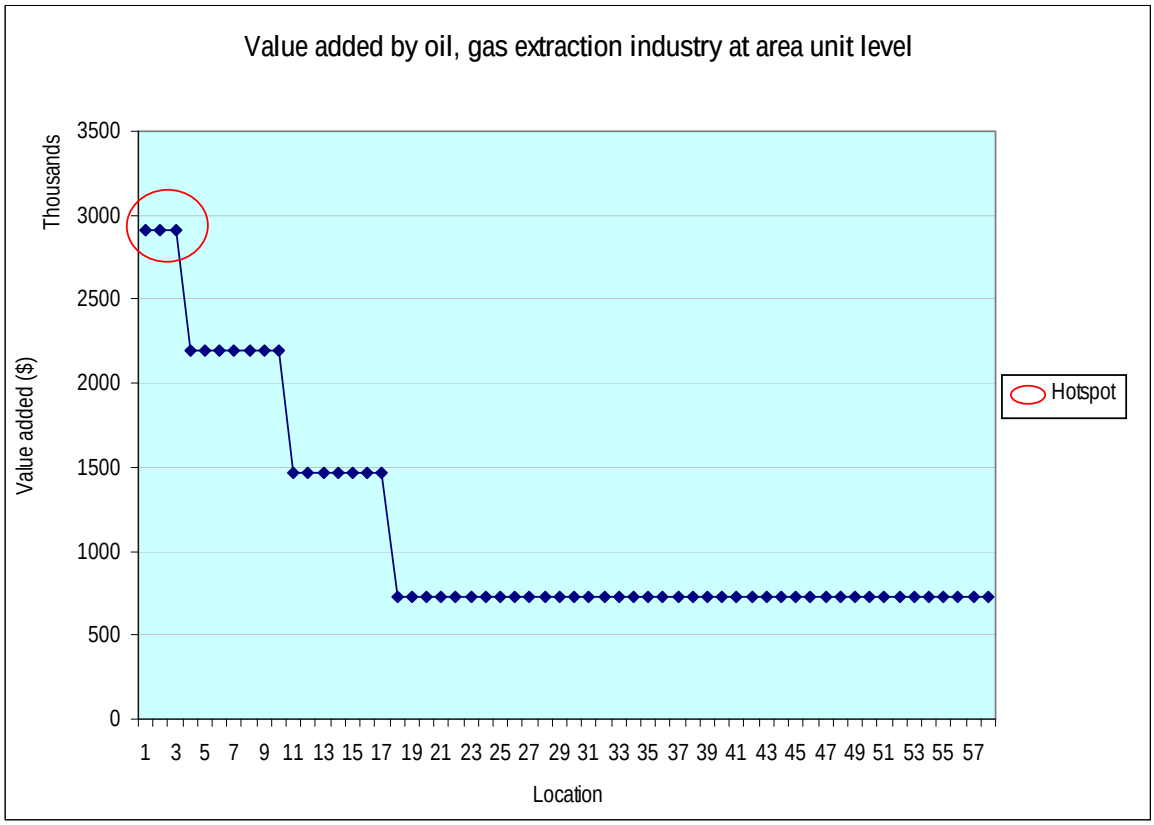


Figure 38: Overall trend of value added by oil and gas exploration industry at area unit level (Statistics New Zealand data).

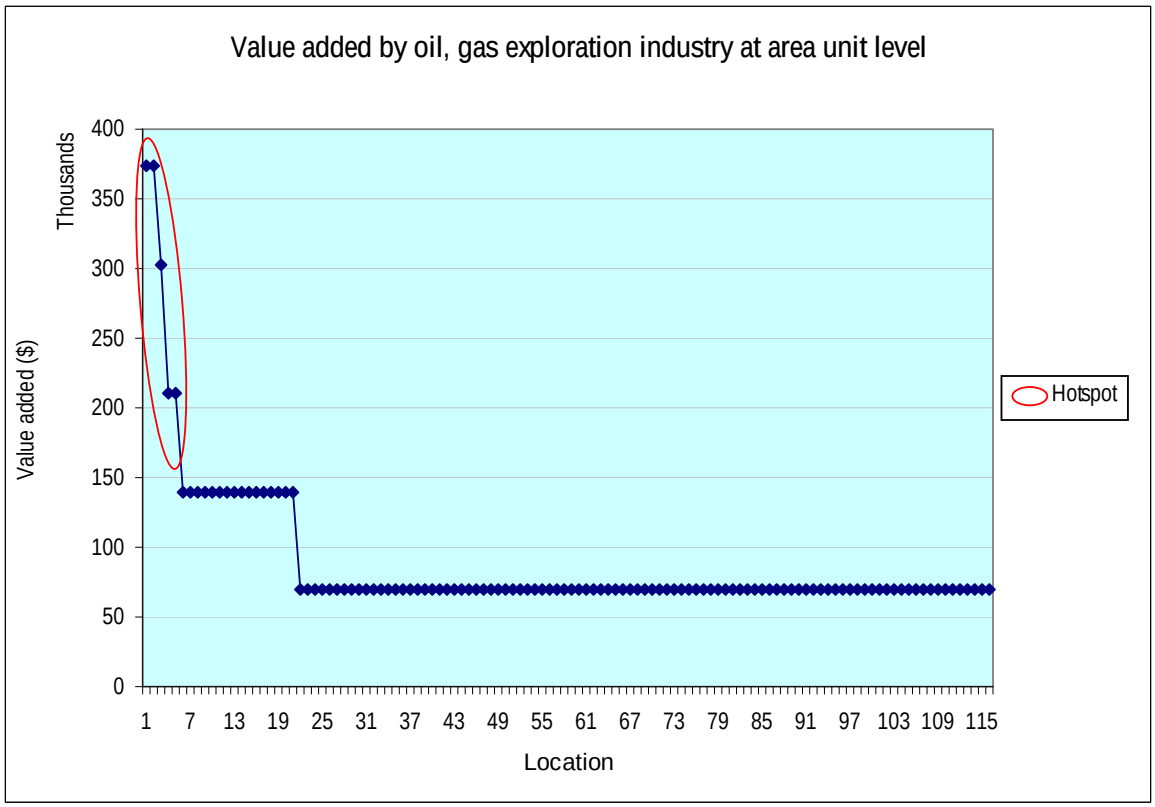


Figure 39: Economic value added by oil and gas extraction industry, based on employment as at 2006 census by area unit level (Statistics New Zealand data).

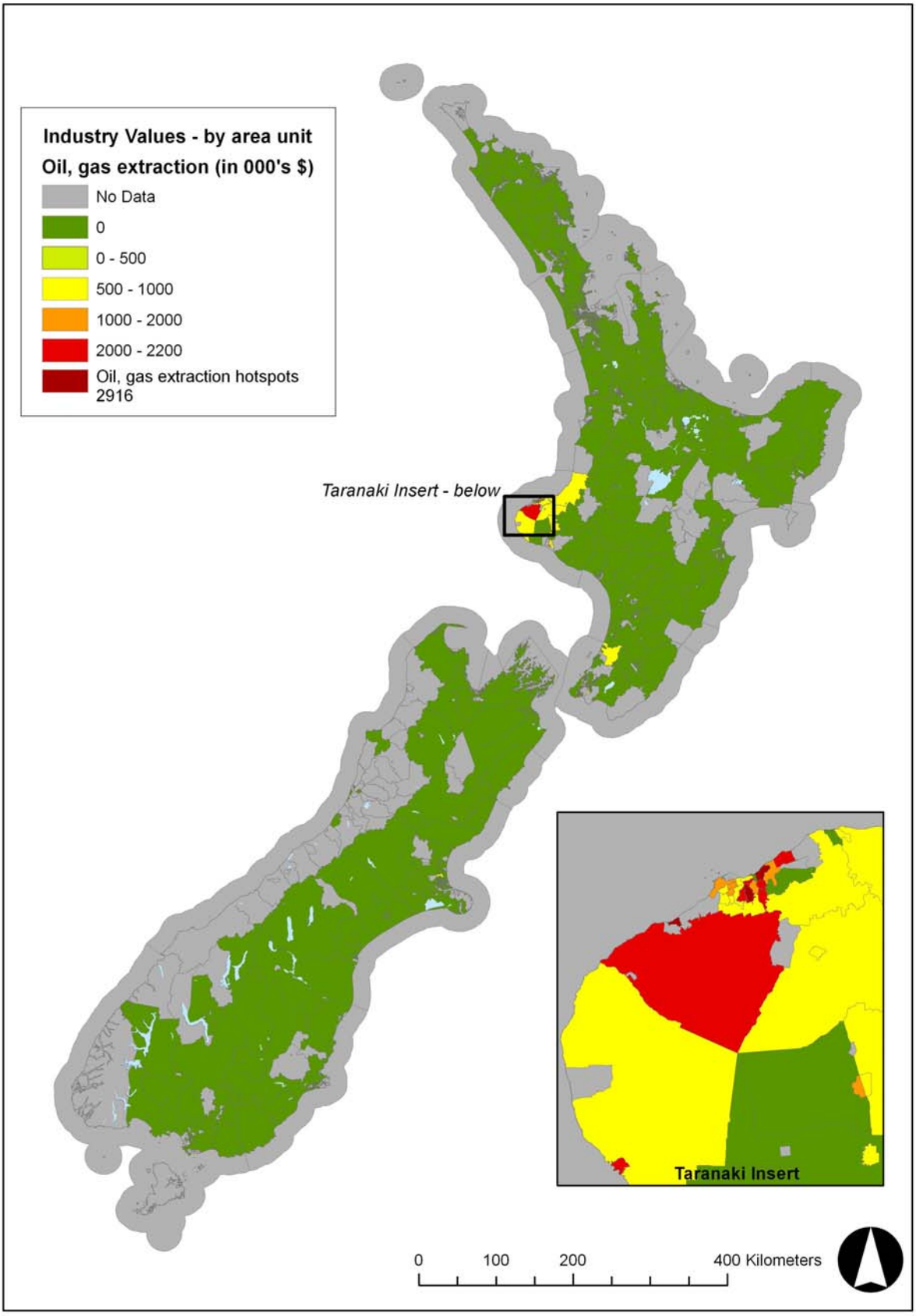


Figure 40: Economic value added by oil and gas exploration industry, based on employment as at 2006 census by area unit level (Statistics New Zealand data).

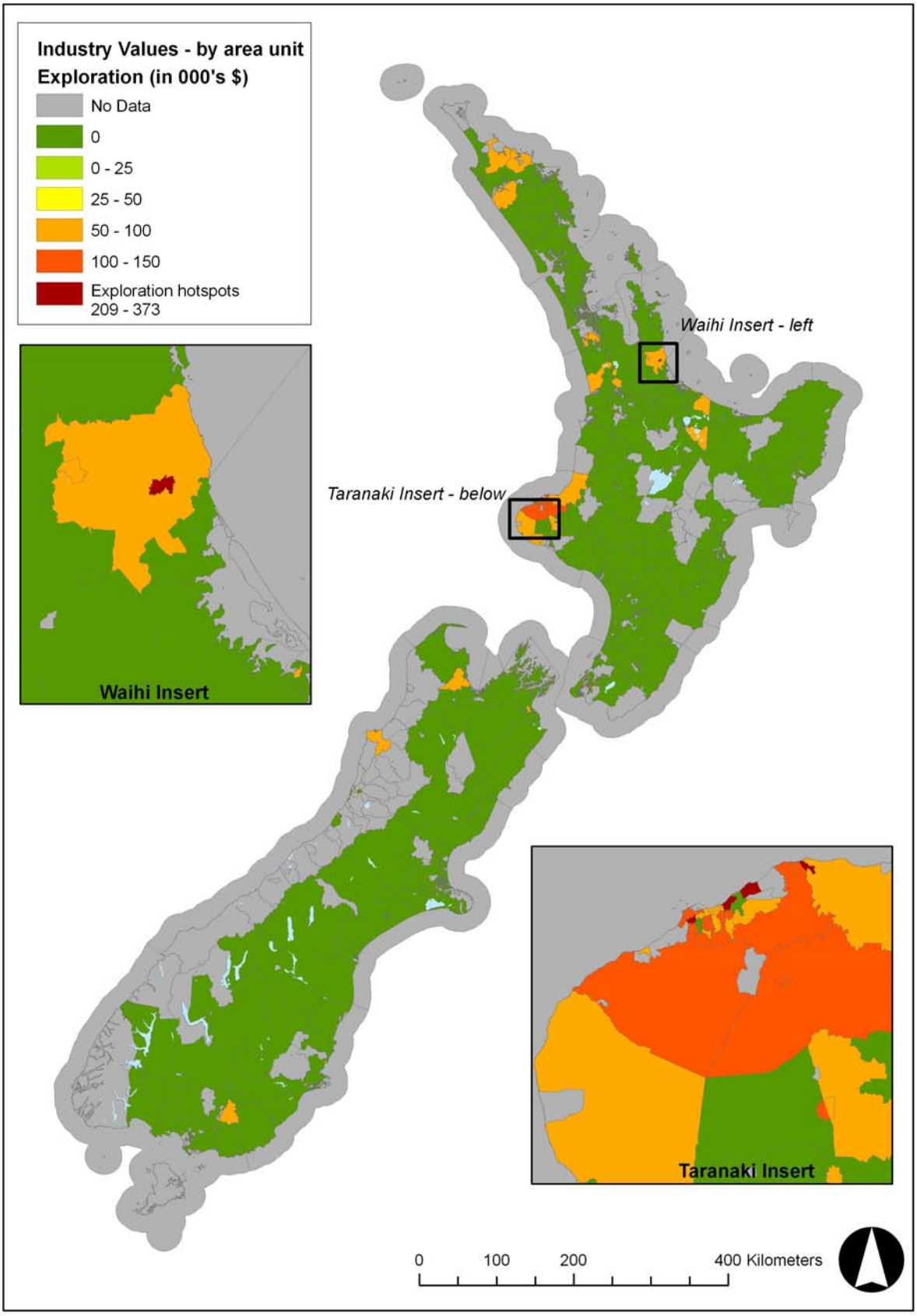


Figure 41: Overall trend of value added by construction material mining industry at area unit level (Statistics New Zealand data).

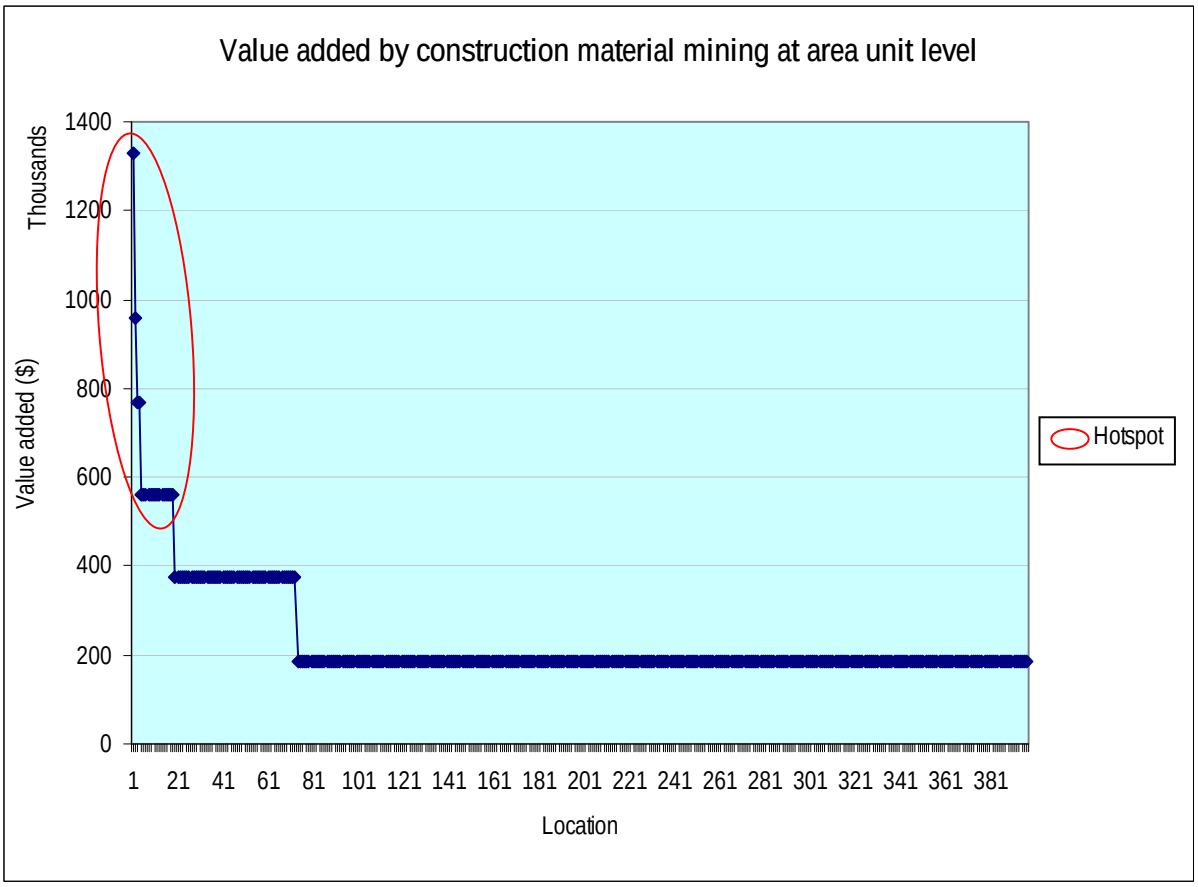
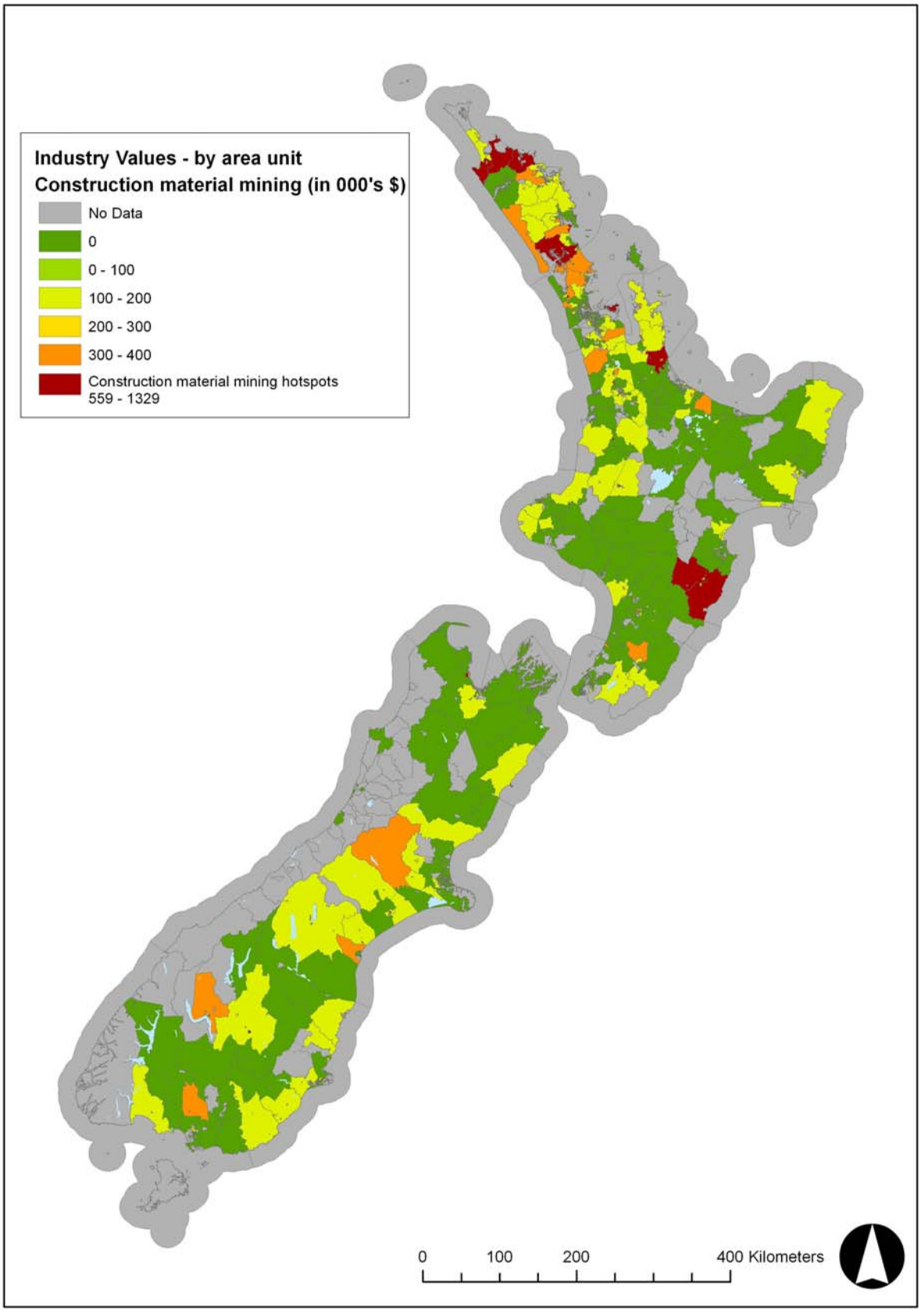


Figure 42: Economic value added by construction material mining industry, based on employment as at 2006 census by area unit level (Statistics New Zealand data).



Added value hotspots were identified as the top 5% of all values for cafes and restaurants industry while, the top 4.1% of all values were identified as the pub, taverns and bars industry hotspots (Figures 43 and 44). The areas where the highest values are clustered represent highly populated areas, and tourist destinations (Figures 45 and 46).

Accommodation industry hotspots were defined as the top 5.1% of the values and, clubs (hospitality) industry hotspots were the top 2.6% of all values (Figures 47 and 48). Accommodation industry hotspots are clustered around regions that are popular for tourism, with the highest value occurring in Queenstown (Figure 49). Spatial distribution of the added value for clubs industry illustrates a lack of data, and the hotspots are scattered around the country (Figure 50).

The water transport industry grouping consists of international sea transport, coastal water transport, and inland water transport. For this attribute, hotspots were defined as the top 4.7% of all values (Figure 51), and the spatial distribution reveals hotspots concentrated around Waiheke Island, Marlborough Sounds, Milford Sounds and Stewart Island, with the highest values occurring in the Te Anau, Picton and Milford area units (Figure 52). The hotspots represent locations where tourism involves a significant marine transport component.

Value added by services to water transport industry follows a similar pattern, in which the top two values are noticeably larger than the remaining values (Figure 53). This grouping comprises stevedoring, water transport terminals, port operations and other services. The top 5.2% of the values were selected as the high value areas, and occur in area units mainly clustered around Tauranga, followed by the Taranaki, New Plymouth, Napier, Christchurch, Bluff, Nelson and Picton regions (Figure 54).

Figure 43: Overall trend of value added by cafes and restaurants industry at area unit level (Statistics New Zealand data).

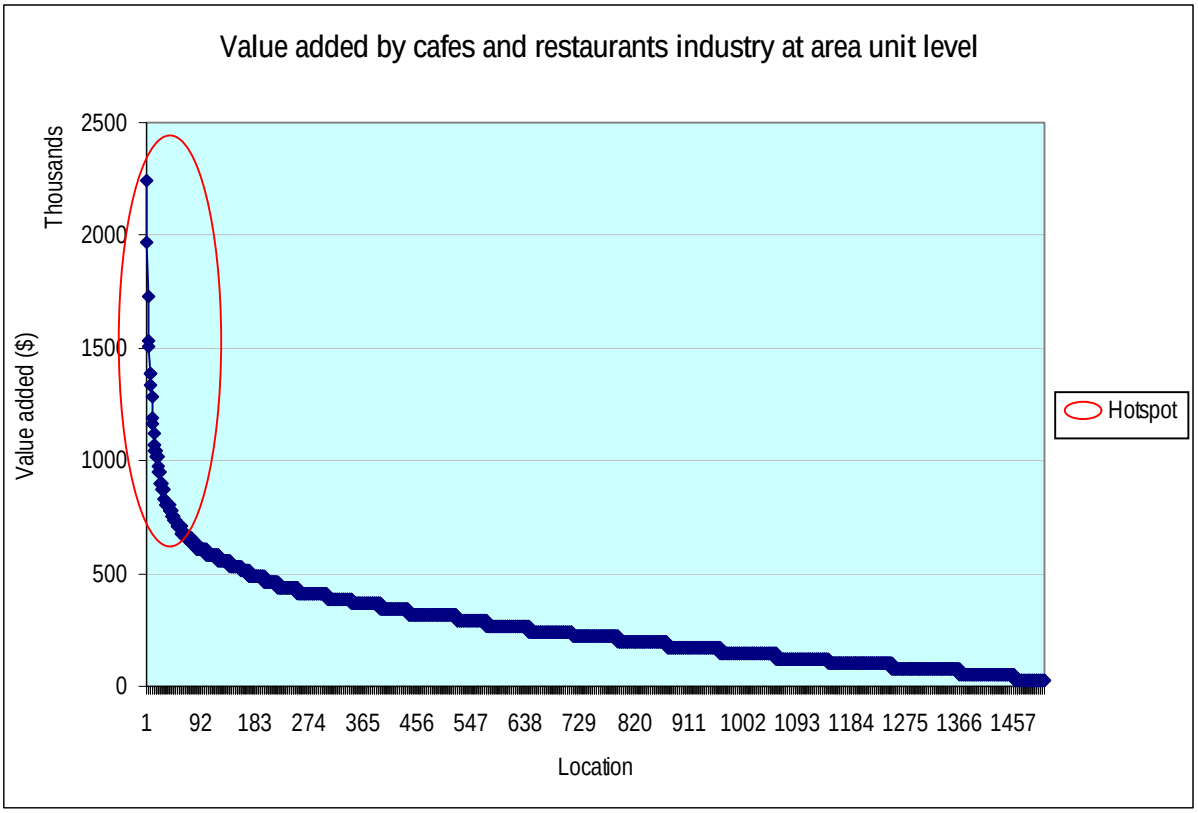


Figure 44: Overall trend of value added by pubs, taverns and, bars industry at area unit level (Statistics New Zealand data).

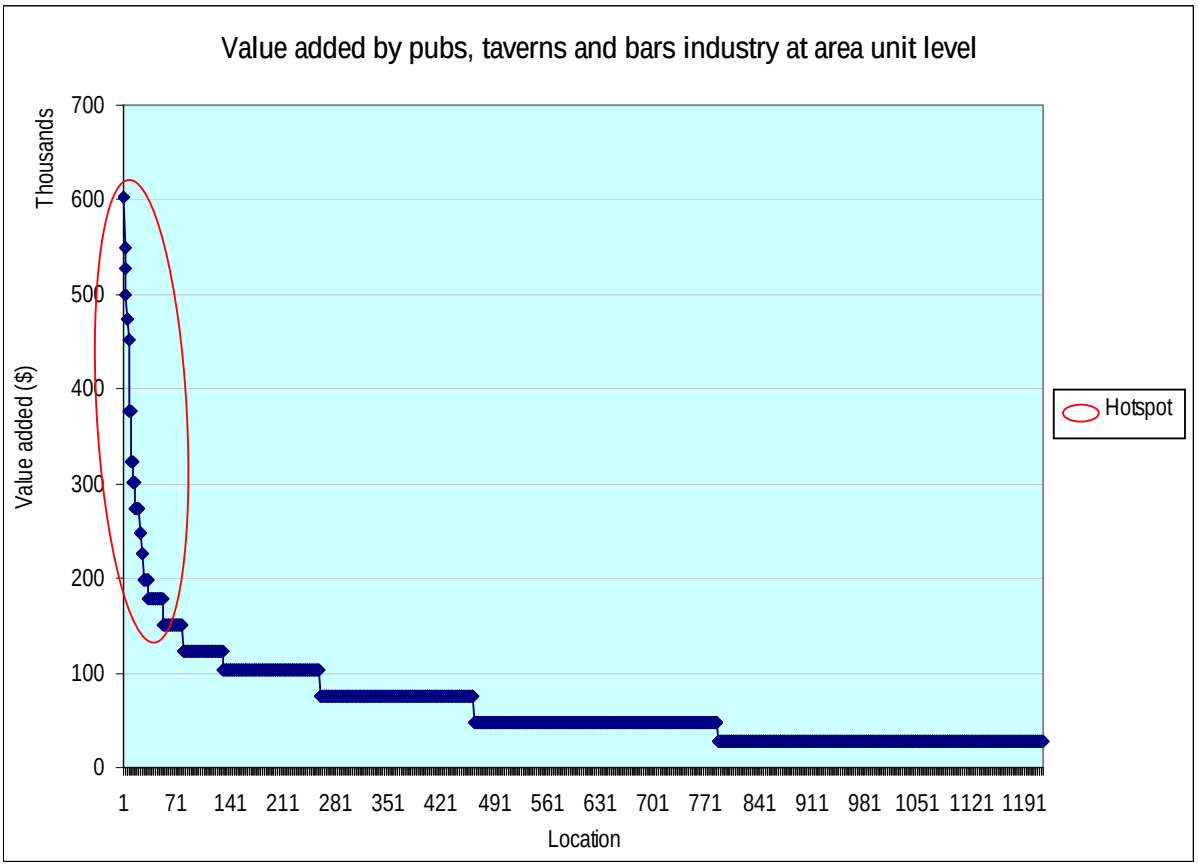


Figure 45: Economic value added by cafes and restaurants industry, based on employment as at 2006 census by area unit level (Statistics New Zealand data).

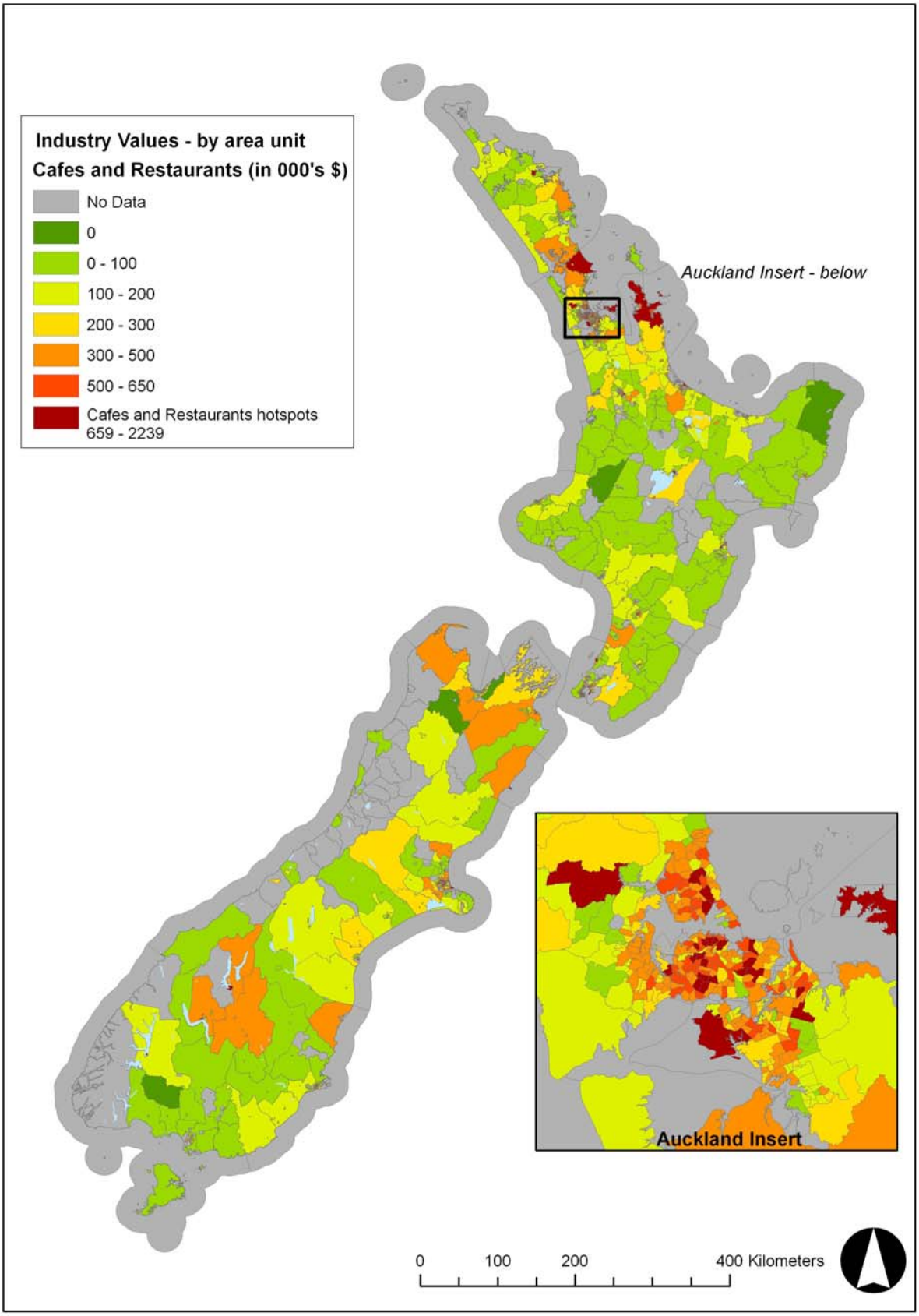


Figure 46: Economic value added by pubs, taverns and bars industry, based on employment as at 2006 census by area unit level (Statistics New Zealand data).

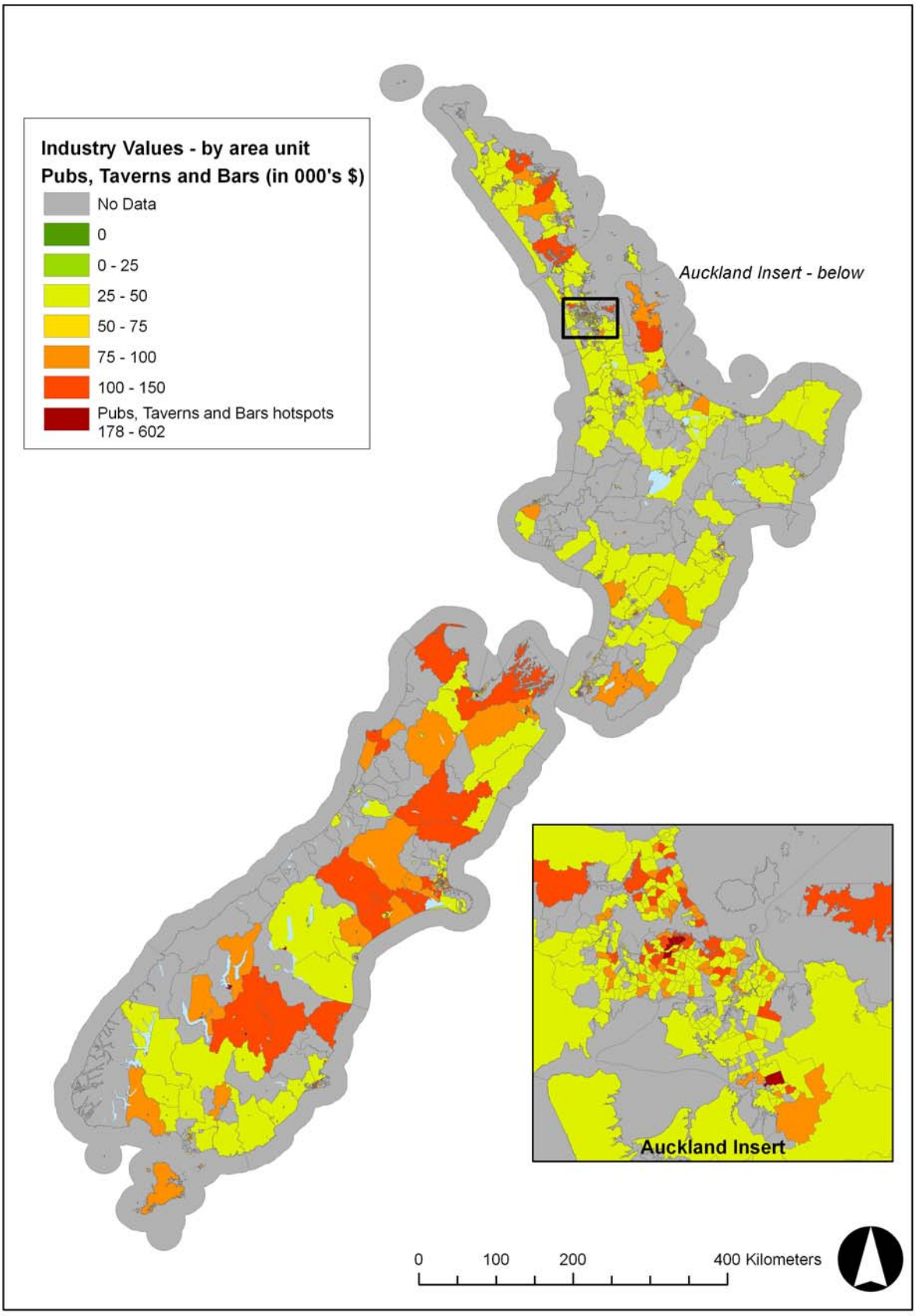


Figure 47: Overall trend of value added by accommodation industry at area unit level (Statistics New Zealand data).

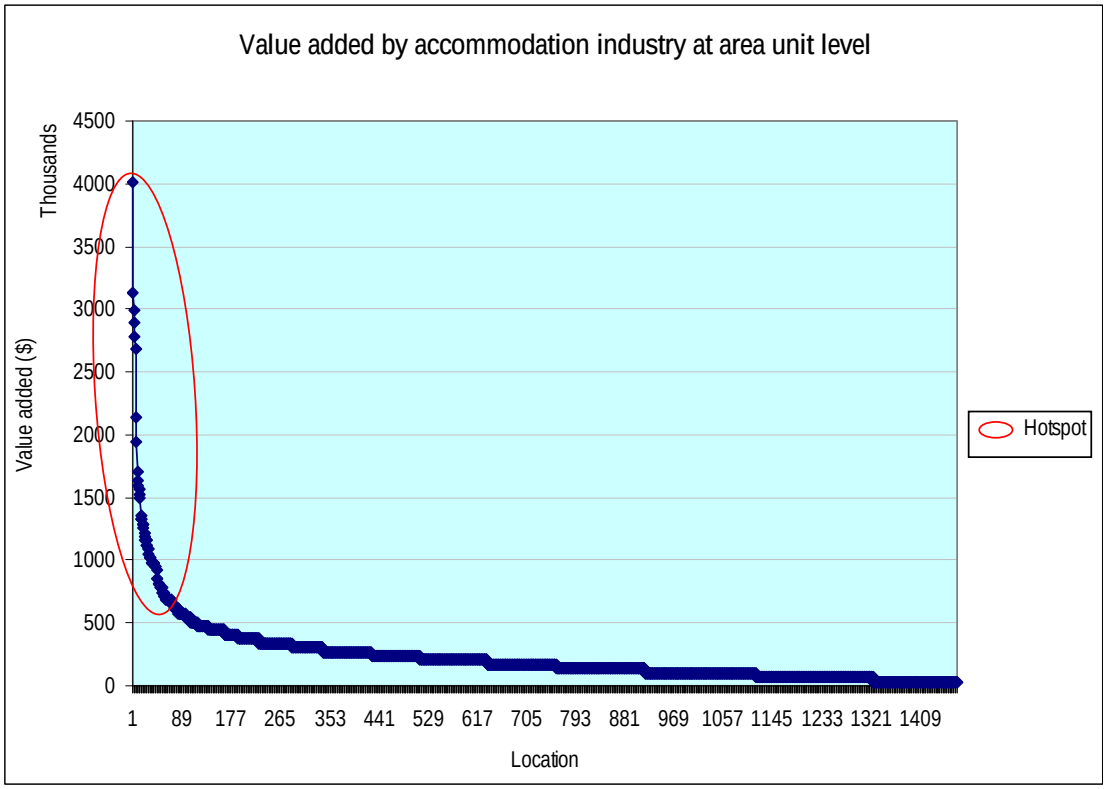


Figure 48: Overall trend of value added by clubs (hospitality) industry at area unit level (Statistics New Zealand data).

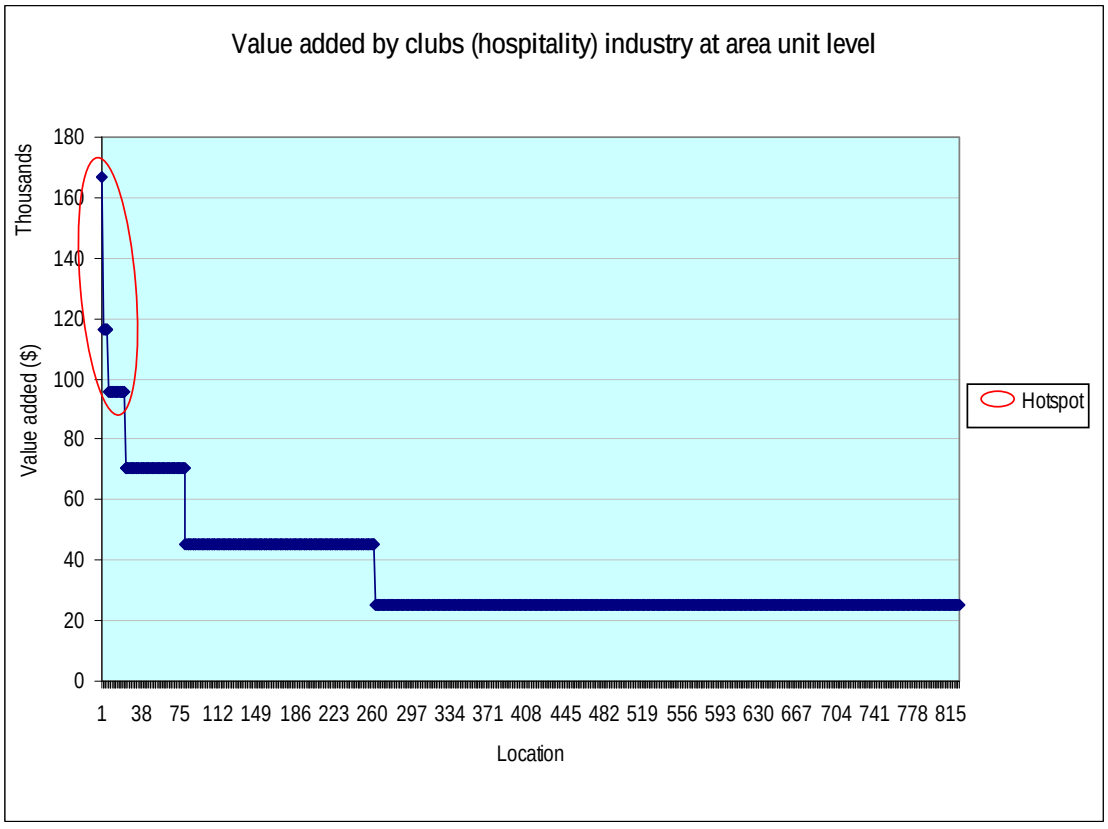


Figure 49: Economic value added by accommodation industry, based on employment as at 2006 census by area unit level (Statistics New Zealand data).

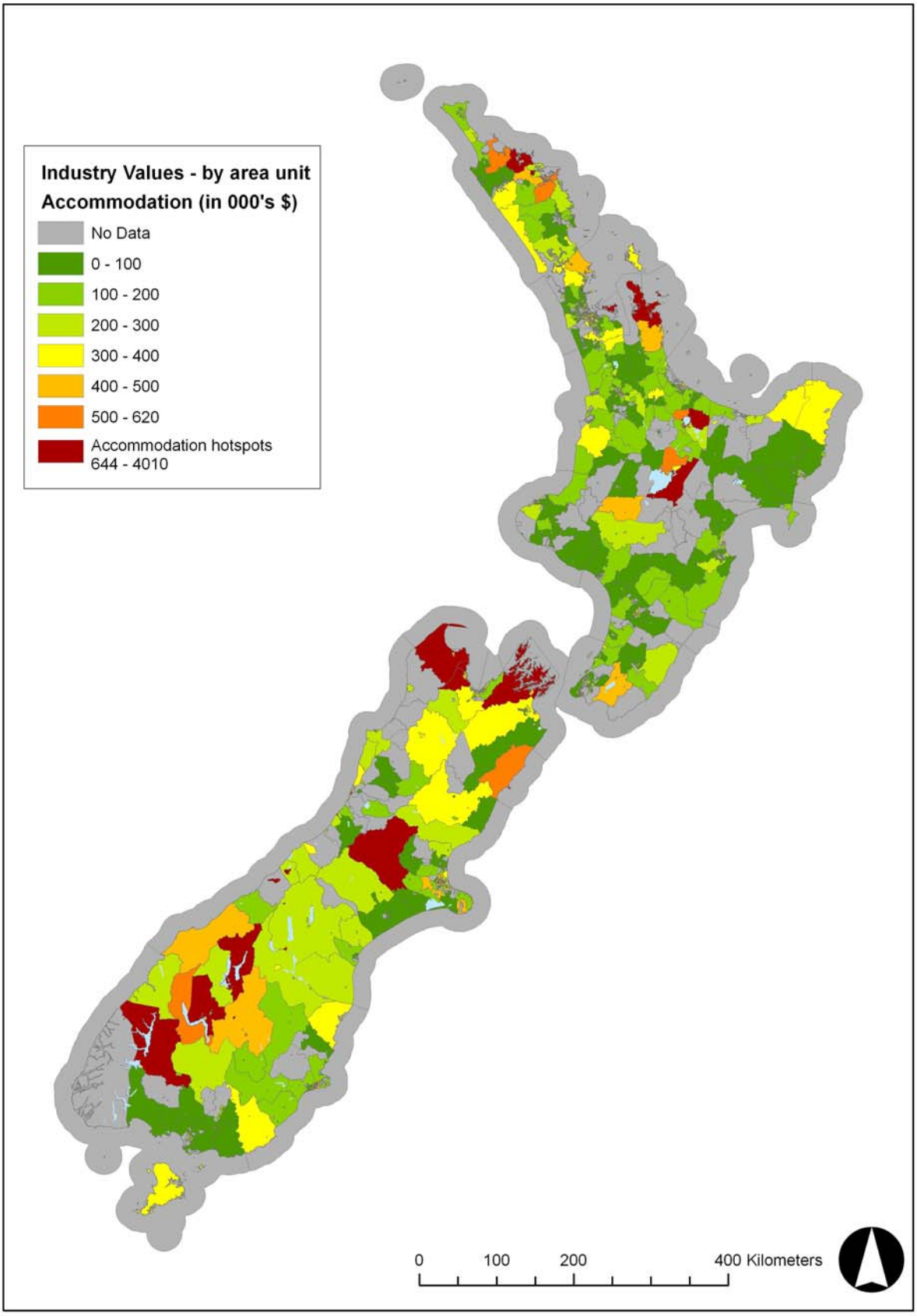


Figure 50: Economic value added by clubs (hospitality) industry, based on employment as at 2006 census by area unit level (Statistics New Zealand data).

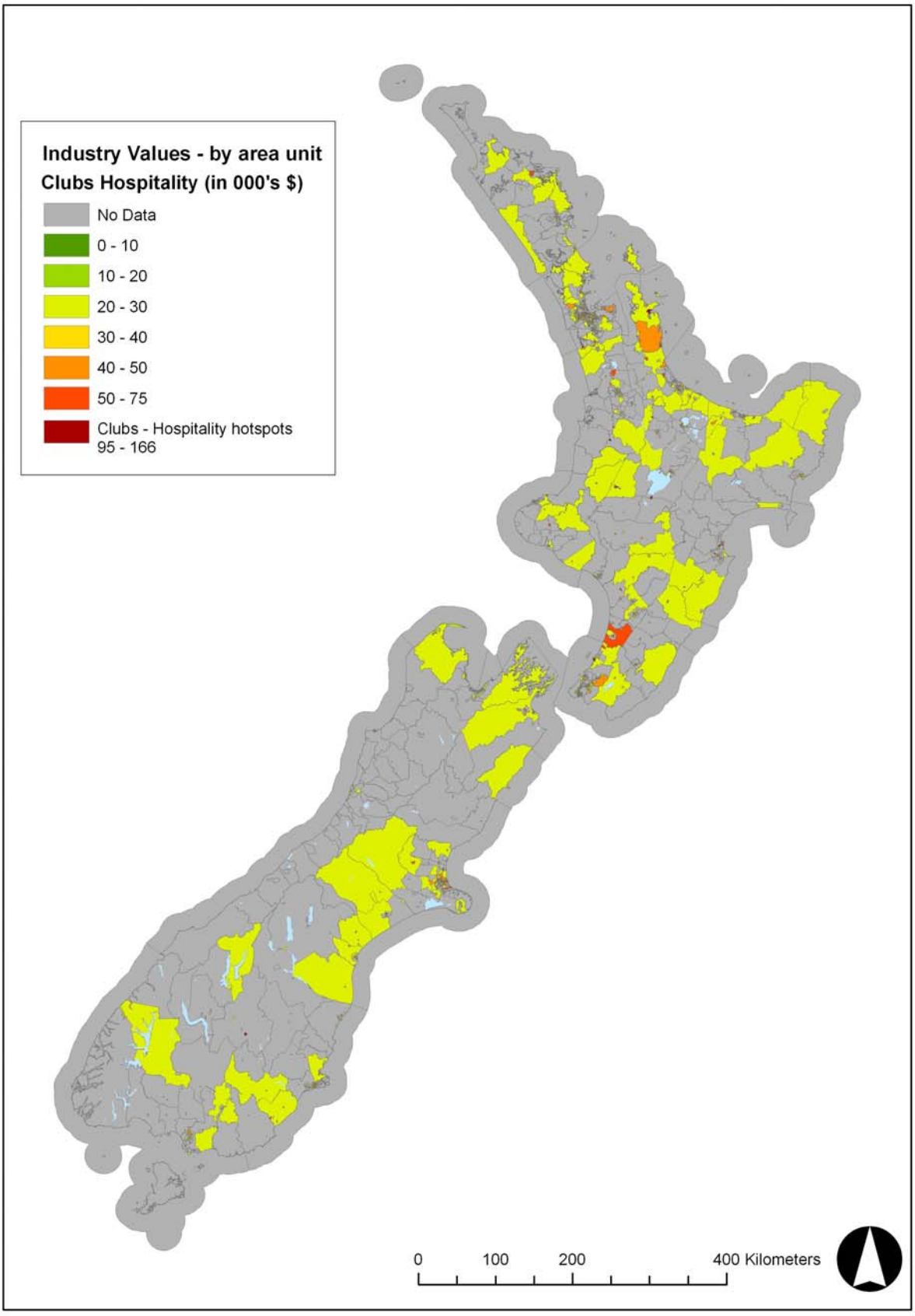


Figure 51: Overall trend of value added by water transport industry at area unit level (Statistics New Zealand data).

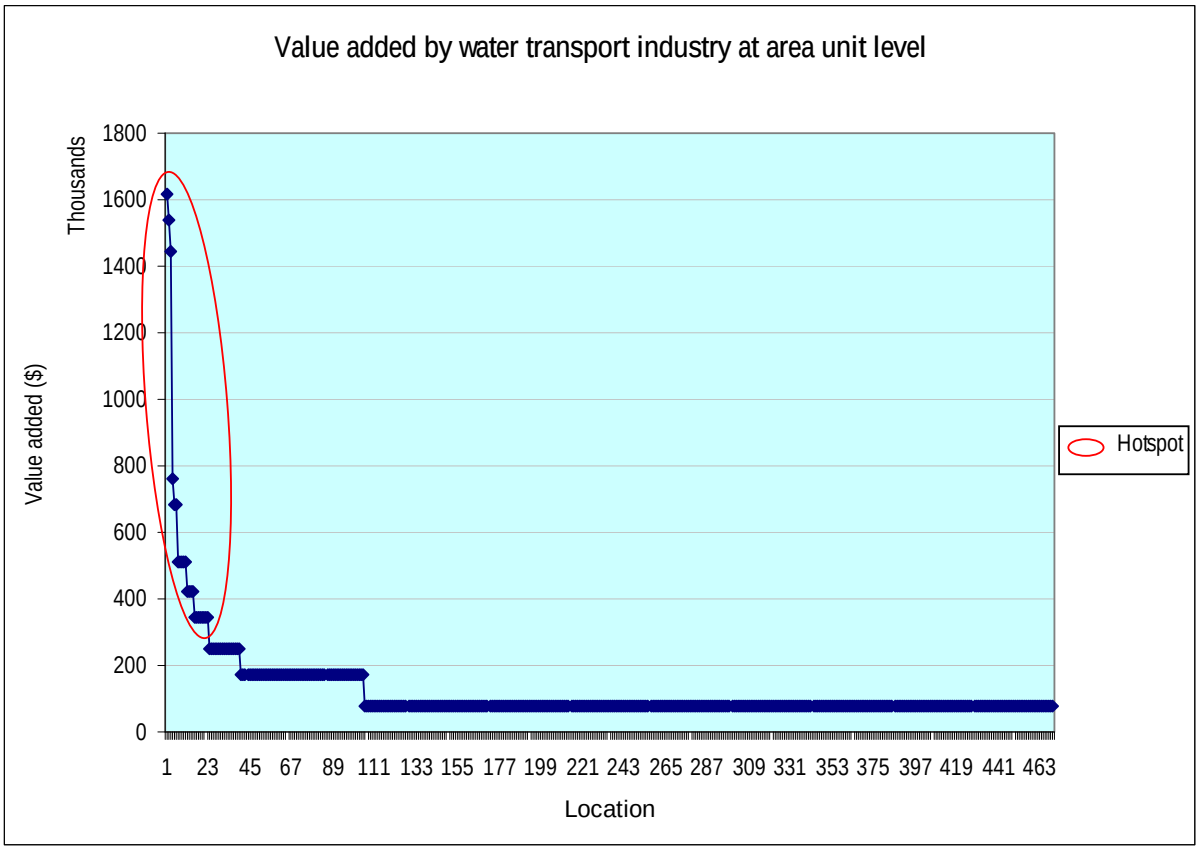


Figure 52: Economic value added by water transport industry, based on employment as at 2006 census by area unit level (Statistics New Zealand data).

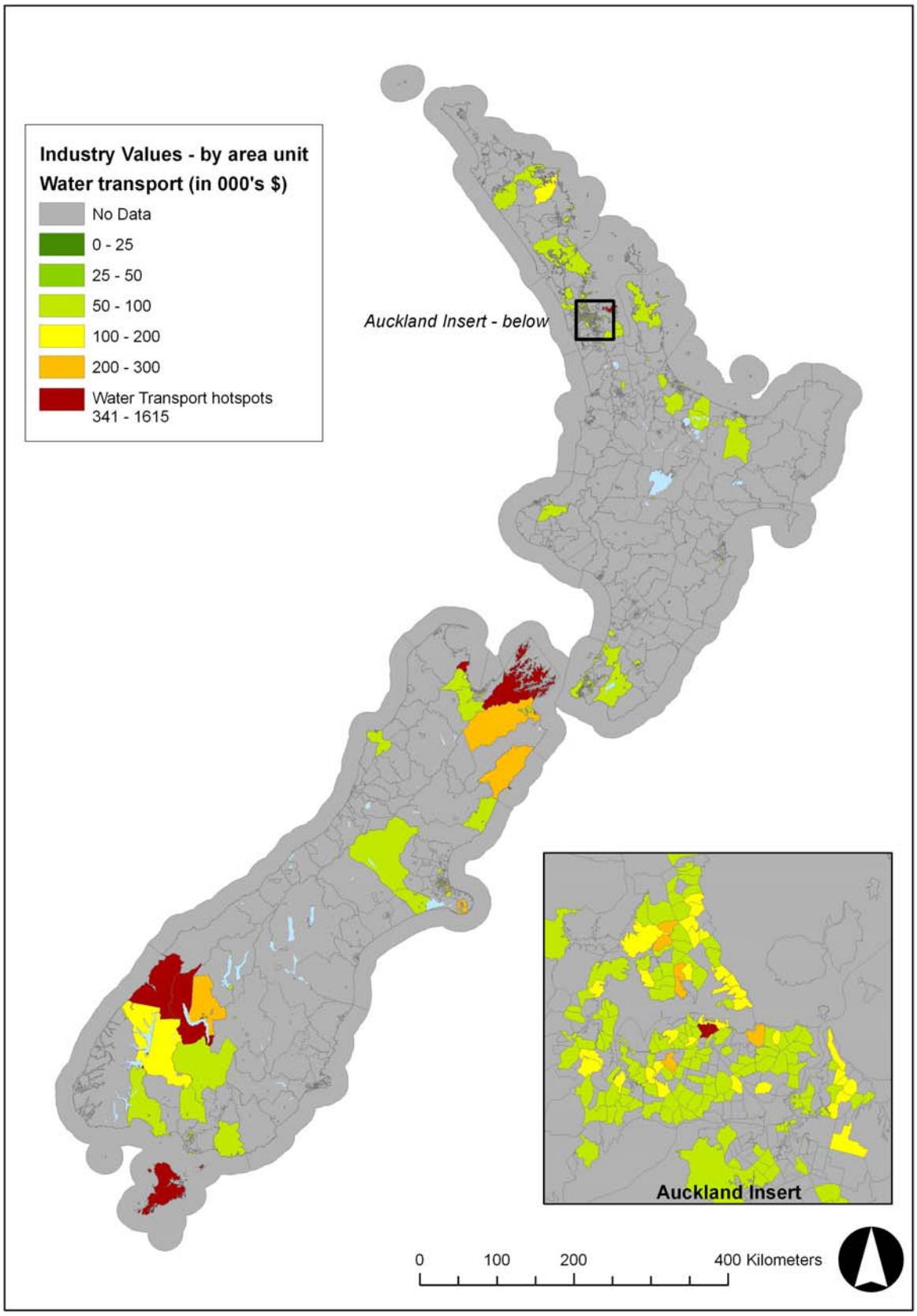


Figure 53: Overall trend of value added by services to water transport industry at area unit level (Statistics New Zealand data).

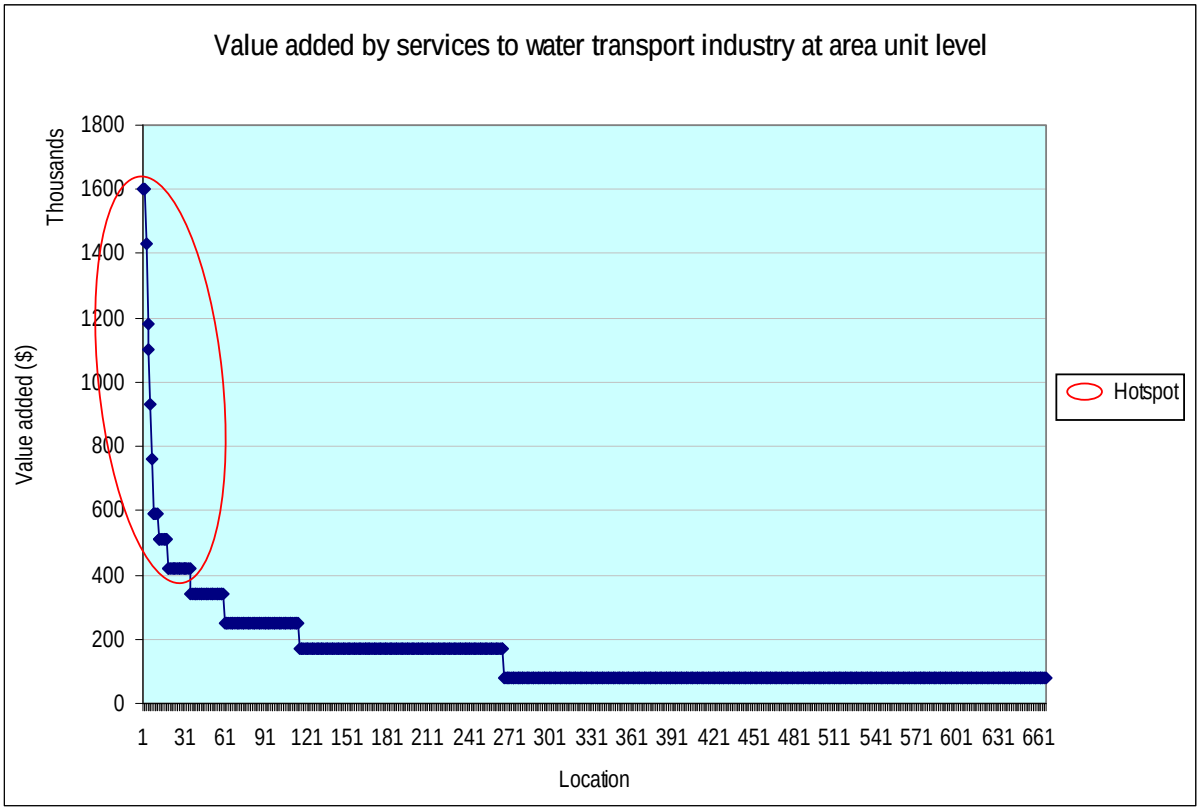
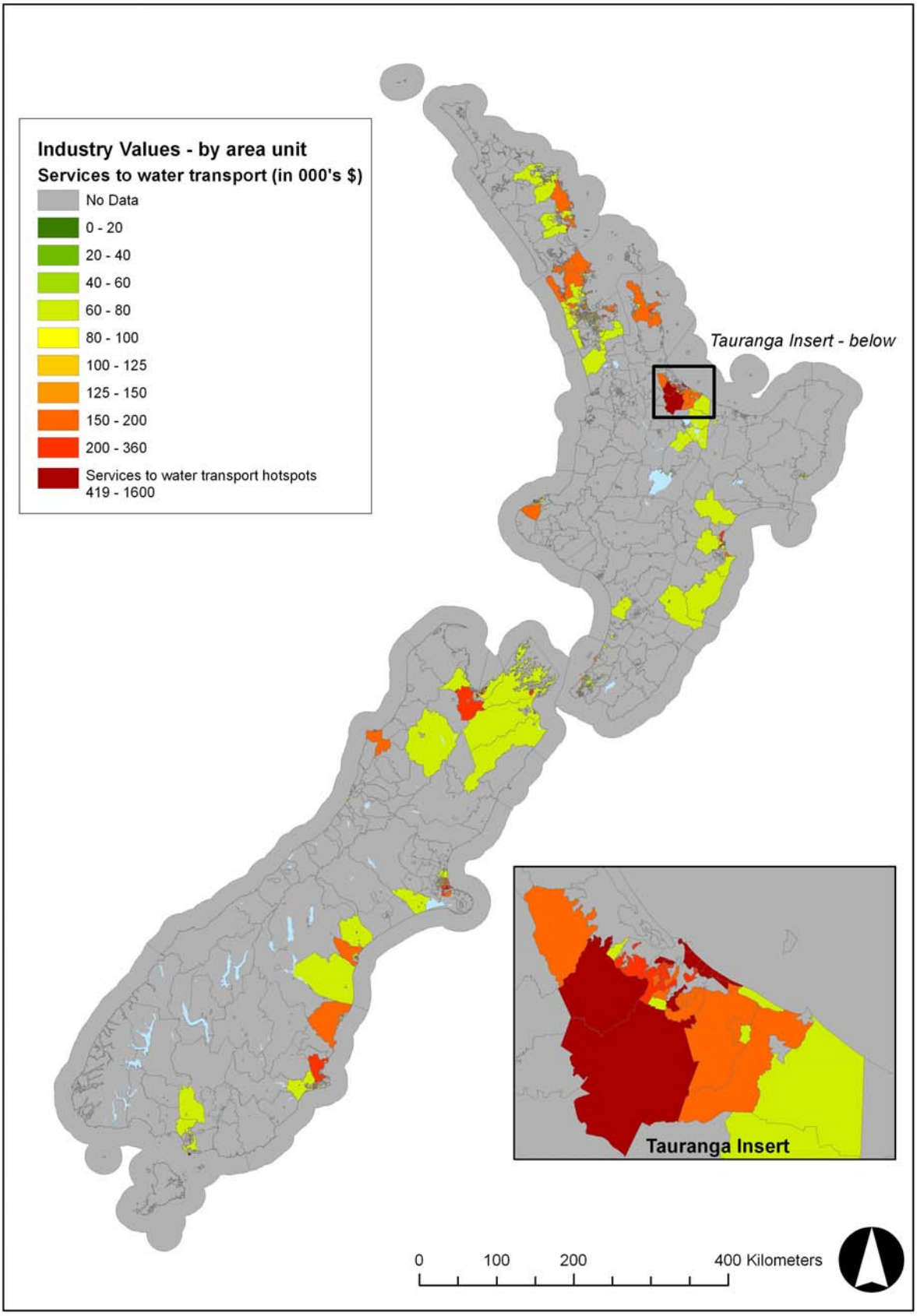


Figure 54: Economic value added by services to water transport industry, based on employment as at 2006 census by area unit level (Statistics New Zealand data).



3.2 OVERLAY ANALYSIS

This section discusses coincidence among high-value attributes for each dataset and also among datasets.

3.2.1 Fisheries value at risk

High value areas of total finfish, total shellfish, rock lobster and eel species coincide in fishing grounds around the South island (Figure 55).

As discussed in previous sections, different species are recorded at unique FSAs. Thus coincidences among the hotspots of different species are not analysed at an exact location but are done by looking at locations that are geographically close to each other.

High value areas for finfish occurring off Canterbury coastal area overlap with high value areas of value at risk for the eel fishery in Lake Ellesmere Migration Area. Moreover, Southland coastal region is a hotspot for both rock lobster and shellfish species.

3.2.2 Residential land value

High value areas for total land value, total capital value, total improvements value, and average land value overlap in area units in Auckland city and North Shore city, while total land value, total capital value, and total improvement value coincide in area units around the Auckland region, Thames-Coromandel district, Marlborough district, Lower Hutt city, and Tauranga city (Figure 56 and Table 2).

3.2.3 Coastal industry added-value

Marlborough district is found to be a hotspot for aquaculture, marine fishing NEC, and rock lobster fishing industries, while the Far North district is a hotspot for aquaculture and, marine fishing NEC (Table 3). Moreover, rock lobster fishing and marine fishing NEC high value areas overlap in Invercargill city.

Aquaculture and finfish trawling industry high value areas intersect in Nelson city, while line fishing, fish wholesale, and marine equipment retailing industries thrive in Christchurch city. Manukau city is a hotspot for fish wholesale and marine equipment retailing industries, while Auckland city is popular for boat building industry in addition to fish wholesale and marine equipment retailing industries. High value areas coincide for ship building, boat building and marine equipment retailing in North Shore city, while the Whangarei district is a high value area for line fishing and ship building industries.

The coincidences among high value areas of coastal industries at the area unit level are not discussed in detail (Table 4).

Figure 55: Overlay of hotspots between the fisheries value at risk for total shellfish, total finfish, rock lobster and eel species at Fisheries Statistical Area (FSA) units (Ministry of Fisheries data).

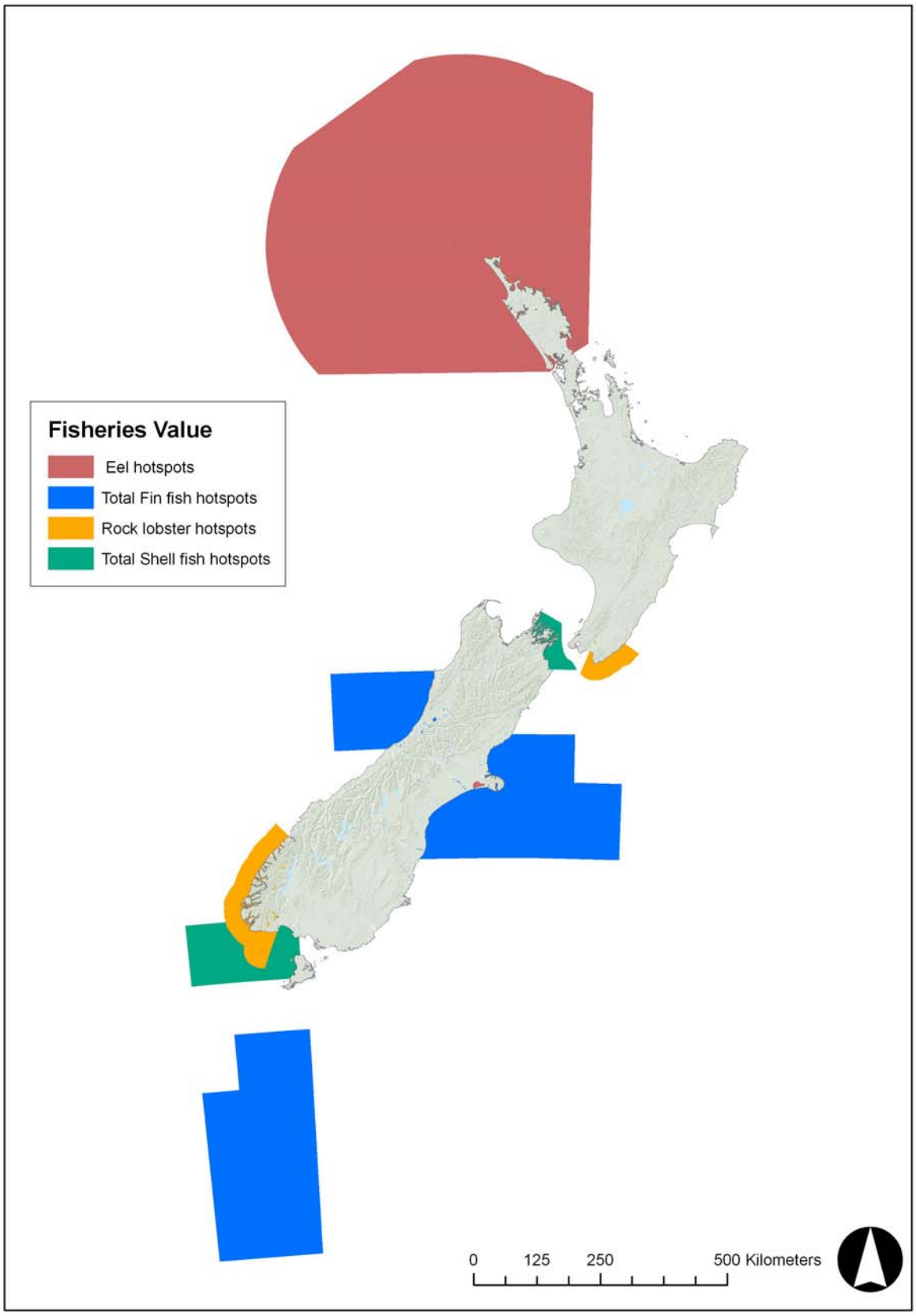


Figure 56: Overlay of hotspots between residential land value data attributes at area unit level (Quotable Value Ltd data).

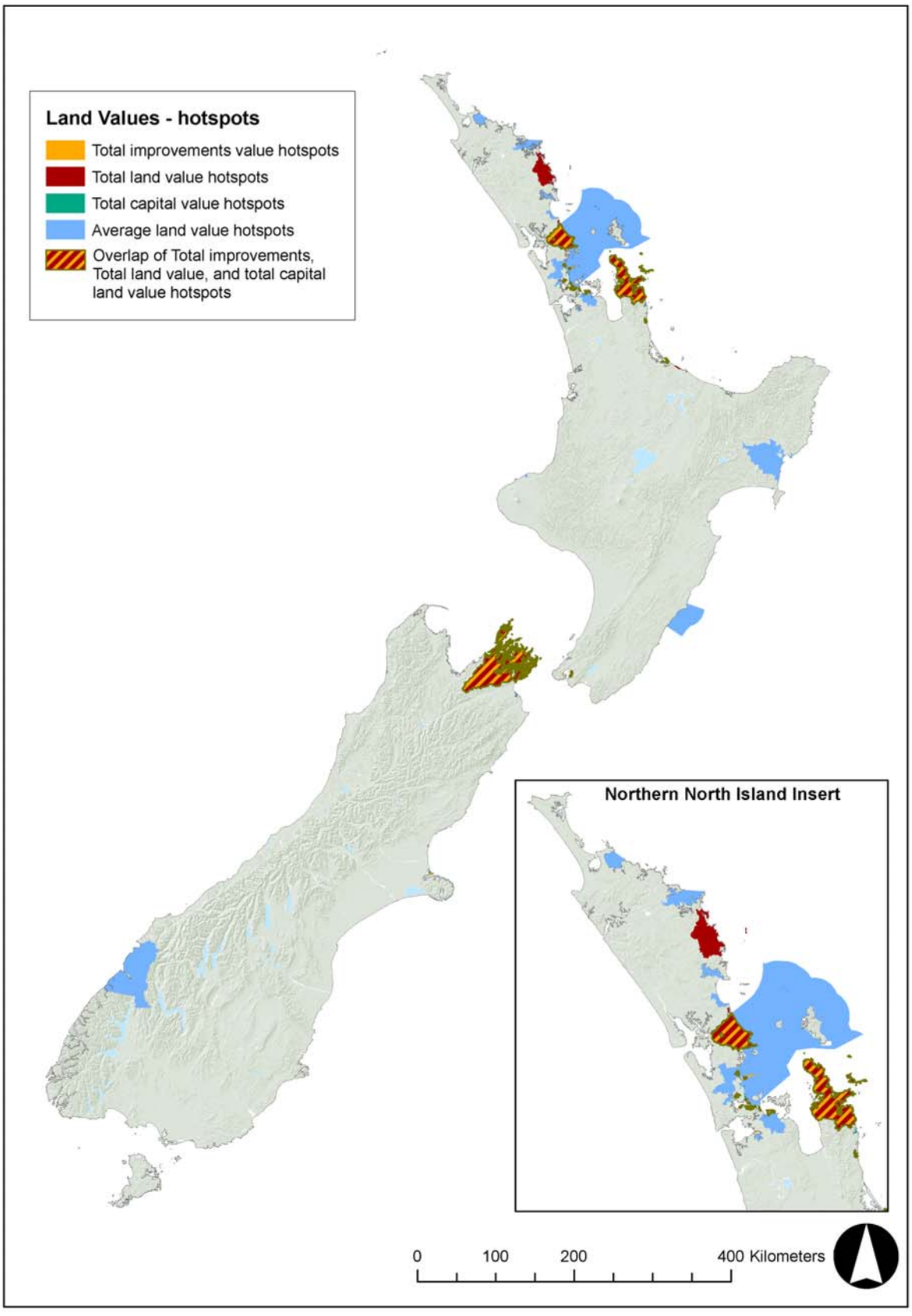


Table 2: Overlay among residential land value hotspots at area unit level

Area unit name	Territorial local authority name	Land value hotspots	Area unit name	Territorial local authority name	Land value hotspots
Auckland Central West	Auckland City	Total capital value Total improvements value	Castor Bay	North Shore City	Total capital value Total land value Average land value
Glendowie	Auckland City	Total capital value Total land value	Greenhithe	North Shore City	Total capital value Total land value Total improvements value
Herne Bay	Auckland City	Total capital value Total land value Average land value Total improvements value	Hauraki	North Shore City	Total capital value Total land value Total improvements value
Kohimarama West	Auckland City	Total capital value Total land value	Lake Pupuke	North Shore City	Total capital value Total land value Average land value
Meadowbank North	Auckland City	Total capital value Total land value Total improvements value	Mt Victoria	North Shore City	Total capital value Total land value Average land value Total improvements value
Mission Bay	Auckland City	Total capital value Total land value Total improvements value	Takapuna Central	North Shore City	Total capital value Total land value Average land value
Orakei North	Auckland City	Total capital value Total land value Average land value Total improvements value	Torbay	North Shore City	Total capital value Total land value
Orakei South	Auckland City	Total capital value Total land value Average land value Total improvements value	Cape Rodney	Rodney District	Total capital value Total land value Total improvements value
Parnell East	Auckland City	Total capital value Average land value Total improvements value	Manly	Rodney District	Total capital value Total land value Total improvements value
Parnell West	Auckland City	Total capital value Total land value Total improvements value	Orewa	Rodney District	Total capital value Total land value Total improvements value
Remuera West	Auckland City	Total capital value Total land value Average land value Total improvements value	Red Beach	Rodney District	Total capital value Total improvements value
St Heliers	Auckland City	Total capital value Total land value Total improvements value	Matua	Tauranga City	Total capital value Total land value Total improvements value
St Marys	Auckland City	Total capital value Total improvements value	Mt Maunganui North	Tauranga City	Total capital value Total land value Total improvements value

Table 2 continued

Area unit name	Territorial local authority name	Land value hotspots	Area unit name	Territorial local authority name	Land value hotspots
Waitaramoa	Auckland City	Total capital value Average land value	Omanu	Tauranga City	Total capital value Total land value Total improvements value
Westmere	Auckland City	Total capital value Total land value Total improvements value	Pauanui Beach	Thames-Coromandel District	Total capital value Total land value
Moncks Bay	Christchurch City	Total capital value Total improvements value	Te Rerenga	Thames-Coromandel District	Total capital value Total land value Total improvements value
Eastbourne	Lower Hutt City	Total capital value Total land value Total improvements value	Whangamata	Thames-Coromandel District	Total capital value Total land value Total improvements value
Beachlands-Maraetai	Manukau City	Total capital value Total land value Total improvements value	Whitianga	Thames-Coromandel District	Total capital value Total land value Total improvements value
Bucklands and Eastern Beaches	Manukau City	Total capital value Total land value Total improvements value	Lucken Point	Waitakere City	Total capital value Total improvements value
Marlborough Sounds Terrestrial	Marlborough District	Total capital value Total land value Total improvements value	Ohope	Whakatane District	Total capital value Total land value

Table 3: Overlay among industry added value hotspots at territorial local authority (TLA) level

Territorial local authority name	Industry added value hotspots
Invercargill City	Rock lobster fishing industry Marine fishing (not elsewhere classified) industry
Marlborough District	Rock lobster fishing industry Aquaculture industry Marine fishing (not elsewhere classified) industry
Nelson City	Finfish trawling industry Aquaculture industry
Christchurch City	Line fishing industry Fish wholesale industry
Whangarei District	Line fishing industry Ship building industry
Far North District	Marine fishing (not elsewhere classified) industry Aquaculture
North Shore City	Ship building industry Marine equipment retailing industry Boat building industry
Auckland City	Fish wholesale industry Marine equipment retailing industry Boat building industry
Manukau City	Fish wholesale industry Marine equipment retailing industry

Table 4: Overlay among industry added value hotspots at area unit level

Area unit name	Industry added value hotspots	Area unit name	Industry added value hotspots
Alexandra	Construction material mining industry Pubs, taverns and bars industry Clubs (hospitality) industry	Orewa	Cafes and restaurants industry Accommodation industry
Allenton	Construction material mining industry Pubs, taverns and bars industry Clubs (hospitality) industry	Otago University	Cafes and restaurants industry Pubs, taverns and bars industry Accommodation industry
Aro Street-Nairn Street	Cafes and restaurants industry Pubs, taverns and bars industry	Palmerston North Central	Cafes and restaurants industry Pubs, taverns and bars industry
Auckland Central East	Cafes and restaurants industry Pubs, taverns and bars industry Accommodation industry Water transport industry Clubs (hospitality) industry	Paraparaumu Central	Cafes and restaurants industry Clubs (hospitality) industry
Auckland Central West	Cafes and restaurants industry Pubs, taverns and bars industry Accommodation industry Water transport industry	Parnell West	Cafes and restaurants industry Clubs (hospitality) industry
Avon Loop	Cafes and restaurants industry Pubs, taverns and bars industry	Picton	Aquaculture industry Accommodation industry Water transport industry Services to water transport industry
Bluff	Marine fishing industry Services to water transport industry	Queenstown Bay	Cafes and restaurants industry Pubs, taverns and bars industry Accommodation industry Water transport industry
Cape Rodney	Marine fishing industry Cafes and restaurants industry	Queenstown Hill	Cafes and restaurants industry Pubs, taverns and bars industry Accommodation industry Water transport industry
Caversham	Pubs, taverns and bars industry Accommodation industry	Riccarton	Cafes and restaurants industry Accommodation industry
Coromandel	Aquaculture industry Accommodation industry	Riccarton West	Cafes and restaurants industry Pubs, taverns and bars industry Services to water transport industry
Fitzroy	Oil, gas extraction industry Oil, gas exploration industry	Russell	Accommodation industry Water transport industry
Freemans Bay	Cafes and restaurants industry Pubs, taverns and bars industry	Sockburn	Cafes and restaurants industry Pubs, taverns and bars industry Accommodation industry
Golden Bay	Marine fishing industry Aquaculture industry Accommodation industry	St Albans East	Cafes and restaurants industry Pubs, taverns and bars industry Accommodation industry Clubs (hospitality) industry
Greenmeadows	Clubs (hospitality) industry Services to water transport industry	Stewart Island	Aquaculture industry Water transport industry

Table 4 continued

Area unit name	Industry added value hotspots	Area unit name	Industry added value hotspots
High St-Stuart St	Cafes and restaurants industry Pubs, taverns and bars industry Accommodation industry	Struan Park	Oil, gas extraction industry Services to water transport industry
Hillcrest West	Cafes and restaurants industry Pubs, taverns and bars industry	Stuart St-Frederick St	Cafes and restaurants industry Pubs, taverns and bars industry Accommodation industry
Hilltop	Cafes and restaurants industry Accommodation industry	Sunshine Bay	Cafes and restaurants industry Accommodation industry Water transport industry
Kaikoura Township	Marine fishing industry Cafes and restaurants industry Accommodation industry Water transport industry	Sydenham	Cafes and restaurants industry Pubs, taverns and bars industry
Kaiteriteri	Accommodation industry Water transport industry	Takaro	Cafes and restaurants industry Clubs (hospitality) industry
Kelburn	Cafes and restaurants industry Pubs, taverns and bars industry	Taradale North	Clubs (hospitality) industry Services to water transport industry
Kerikeri	Cafes and restaurants industry Accommodation industry	Tauhara	Cafes and restaurants industry Accommodation industry
Kingsland	Cafes and restaurants industry Pubs, taverns and bars industry	Taumarunui Central	Construction material mining industry Clubs (hospitality) industry
Lambton	Cafes and restaurants industry Pubs, taverns and bars industry Accommodation industry	Taupo Central	Cafes and restaurants industry Accommodation industry
Linwood	Cafes and restaurants industry Pubs, taverns and bars industry Accommodation industry	Te Anau	Cafes and restaurants industry Accommodation industry Water transport industry
Mangapa-Matauri Bay	Construction material mining industry Accommodation industry	Te Kuiti	Construction material mining industry Clubs (hospitality) industry
Marlborough Sounds Terrestrial	Marine fishing industry Aquaculture industry Accommodation industry Water transport industry	Te Rerenga	Marine fishing industry Aquaculture industry Cafes and restaurants industry Accommodation industry
Mt Cook-Wallace Street	Cafes and restaurants industry Pubs, taverns and bars industry Accommodation industry Water transport industry	Tinwald	Construction material mining industry Pubs, taverns and bars industry
Mt Maunganui North	Cafes and restaurants industry Pubs, taverns and bars industry Accommodation industry Services to water transport industry	Turangi	Accommodation industry Clubs (hospitality) industry
Mt Victoria West	Cafes and restaurants industry Pubs, taverns and bars industry Accommodation industry Water transport industry	Twizel Community	Aquaculture industry Pubs, taverns and bars industry Accommodation industry

Table 4 continued

Area unit name	Industry added value hotspots	Area unit name	Industry added value hotspots
Naylor	Cafes and restaurants industry Pubs, taverns and bars industry	University	Cafes and restaurants industry Pubs, taverns and bars industry Accommodation industry
Newtown East	Cafes and restaurants industry Pubs, taverns and bars industry Accommodation industry	Waiheke Island	Construction material mining industry Cafes and restaurants industry Accommodation industry Water transport industry
Newtown West	Cafes and restaurants industry Pubs, taverns and bars industry	Wanaka	Cafes and restaurants industry Pubs, taverns and bars industry Accommodation industry
North Dunedin	Cafes and restaurants industry Pubs, taverns and bars industry Accommodation industry	Westport Urban	Marine fishing industry Pubs, taverns and bars industry
North East Valley	Cafes and restaurants industry Pubs, taverns and bars industry	Whangamata	Pubs, taverns and bars industry Clubs (hospitality) industry
Ohope	Water transport industry Clubs (hospitality) industry	Whitianga	Accommodation industry Clubs (hospitality) industry
Omanu	Cafes and restaurants industry Pubs, taverns and bars industry Services to water transport industry	Willis Street-Cambridge Terrace	Cafes and restaurants industry Pubs, taverns and bars industry Accommodation industry

3.2.4 Fisheries value at risk and coastal industry added value

The overlay of high value areas between fisheries value at risk and industry added values at TLA level shows the following coincidences among high values, which represent direct or indirect dependence between the harvest of a particular species and particular industry (Figs 57-60). Since the two datasets are recorded at different scales, coincidences among the hotspots of the two datasets are analysed by examining locations based on geographical proximity.

The finfish trawling industry hotspot in the Timaru district overlaps with the value at risk for total finfish hotspot found off the Canterbury coastal area (Figure 57). Line fishing, marine equipment retailing, and fish wholesale industry hotspots in Christchurch city coincide with the eel fishery high value area occurring in Lake Ellesmere Migration Area, and the finfish hotspot occurring off the Canterbury area (Figure 58).

Rock lobster fishing, aquaculture and marine fishing NEC high value areas in Marlborough district are found adjacent to the shellfish value at risk hotspot occurring off the Marlborough coast (Figure 59). The productive eel fishing grounds off Northland overlaps with the line fishing, and ship building hotspots in Whangarei district, and also with the marine fishing NEC, and aquaculture industry hotspots in the Far North district (Figure 60).

Coincidences between the high value areas for fisheries value at risk and fisheries related industry added values at SNZ area unit level are not discussed in detail (Table 5).

Figure 57: Overlay between Industry added values at territorial local authority (TLA) level and Fisheries value at risk (Quotable Value Ltd data and Ministry of Fisheries data).

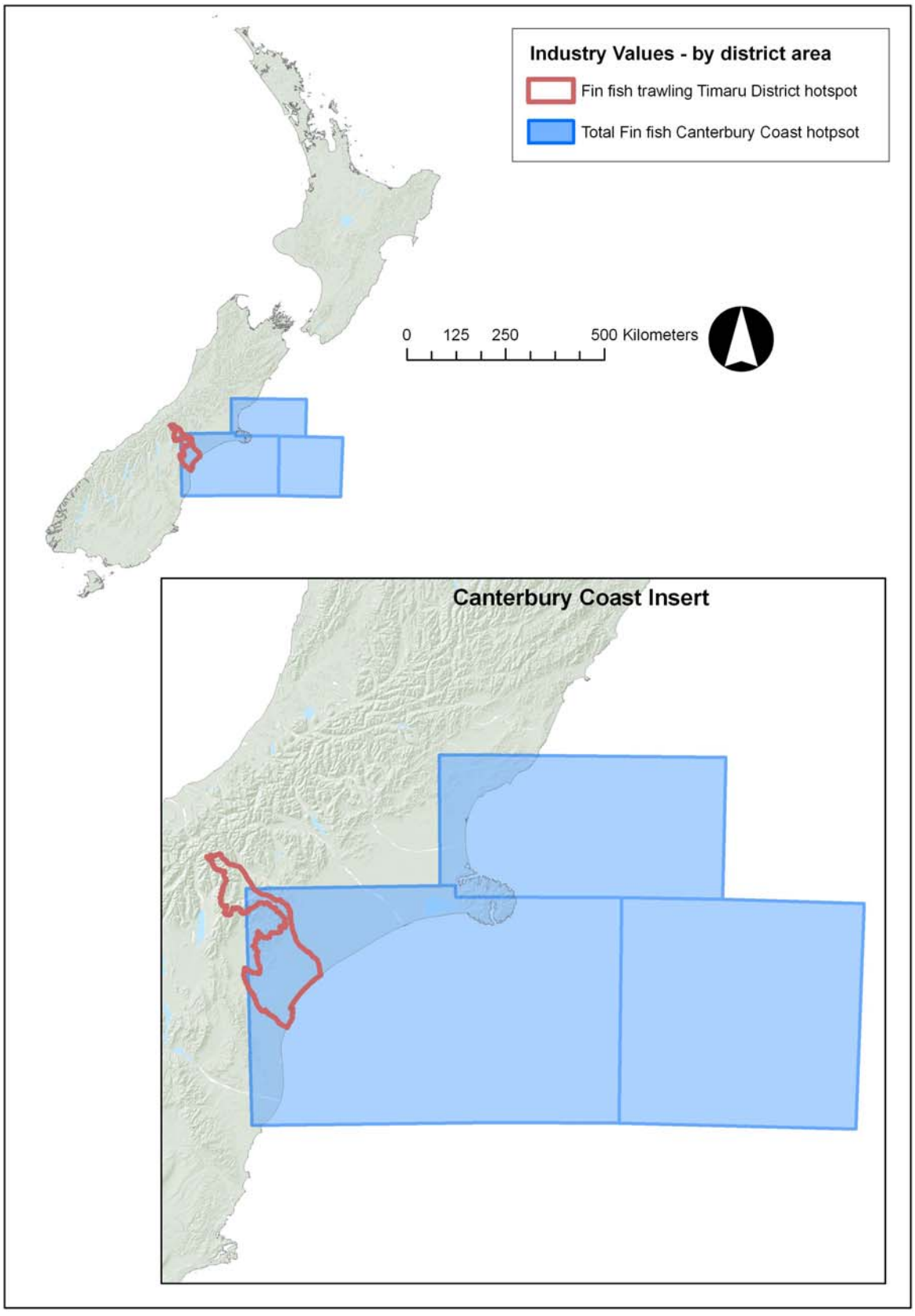


Figure 58: Overlay between Industry added values at territorial local authority (TLA) level and Fisheries value at risk (Quotable Value Ltd data and Ministry of Fisheries data).

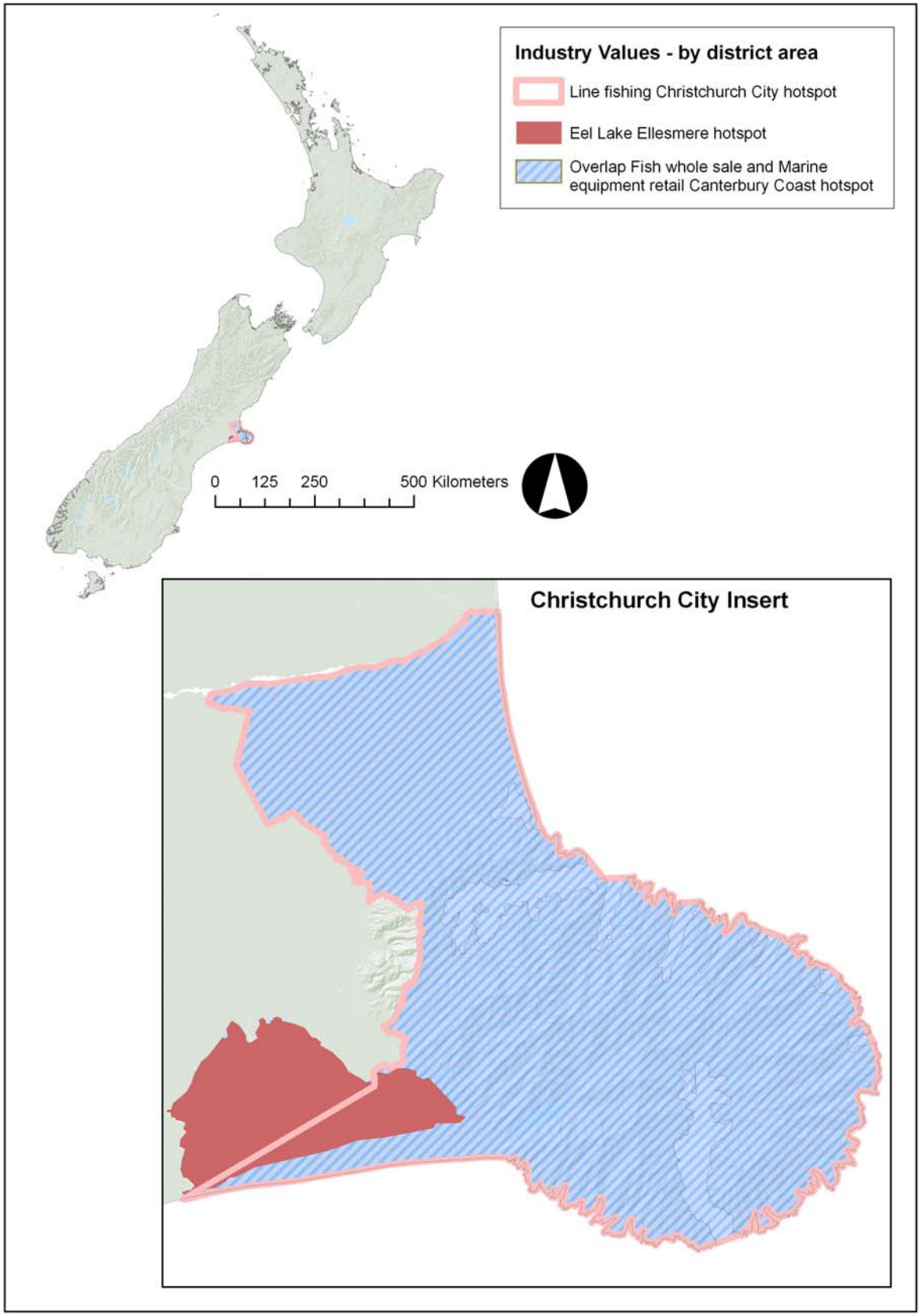


Figure 59: Overlay between Industry added values at territorial local authority (TLA) level and Fisheries value at risk (Quotable Value Ltd data and Ministry of Fisheries data).

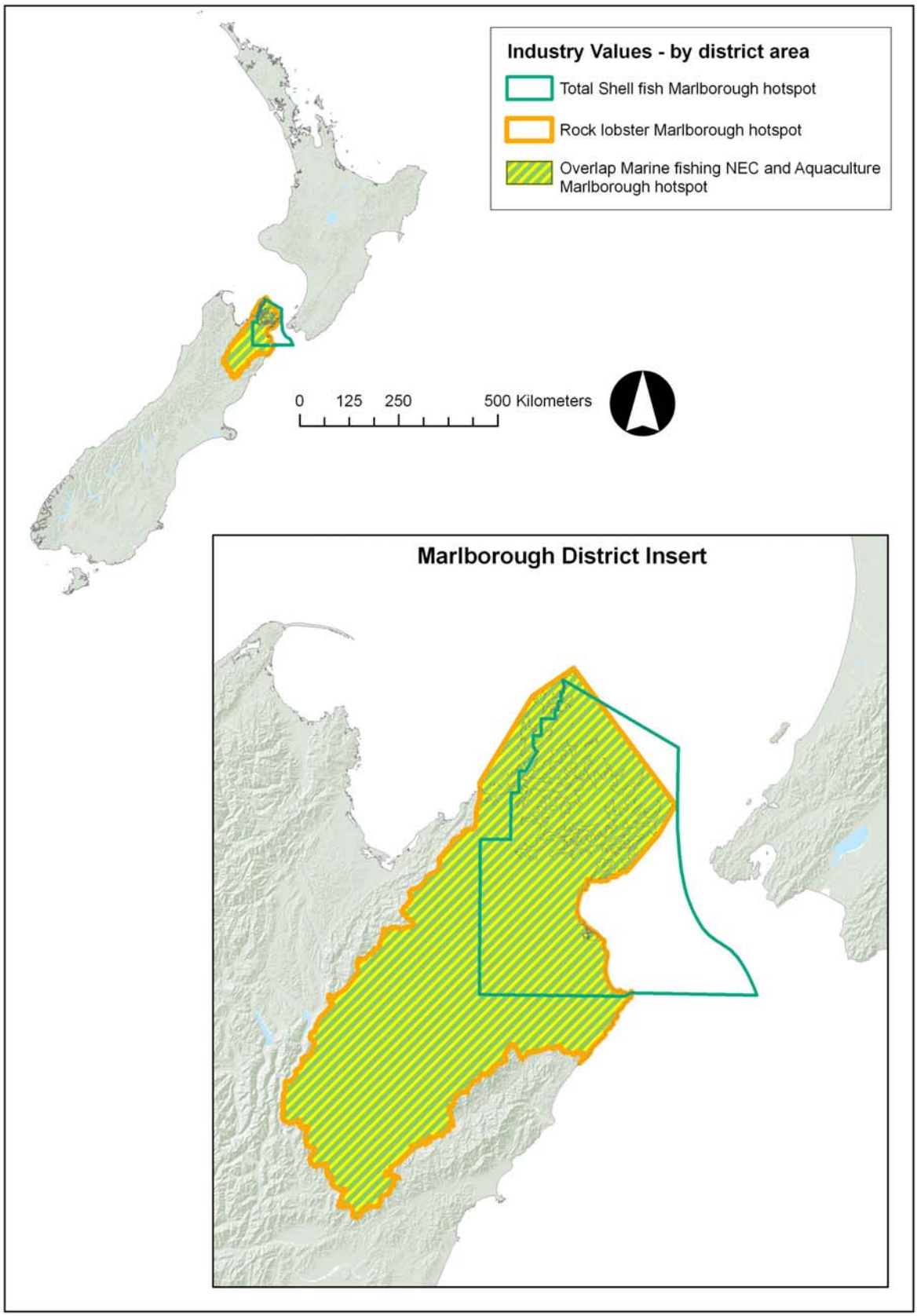


Figure 60: Overlay between Industry added values at territorial local authority (TLA) level and Fisheries value at risk (Quotable Value Ltd data and Ministry of Fisheries data).

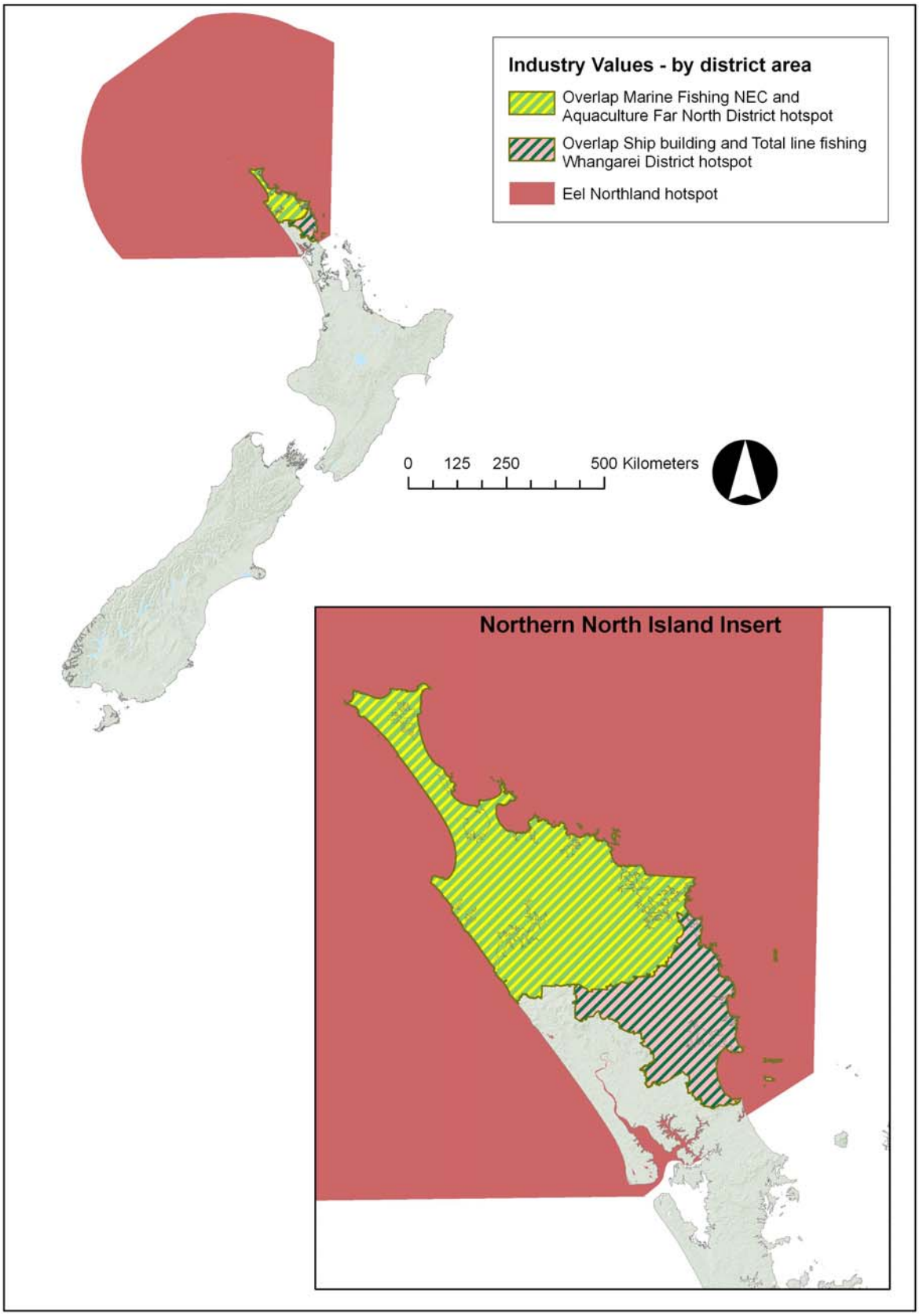


Table 5: Overlay between industry added value hotspots at area unit level, and fisheries value at risk hotspots

Area unit name	Industry added value hotspots and fisheries value at risk hotspots
Havelock	Aquaculture industry Shellfish value at risk
Levels	Marine fishing industry Finfish value at risk
Manapouri	Water transport industry Rock lobster value at risk
Marlborough Sounds Terrestrial	Marine fishing industry Aquaculture industry Water transport industry Shellfish value at risk
Milford	Water transport industry Rock lobster value at risk
North Cape	Aquaculture industry Eel value at risk
Picton	Aquaculture industry Water transport industry Shellfish value at risk
Redwoodtown	Aquaculture industry Shellfish value at risk
Russell	Water transport industry Eel value at risk
Seaview	Marine fishing industry Finfish value at risk
Stewart Island	Aquaculture industry Water transport industry Shellfish value at risk
Tuturumuri	Marine fishing industry Rock lobster value at risk
Waikawa	Water transport industry Shellfish value at risk
Wairau	Aquaculture industry Shellfish value at risk
Watlington	Marine fishing industry Finfish value at risk
Westport Urban	Marine fishing industry Finfish value at risk

3.3 DATA LIMITATIONS AND RECOMMENDATIONS

This section discusses the data limitations and caveats associated with each dataset and the conducted analysis. Recommendations are discussed for future extensions.

3.3.1 Fisheries value at risk data

An estimate of the present value of future fisheries harvest was used as an indicator of economic value arising from a direct use of coastal and marine ecosystems. Fisheries value at risk indicator represents a long-term asset value and was developed using quota share prices and export prices (free on board, FOB) derived from the Ministry of Fisheries, prevailing at the time of the 2006 census. This indicator provides more accurate information than the industry added values for commercial fisheries, with the caveat that for species with neither quota share prices nor species-specific export prices available, generic frozen export prices were used in deriving the value at risk.

3.3.2 Residential land value data

Residential land value was utilised as an indicator of amenity values associated with coastal locations, on the basis that proximity to the coast increases property values. Values for all residential properties within 1 km of the coastline of New Zealand were derived from Quotable Value New Zealand Ltd at SNZ area unit level. In this project total land value by area unit was used as the primary indicator while average residential land value per property by area unit was also analysed.

The 1-km distance criterion used in the Economic Value Mapping project was arbitrary. The amenity value provided by the coast however may not be limited to a 1-km distance boundary. At some locations residential properties may not have the same impact of being close to the coast as at another location, depending on other amenities the location offers. For example, residential properties in Downtown Auckland are highly valued not necessarily because they are closer to the coast but because of other facilities available in the area. On the other hand, in areas like the Thames-Coromandel region, the value of residential properties located more than 1 km away from the coast may most certainly increase because of proximity to the coast. Thus when looking at area units with high residential land values, MAFBNZ should consider the amenities available in that area to understand whether the amenity value provided by proximity to the coastline is accurately stated.

Even though the GIS maps presented in this report give a visual interpretation of the data, it should be noted that the residential land values are aggregated at the SNZ area unit levels which significantly vary in size. Thus a large area unit in a rural area might have the same total value as a smaller area unit in a more urbanised area. This could also give misleading information on the high value areas. The per hectare value by area unit would provide MAFBNZ with a better indication of the value of residential properties in coastal areas. Therefore, for future data acquisitions it would be advisable to consider the possibilities of deriving the per hectare value of coastal land for use as an indicator of amenity values associated with coastal locations.

3.3.3 Coastal industry added-value data

Annual added value of commercial activity that is reliant on coastal or marine resources (directly or indirectly) was used as an indicator of the value added for commercial activities of selected industries associated with the coast. This indicator was derived from employment data from the 2006 Census of Population and Dwellings, based on the area of usual residence,

and industry productivity data sourced from the National Accounts' Inter-Industry Study 1996.

The total value added in a given industry was allocated to area units on the basis of the share of that industry's employees who reside in a given area unit. Moreover, the industry added value data were only available for highly aggregated industries.

The main limitations for this dataset arise from the two sources; first, from the use of census data in deriving the number of employees for a given industry, and second from the deriving the industry added values using the national accounts at highly aggregated industry groups. The census was carried out on March 6, and only records employment during the first week of March 2006. This limits the validity and the accuracy of using this information to derive an annual added value. Coastal industries are highly likely to show seasonal trends – fishing activities peak at different times of the year for different species, and industries which are dependent on tourism (e.g., accommodation) peak at those times when the tourism industry peaks. The use of census data for deriving the employment numbers fails to capture seasonal variations. Furthermore, the census data were recorded based on the area of usual residence and may not capture the impacts of seasonal migration of workers. When using these data for decision making, MAFBNZ should investigate the impact of seasonal variation on industry added values. In future projects, it would also be worthwhile to examine the employment data based on the area of employment, given that people are likely to work away from home at times when the activities peak. For some of the fisheries-related industries, finfish trawling for example, it would be useful to derive the added value based on the location where the catch is landed rather than the residence of the employees or the area of employment.

Issues also arise with the precision of reported information because of the use of national accounts for deriving added values and because of the level of industry aggregation. Strict confidentiality rules imposed by SNZ resulted in a significant amount of data suppression at area unit level. In some cases area units with no recorded data may be hotspots for a particular industry. For these reasons, it is important that MAFBNZ investigates both areas of interest at a regional scale with the help of local experts' knowledge, and also disaggregated industry level data when making important decisions. For future extensions it would be useful to explore different data sources at regional scale to get more informative data, especially for those areas that are suspected hotspots but actually are listed as having no data. Moreover, it is recommended that MAFBNZ look into opportunities for updating the data used in deriving the added values and conducting further analyses to examine the trends in industry values.

3.3.4 Meta analysis

Meta analyses discussed in this report are based on definitive criteria used for classifying a hotspot. In this study the applied 95th percentile criterion is used for consistency but it is arbitrary. For some data attributes the 95th percentile cut-off point works well in capturing hotspots that align with the natural break points demonstrated in the distribution of the data (e.g. value at risk for total shellfish, value added by finfish trawling industry at TLA level). However, this definitive criterion does not separate distinct high value areas for other data attributes (e.g., total residential land value, value added by ship building industry at TLA level). For that reason, when making decisions regarding the selected high value areas it is advisable to examine the figures illustrating the overall trend of data attributes.

4 Acknowledgements

We would like to acknowledge all those who have contributed to this project. We would like to thank Janice Willoughby for technically reviewing the report and data analysis, Anne Austin for editing the report and Mike Krausse for reviewing the report. In particular we would like to thank MAFBNZ for their input and funding of the project.

5 References

MAF Biosecurity New Zealand (2009) *Mapping the Values of New Zealand's Coastal Waters: 2. Economic Values.* Biosecurity New Zealand Technical Paper No. 2009/xx. 74pp.

Appendix A: Residential Land Values

Figure 61: Overall trend of total improvement value for all residential and lifestyle properties within 1 km of the coast at area unit level (Quotable Value Ltd data).

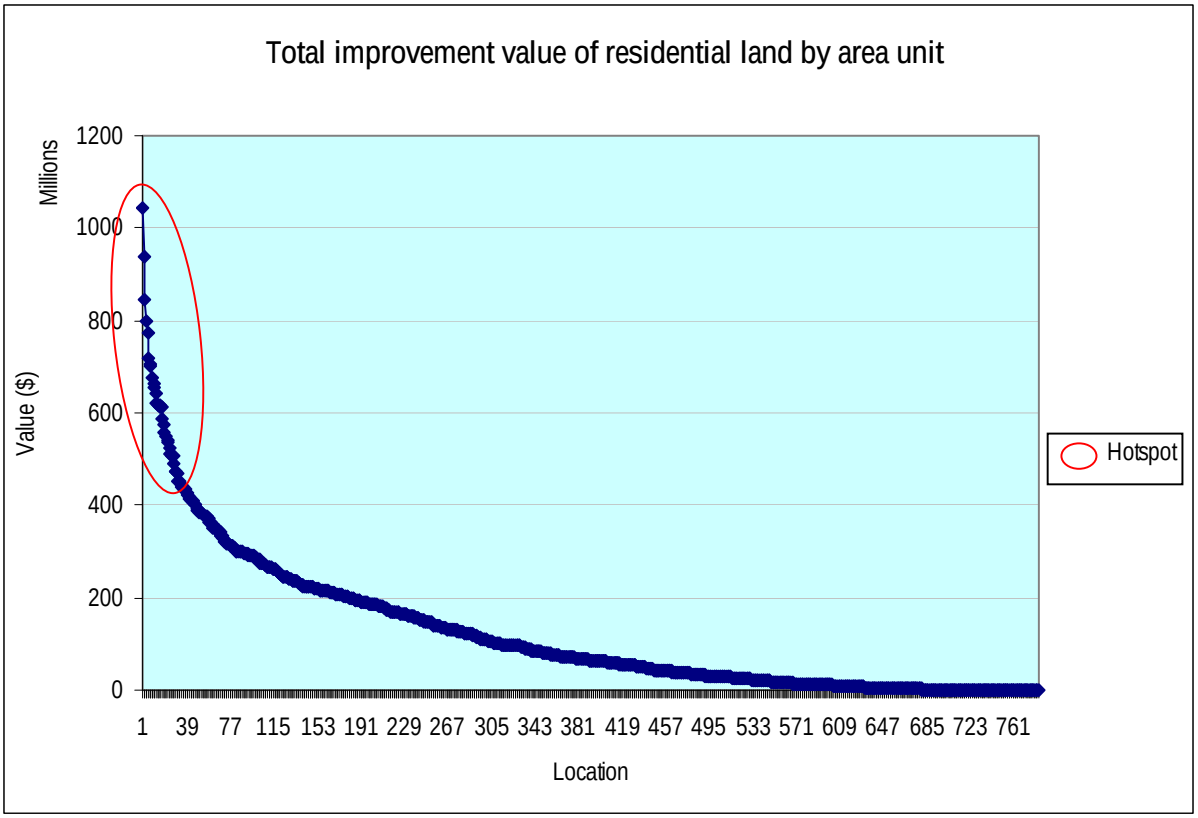


Figure 62: Total improvements value for all residential and lifestyle properties within 1 km of the coast at area unit level (Quotable Value Ltd data).

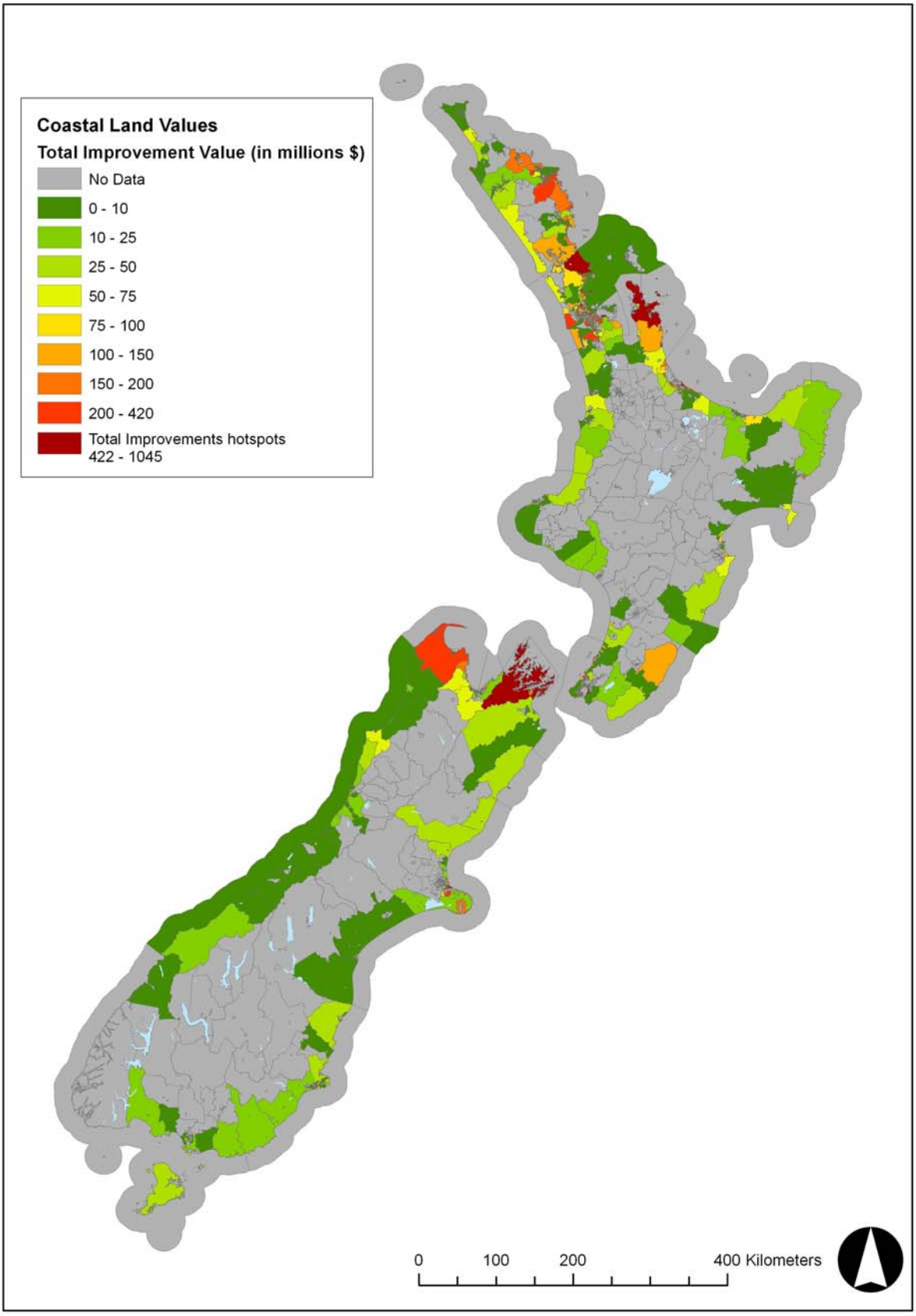


Figure 63: Average land area for residential or lifestyle property within 1 km of the coast at area unit level (Quotable Value Ltd data).

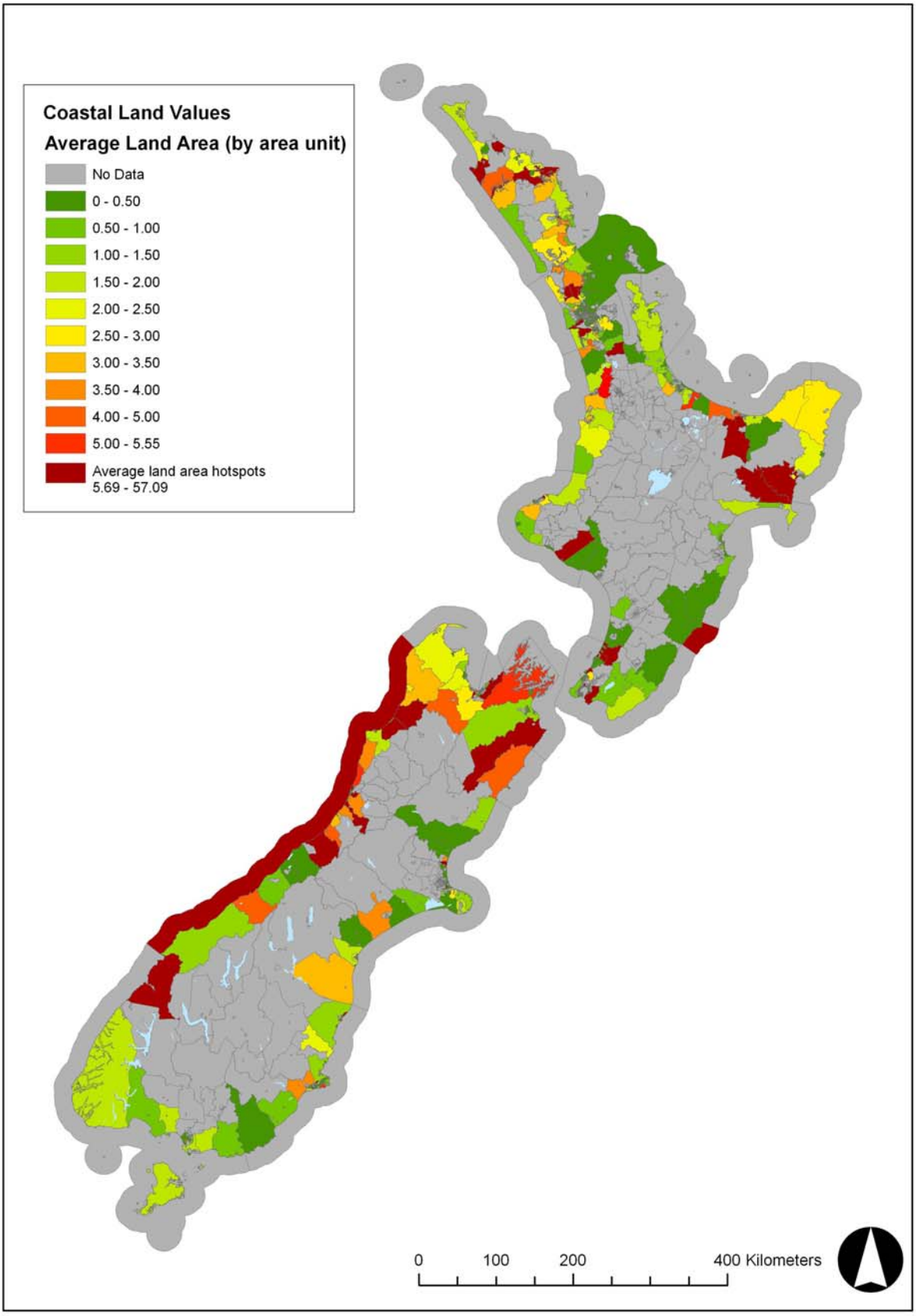
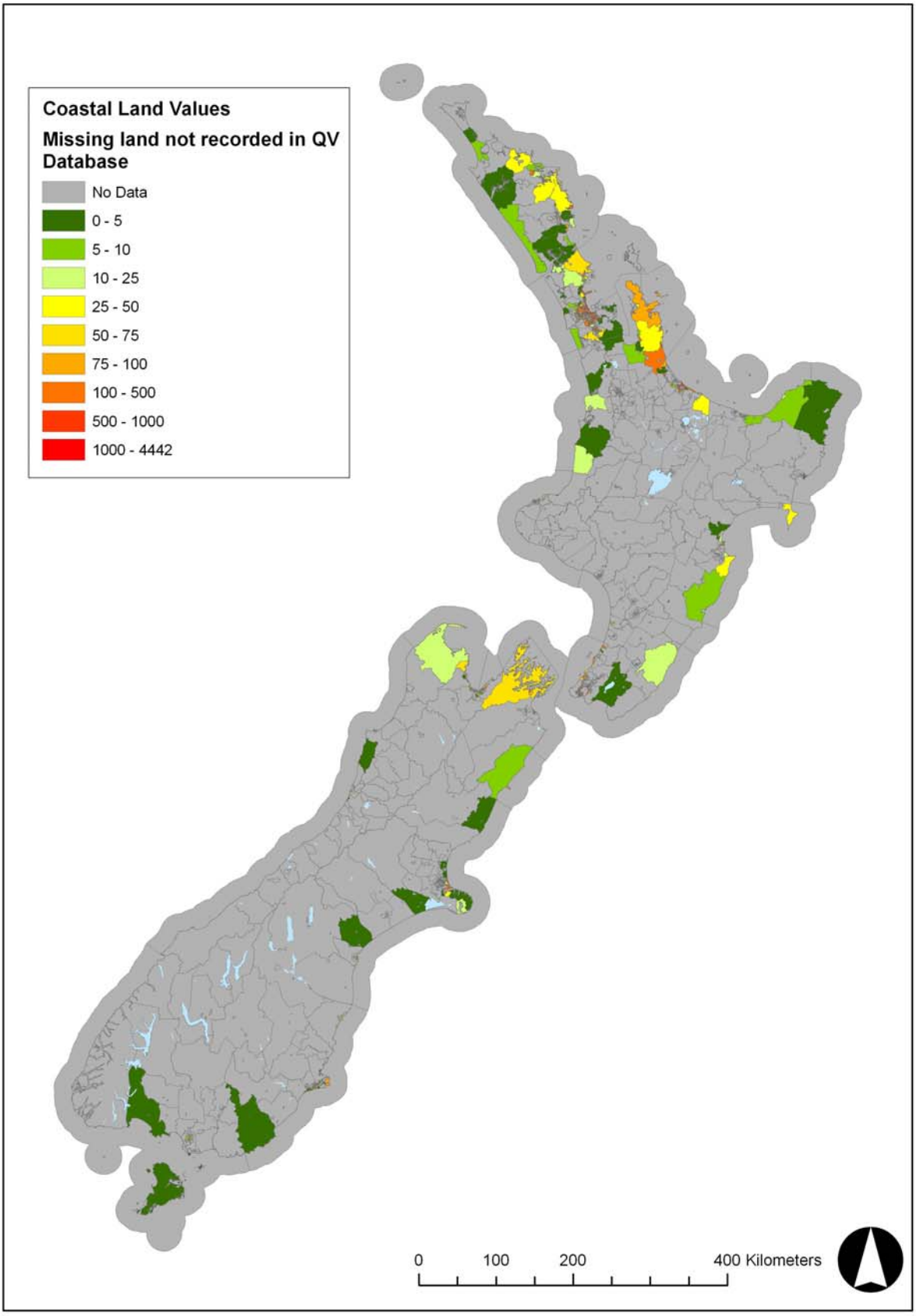


Figure 64: Number of properties without land area recorded, for all residential and lifestyle properties within 1 km of the coast at area unit level (Quotable Value Ltd data).



Appendix B: Economic Value Added By All Industries (Including Non Coastal)

Figure 65: Overall trend of value added by all industries (including non coastal) at area unit level (Statistics New Zealand data).

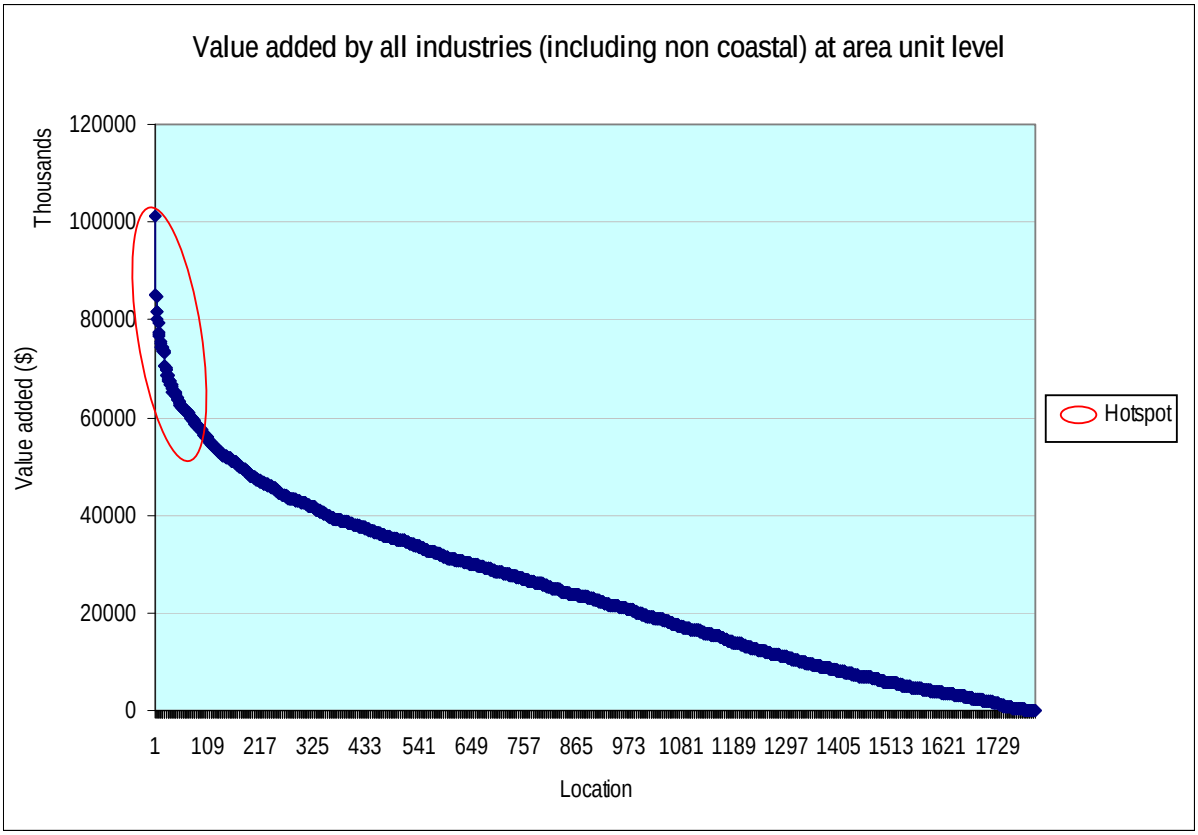
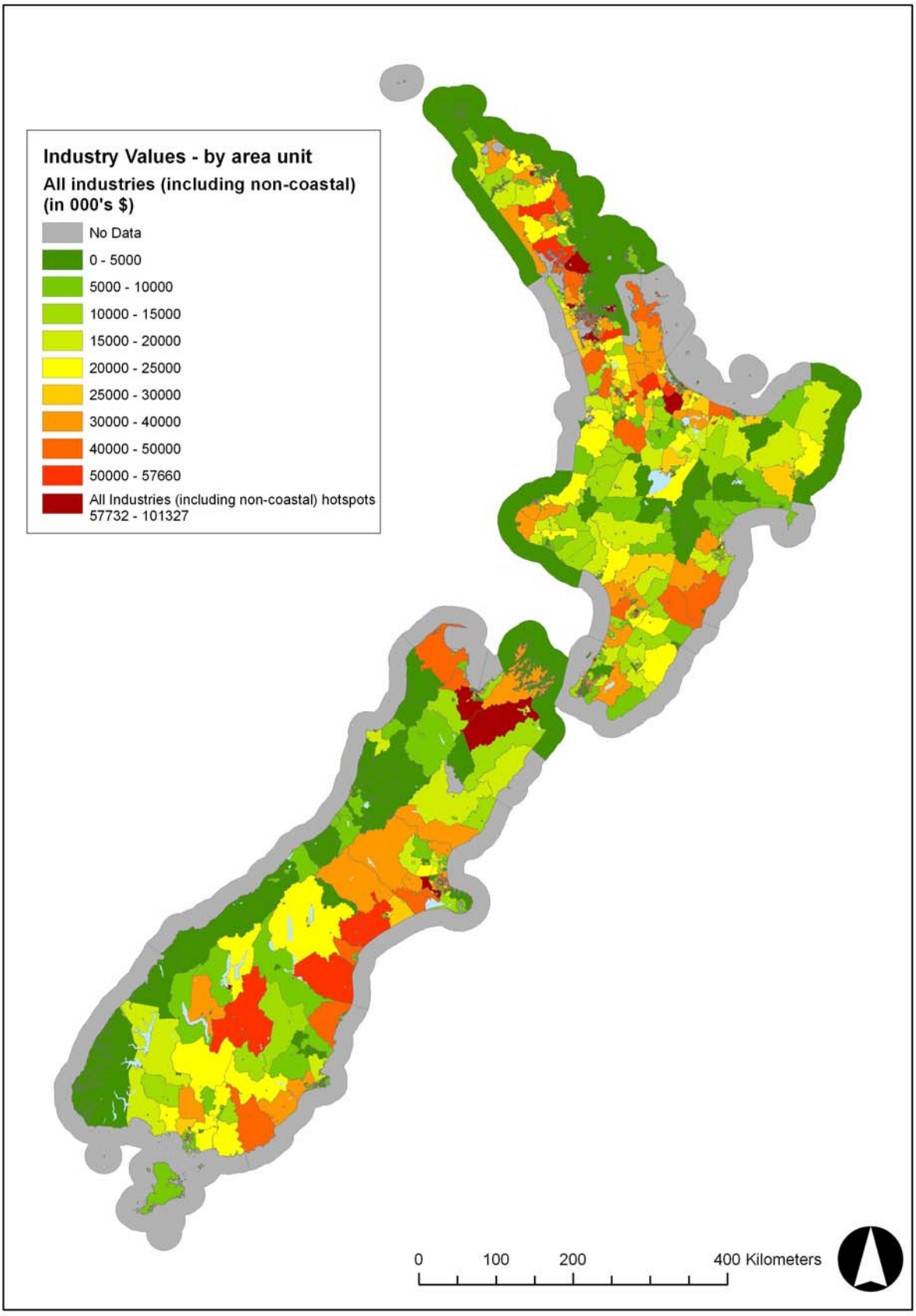



Figure 66: Economic value added by all industries (including non coastal), based on employment as at 2006 census by area unit level (Statistics New Zealand data).