

# Mapping the Values of New Zealand's Coastal Waters. 2. Economic Values

MAF Biosecurity Technical Paper No: 2009/05

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ISBN 978-0-478-33877-5 (Online)  
ISSN 1177-6412 (Online)

June 2009

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<b>Abstract</b>	<b>1</b>
<b>1 Introduction</b>	<b>3</b>
1.1 Objectives	4
1.2 Sub-components of economic value	4
<b>2. Methods</b>	<b>6</b>
2.1 Subcomponent and dataset selection	6
2.2 Extent of study area	8
2.3 Calculation of coastal industry added-value	14
2.4 Calculation of fisheries value at risk	20
2.5 Calculation of residential land value	26
<b>3 Results</b>	<b>28</b>
3.1 Coastal industry added-value	28
3.2 Fisheries value at risk	38
3.3 Residential land value	42
<b>4 Discussion</b>	<b>44</b>
4.1 Coastal industry Added-value	44
4.2 Fisheries value at risk	47
4.3 Residential land value	47
<b>5. Acknowledgements</b>	<b>48</b>
<b>6. References</b>	<b>48</b>
<b>Appendix A ANZSIC96 Classification</b>	<b>51</b>
<b>Appendix B MFish QMS and non-QMS Species Value at Risk</b>	<b>71</b>
<b>Appendix C Area units excluded from Residential Land Value dataset</b>	<b>74</b>

Figure 1:	Sub-components of economic value	5
Figure 2:	Geographic division of New Zealand into area units based on the 2006 Digital Boundaries Geospatial Dataset. Insert shows detail of area units within the Auckland region (Coloured sections show regional council and unitary authority boundaries).	10
Figure 3:	Combined Finfish and Shellfish Fisheries Statistical Areas (FSA) used to map indicators of fisheries value at risk	11
Figure 4:	Rock Lobster Fisheries Statistical Areas (FSA) used to map indicators of fisheries value at risk	12
Figure 5:	Eel Fisheries Statistical Areas (FSA) used to map indicators of fisheries value at risk	13
Figure 6:	Census 2006 questions regarding employment. These questions formed the basis for employment data purchased for the derivation of Coastal Industry Added-Value	18
Figure 7:	Decision rule for selection of method to estimate Fisheries Value at Risk per kilogram (KV) depending on species and available price data.	23
Figure 8:	Regression Fit for Quota Share Price, used in the calculation of Fisheries Value at Risk	24
Figure 9:	Non QMS Value at Risk (VAR) as a function of free on board (FOB) export price	25
Figure 10:	Economic value added by Water Transport Industry (international sea transport, coastal water transport and inland water transport), based on employment as at 2006 census (Statistics New Zealand data).	29
Figure 11:	Economic value added by Services to Water Transport Industry (stevedoring, water transport terminals, port operations and services to water transport) in the upper and central North Island, based on employment as at 2006 census (Statistics New Zealand data).	30
Figure 12:	Economic value added by Oil & Gas Extraction Industry in the Taranaki region, based on employment as at 2006 census (Statistics New Zealand data).	31
Figure 13:	Economic value added by Exploration Industry in the Taranaki region, based on employment as at 2006 census (Statistics New Zealand data).	32
Figure 14:	Economic value added by Marine Fishing nec (not elsewhere classified), based on employment as at 2006 census by territorial local authority (Statistics New Zealand data) (In this figure Marine Fishing does not include Rock Lobster Fishing, Finfish Trawling, Squid Jigging or Line Fishing).	35
Figure 15:	Economic value added by the Aquaculture Industry, based on employment as at 2006 census by territorial local authority (Statistics New Zealand data).	36
Figure 16:	Economic value added by the Boat Building Industry, based on employment as at 2006 census by territorial local authority (Statistics New Zealand data).	37
Figure 17:	Combined Finfish and Shellfish Species Value At Risk based on the statistical areas to which catches are reported (Ministry of Fisheries data).	39
Figure 18:	Eel Species Value At Risk based on the statistical areas to which catches are reported (Ministry of Fisheries data).	40
Figure 19:	Rock Lobster Species Value At Risk based on the statistical areas to which catches are reported (Ministry of Fisheries data).	41
Figure 20:	Total land value for coastal area units based on ArcMap quintile distribution analysis (Quotable Value Ltd data).	43

<b>Tables</b>		<b>Page</b>
Table 1:	Selected sub-components of economic value and their associated datasets	7
Table 2:	Industries selected to determine Coastal Industry Added-Value	15
Table 3:	Industries aggregated by industry classification	16
Table 4:	Industries aggregated by district	17
Table 5:	Coastal industries and the corresponding high level industries used to derive labour productivity values ( $TVA_i$ /employee)	20
Table 6:	Example of residential land value data (\$)	27
Table 7:	Sample data from 2006 Census, showing population employed per area of usual residence, showing effect of rounding and confidentiality suppression	46



## Abstract

Introduced species are recognised as one of the greatest threats to natural environments worldwide. New Zealand's ability to assess and manage these risks is significantly hampered by a lack of detailed information on the resources that should be protected: Which species are of greatest concern? What values are at risk? Where should surveillance monies be concentrated? Which incursion can or should be responded to?

To help address these questions and thereby improve risk management in the marine environment, MAF Biosecurity New Zealand (MAFBNZ) commissioned research to map the economic, environmental, social and cultural values associated with New Zealand's coastal and marine environments.

This project has generated a set of geographically-specific indicators of economic value at risk from non-indigenous marine pests that may become established in New Zealand waters. The economic indicators are a subset of a wider set of indicators incorporated into a Geographical Information System (GIS) database system designed to facilitate decision making by MAF Biosecurity New Zealand. The economic indicators describe three components – Coastal Industry Added-Value (derived from 2006 Census – Statistics New Zealand data), Fisheries Value at Risk (derived from Ministry of Fisheries data) and Residential Land Value (derived from Quotable Value Ltd data). These components are mapped to three GIS layers that indicate the values at risk at various levels of data aggregation.

Value added data were available only at a national level, so Coastal Industry Added-Value was derived indirectly using local employment data and national value added data at an industry level. This assumes uniform labour productivity across geographic units, but the results nonetheless provide a reasonable indicator of the annual flow of economic value added from coastal industries. Fishing activity, however, is highly seasonal, and employment data from the Census is unlikely to capture adequately the economic value of fishing. Thus, fisheries value at risk was estimated by fisheries statistical area using catch per area unit and a per kilogram value derived from prices of fisheries quota shares and export prices. The value of coastal land is the third sub-component of economic value estimated, because some portion of this value is potentially at risk from adverse effects of non-indigenous species. Valuation data was obtained from Quotable Value NZ for all residential and lifestyle properties within 1 km of the coast and normalised to 2007 values using a housing price index based on sales in the first half of 2007. The total unimproved value of such properties within an area unit was selected and mapped as an indicator of economic value at risk.

The indicators of each sub-component of economic value have been mapped using a Geographic Information System, enabling the user to identify the nature and magnitude of economic value at risk from an incursion of a non-indigenous marine species. Within the fisheries GIS layer, the user can select the species at risk to display the geographic distribution of value at risk. The coastal industry added-value data can also be displayed for each specific coastal industry.

The three resulting sets of indicators are neither additive nor comprehensive. Whereas the coastal industry data represents annual flows of economic value, the fisheries and residential land values represent the long-term value of assets that are potentially at risk. Non-market components of total economic value have been mapped qualitatively in the social value mapping project, because quantitative data are not available to map these components.

The indicators are a snap-shot of information held at the time of compilation. It is recommended the data be updated and supplemented periodically.



# 1 Introduction

New Zealand, as a consequence of its position – geographic isolation, geology and oceanic surrounds – has a great diversity of marine habitats inhabited by an estimated 65,000 species, many unique to New Zealand (Arnold 2004, Gordon in press). This geographic isolation also means that more than 98 percent of goods are transported by shipping (Statistics New Zealand 2006), which makes New Zealand's marine environment potentially vulnerable to the arrival of non-indigenous species.

Introduced species are now recognised as one of the greatest threats to natural environments worldwide (Wilcove et al. 1998, Mack et al. 2000, Gordon in press). The extent of the threat imposed by an actual or potential incursion of an alien marine species will vary depending on the species, available habitat(s) and the environment(s) that are threatened. New Zealand's ability to assess and manage these risks is significantly hampered by a lack of detailed information on the resources that should be protected: Which species are of greatest concern? Where should surveillance monies be concentrated? Which incursion can, or should be responded to?

MAF Biosecurity New Zealand (MAFBNZ), the agency charged with the management of introduced species across New Zealand, has established a programme to develop a multi-disciplinary Marine Biosecurity Decision Support Tool, comprising three projects:

1. Identification and mapping of four core values: **environmental, economic, social and cultural values.**
2. Identification of the marine species that may present a threat to these values; the possible mechanisms for their introduction, likelihood of establishment and the likely impacts if they establish in New Zealand waters.
3. Procedures for assessing the risk posed by incursions of new organisms to the identified values of New Zealand's marine environment.

The tool will be used for preventive purposes, i.e. risk management and contingency processes, as well as incursion responses.

The first stage of this programme – marine value mapping – aims to understand the range of elements that are at risk. This report documents the findings of the project to map the **economic** value of New Zealand's marine environment, such as infrastructure, shipping and commercial fishing. The three companion values mapping studies (social, cultural and environmental) are reported separately.

A key feature of the mapping project is that the values are to be spatially displayed using a geographic information system (GIS), providing a visual representation of the underlying database of information.

Although this project has a focus on marine biosecurity, it will also provide opportunities for broader applications, by establishing a comprehensive database of marine resources and their values that can be applied to a variety of coastal zone impacts, enabling better integration of coastal zone management.

## 1.1 OBJECTIVES

The overall objective of this project was to determine the perceived economic value of New Zealand's marine environment.

### 1.1.1 Specific objectives

1. To identify the sub-components of economic value for New Zealand's marine systems.
2. To determine the data holdings for the sub-components of economic value, and purchase and/or collate selected data.
3. Use a Delphic process to value the sub-components for which data was collected.

## 1.2 SUB-COMPONENTS OF ECONOMIC VALUE

The marine and coastal environments of New Zealand are valuable from an economic standpoint because they provide a range of goods and services that contribute to the well-being of New Zealanders, and which are part of the market economy. These goods and services include housing, recreation and tourism, ports, fishing and many other industries. Determining the actual or perceived values of an ecosystem or its sub-components, and utilising this information to prioritise management, can be an effective method to aid biosecurity management and decision making (Delorus et al. 2007).

The total economic value (TEV) of a natural resource is the sum of its use and non-use components (see, e.g. Pearce 1991 and Groombridge 1992, cited in Torras 2000).

Use components are related to direct and indirect use of the resource. Examples of direct uses of coastal and marine environments include fishing, aquaculture, tourism, swimming, and recreational boating. While these usually have some market activity associated with them, e.g. from the purchase of supplies, travel and accommodation, the output itself is not directly priced in the market (except where it is provided by a commercial tourism operator).

Indirect use value is associated with benefits that individuals experience indirectly, or as a consequence of the primary function of a given resource (Torras 2000). For example, the ocean's ability to sequester carbon from the atmosphere yields positive value by helping to regulate the global climate. Another example of indirect use value is the scenic landscape associated with the coastal environment; some of this value is reflected in the value of coastal property, as described in the next chapter.

Non-use value can be broadly grouped into two components:

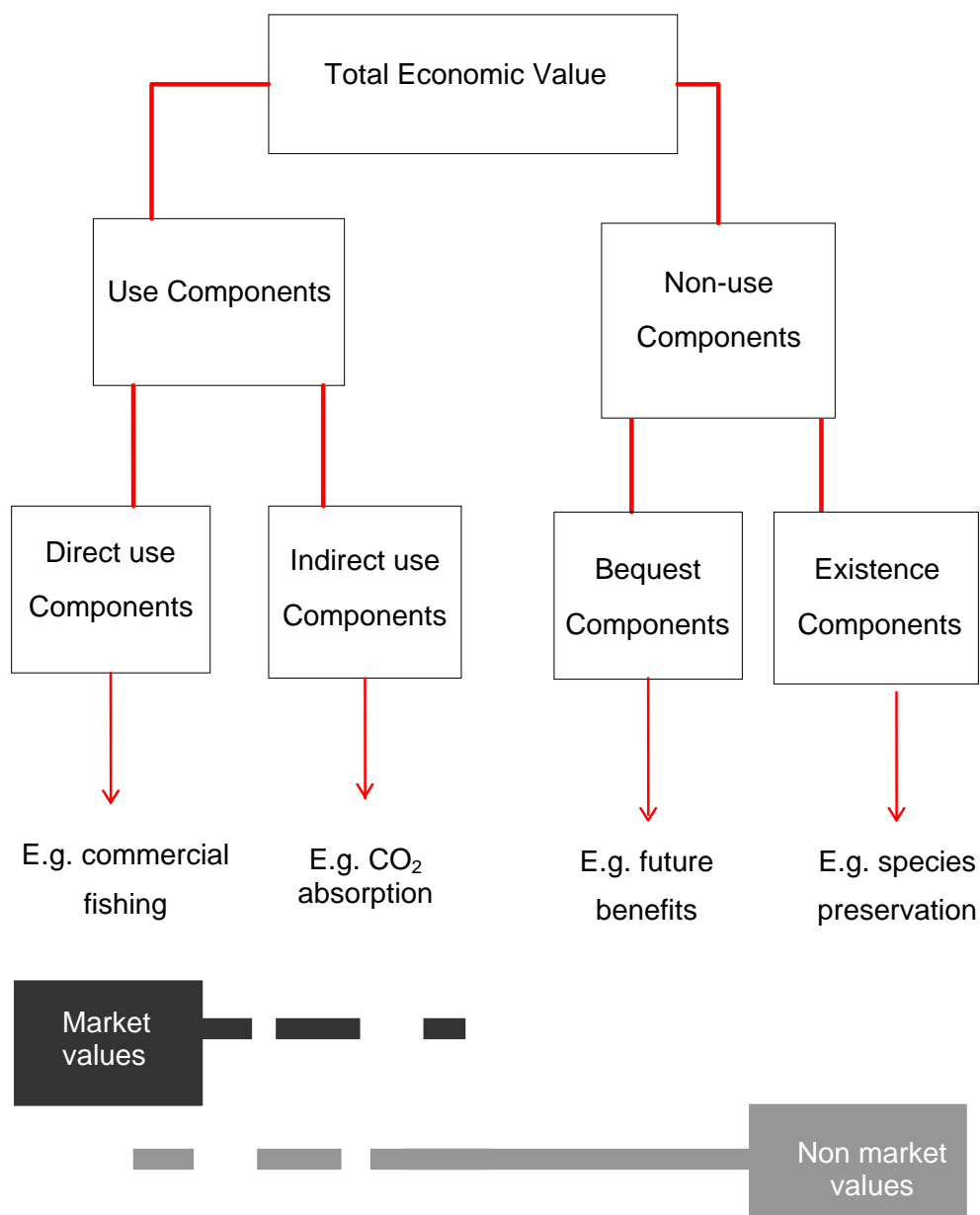
- Bequest components (sometimes called "option value") are benefits from ensuring that certain goods will be available for future generations. For example, communities concerned with future damages from global warming, or invasive species leading to loss of amenity or extinction of a native species, would be willing to pay to reduce those damages, despite the fact that the vast majority of the damage is expected to affect the earth long after their generation has passed away. Policies associated with either long-term or irreversible impacts can lead to losses that consist primarily of bequest value (Dziegielewska et al. 2007).
- Existence value reflects benefits from simply knowing that a certain good or service exists. For example, some people derive satisfaction from the fact that many endangered species are protected against extinction. Many people are willing to pay for protection of these species' habitats, even those located in remote, hard to access areas. Although those

placing the value will most likely never travel to these places, or see the species, they nonetheless value the knowledge that such species exist (Dziegielewska et al. 2007).

Figure 1 shows the relationship between use and non-use components within total economic value.

The lower part of Figure 1 shows that, while most direct use components arise from market (i.e. commercial) activities, i.e. where goods and services are traded and hence priced in the market economy, some direct use activities, such as recreational swimming, fishing and boating, involve non-market values. Conversely, non-use components of total economic value of a resource generally involve non-market values.

Figure 1: Sub-components of economic value



Although many of these use and non-use values are not reflected in market prices, techniques have been developed to estimate their value in financial terms. Within resource management, ecosystem valuation (using economic valuation techniques) has progressed steadily over the last two decades (e.g. Anon 2004, Emerton & Bos 2004, MacKinnon et al. 2004, Pagiola et al. 2004). A combination of delphic processes and economic valuation techniques have been used successfully to value environmental and social aspects of ecosystems (e.g. Hanley et al. 1998, McCracken & Abaza 2001, Navrud & Ready 2002).

These quantitative techniques notwithstanding, after reviewing the availability of data (see next section), a conscious decision was taken in consultation with MAFBNZ to map non-market values in a companion project on Social Value Mapping, using qualitative methods. Including those values in this project as well could have resulted in a considerable amount of double-counting. Hence, this project to identify “economic” indicators addresses only components of market value associated with coastal and marine environments.

## 2. Methods

### 2.1 SUBCOMPONENT AND DATASET SELECTION

A delphi process<sup>1</sup> was used to identify subcomponents, associated datasets and suitable data analysis methods for use in the project. An expert focus group was convened, as the first stage in this process, to identify potentially important economic subcomponents. During a workshop, the experts refined potential subcomponents of economic value of New Zealand’s marine environment and identified potential data sources and agencies that might hold information relevant to the project. The economic subcomponents were broadly divided into market and non-market components, in line with Figure 1.

A data search confirmed that very limited quantitative data was held nationally for non-market activities, including both the non-market value of the activity and the number of users. Significant effort would be required to identify and extract data from research and survey reports (national and international) and, given the limited data, there would be significant uncertainty in extrapolating quantitative valuations to a national scale. It was therefore decided, in conjunction with MAFBNZ, that the non-market activities would be valued qualitatively, under the umbrella of the Social Values Mapping Project.

Following review of the available data sources for market components, and discussion with MAFBNZ, it was decided that quantitative valuation would proceed for three subcomponents. The subcomponents, and the datasets purchased for the analysis, are described in Table 1.

It should be noted that these components are *indicators* of economic value, and are neither additive nor comprehensive. The application and limitations of the data are discussed further in Section 4.

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<sup>1</sup> A Delphi process is a method for structuring a group communication process to allow a group of individuals, as a whole, to reach a considered view on a complex problem or question. The structured communication typically involves some degree of anonymity for the individual responses; feedback on individual contributions of information and knowledge; an opportunity for individuals to revise views; and some assessment of the group judgment or view (Linstone & Turoff 1975).

**Table 1: Selected sub-components of economic value and their associated datasets**

Subcomponent	Datasets purchased for analysis	Description
Coastal Industry Added-Value <sup>2</sup>	<p>Employment data: employed population for selected industries by geographic area units, available from the 2006 Census of Population and Dwellings. Source: Statistics New Zealand (SNZ).</p> <p>Industry productivity data. Source: SNZ.</p>	<p>This sub-component provides an indicator of the value added for commercial (market) activities of selected industries associated with the coast. Value-added comprises the returns to management (entrepreneurship), labour, capital invested and natural resources used in a particular year.</p> <p>This is not measured directly by data, but may be inferred on the basis of labour productivity within the industries, which provides an estimate of the total annual value added derived from commercial activity. This indicator therefore includes both the opportunity cost of resources and any economic surplus (pure profit) associated with those activities.</p> <p>The methodology, including industry selection, is described in Section 2.3.</p>
Fisheries Value at Risk	<p>Fisheries catch data, available from the Catch Effort Landing Return (CELR) database. Source: Ministry of Fisheries (MFish).</p> <p>Quota Management System (QMS) quota share prices, and free on board (FOB) export prices data for seafood exports. Source: New Zealand Seafood Industry Council (SEAFIC).</p>	<p>This sub-component provides an indicator of the value of each fishery within the 200 mile New Zealand Exclusive Economic Zone (EEZ). This indicator represents pure rent, i.e. value over and above the normal return to labour and capital, and is an estimate of the present value of future income streams over an indefinite period of time (compared to the Coastal Industry Added-Value, which is an annual value).</p> <p>This approach was used because the commercial fisheries value at risk is not well captured by the application of the value added/labour productivity approach applied to coastal industry. For consistency purposes, data and costs prevailing at the time of the 2006 Census were used for the analysis.</p> <p>The methodology is described in Section 2.4.</p>
Residential land value	<p>Residential land value for all residential properties within 1 km of the coastline of New Zealand. Source: Quotable Value Ltd (QV)</p>	<p>This sub-component provides an indicator of amenity values associated with coastal locations, on the basis that proximity to the coast increases property value.</p> <p>The methodology is described in Section 2.5.</p>

<sup>2</sup> “Value added” is synonymous with “Added-Value”; the two terms are used interchangeably in this report. It is the return to the factors of production (land, labour and capital), i.e. the difference between total revenue and the cost of material inputs.

## 2.2 EXTENT OF STUDY AREA

The study area for the wider values mapping project suite includes the entire coastline and estuarine region of New Zealand, including the North, South and Stewart Islands, as well as the Three Kings, Kermadec, Chatham and sub-Antarctic Islands. The coastal zone of importance for economic value is defined by both the extent of human activities on-shore and offshore, and biological activities offshore where the effects are felt on-shore.

Human activities extend without limit offshore, but the marine habitats most likely to be impacted by incursion events are the coastal and shelf systems. Most human activities occur inside 12 nautical miles (the territorial sea) and/or the edge of the continental shelf (depth profile of 250 m). This is the outer boundary used in the environmental values mapping projects.

The inshore boundary of the coast is defined in terms of human activities that are on land and are affected by the quality of the proximate coast. The extent of this zone varies with activity. For example, the coastal zone relevant to commercial activities is determined by industries that are defined as having some reliance on coastal or marine resources, which could be located anywhere in New Zealand. By comparison, the coastal zone relevant to coastal property values is more directly dependent on physical proximity to the coast; for the purposes of this study we assumed a inshore boundary of 1 km from the coast.

For this economic value mapping project, the nature of the sub-components selected and the availability of the associated datasets dictated the geographic area units analysed within the project, as follows:

- The datasets purchased from Statistics New Zealand (SNZ) and the Quotable Value (QV) for analysis of Coastal Industry Added-Value and Residential Land Value were based on geographical units contained in the New Zealand 2006 Digital Boundaries Geospatial Dataset. The geographical units are described in Section 2.2.1.
- The dataset purchased from the MFish Catch Effort Landing Return (CELR) database, for the derivation of Fisheries Value at Risk, was purchased for each Fisheries Statistical Area (FSA). Each species group reports catches to a unique FSA. In this project, harvests in the EEZ were attributed to three generic species groups: finfish and shellfish, rock lobsters, and eel species. Section 2.2.2 describes these three geographic catch reporting systems.

### 2.2.1 Land-based geographical units

The New Zealand 2006 Digital Boundaries Geospatial Dataset is created and maintained by SNZ and Land Information New Zealand as the definitive geographic classification for New Zealand. The dataset is based on a meshblock pattern, stored in GIS software.

Meshblocks are the smallest geographic unit in the dataset, and the smallest unit for which statistical data is collected and processed by SNZ. A meshblock is a defined geographic area, varying in size from part of a city block to large areas of rural land. Each meshblock abuts against another to form a network covering all of New Zealand including coasts and inlets, and extending out to the EEZ. Meshblocks are added together to 'build up' larger geographic areas such as area units and urban areas (shown in Figure 2). They are also the principal unit used to draw-up and define electoral district and local authority boundaries<sup>3</sup>.

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<sup>3</sup> Statistics New Zealand. *Glossary Term: meshblock* <http://www2.stats.govt.nz/domino/external/omni/omni.nsf/wwwglsry/meshblock>

Area units are aggregations of meshblocks with unique names. They are non-administrative areas intermediate between meshblocks and territorial authorities. Area units must either define or aggregate to define urban areas, rural centres, statistical areas, territorial authorities or regional councils. Each area unit must be a single geographic entity with a unique name. Area units of main or secondary urban areas generally coincide with communities of interest or parts thereof. Area units within urban areas normally contain a population size of 3,000-5,000<sup>4</sup>.

For this project, data from SNZ and QV was purchased and analysed at area unit level, except where SNZ confidentiality rules meant that data needed to be aggregated to larger geographic units (see Section 2.3.2). Although the Geospatial dataset includes geographical units within the sea (out to the EEZ), the nature of the data purchased (employment data from SNZ and residential land value from QV, as described in Table 1) means that the actual data received was confined to land-based area units only. That is, the employed population data purchased from Statistics New Zealand (SNZ) and the Quotable Value (QV) dataset contained data only in those area units that were land-based, except for a small subset of marine areas that appear to have been included in error (see 2.4 below).

The 2006 digital boundaries included the North and South Island, and Stewart Island. The Three Kings, Kermadec, Chatham and sub-Antarctic Islands were not available in the 2006 dataset.

### 2.2.2 Sea-based geographical units

Fisheries catch data is collated in the CELR database by Fisheries Statistical Area (FSA) within the EEZ. For each species group, fishers report catches to a unique FSA. In this project, harvests in the EEZ were attributed to three generic species groups: finfish and shellfish, rock lobsters, and eel species, as described in detail in the methodology in Section 2.4.

For finfish and shellfish (Figure 3), the study area encompasses the entire EEZ as collectively these species are harvested throughout the EEZ. The methodology described in Section 2.4 used the top 15 species by greenweight (i.e. weight at harvest) in each FSA. Figure 3 shows the FSAs used in the derivation of fisheries value at risk for finfish and shellfish (combined).

The Ministry of Fisheries' statistical reporting areas for rock lobster and eel species are not compatible with the FSA definitions for shellfish and finfish, and hence estimates of value at risk for rock lobster and eel species were compiled and mapped separately. The different geographic configuration of FSAs for these species stems from the origins of the Quota Management System in the mid-1980s. Figures 4 and 5 show the FSAs for rock lobsters and eel species, respectively, used in the derivation of fisheries value at risk.

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<sup>4</sup> Statistics New Zealand *Glossary Term: area unit* <http://www2.stats.govt.nz/domino/external/omni/omni.nsf/wwwglsry/Area+Unit>

Figure 2: Geographic division of New Zealand into area units based on the 2006 Digital Boundaries Geospatial Dataset. Insert shows detail of area units within the Auckland region (Coloured sections show regional council and unitary authority boundaries).

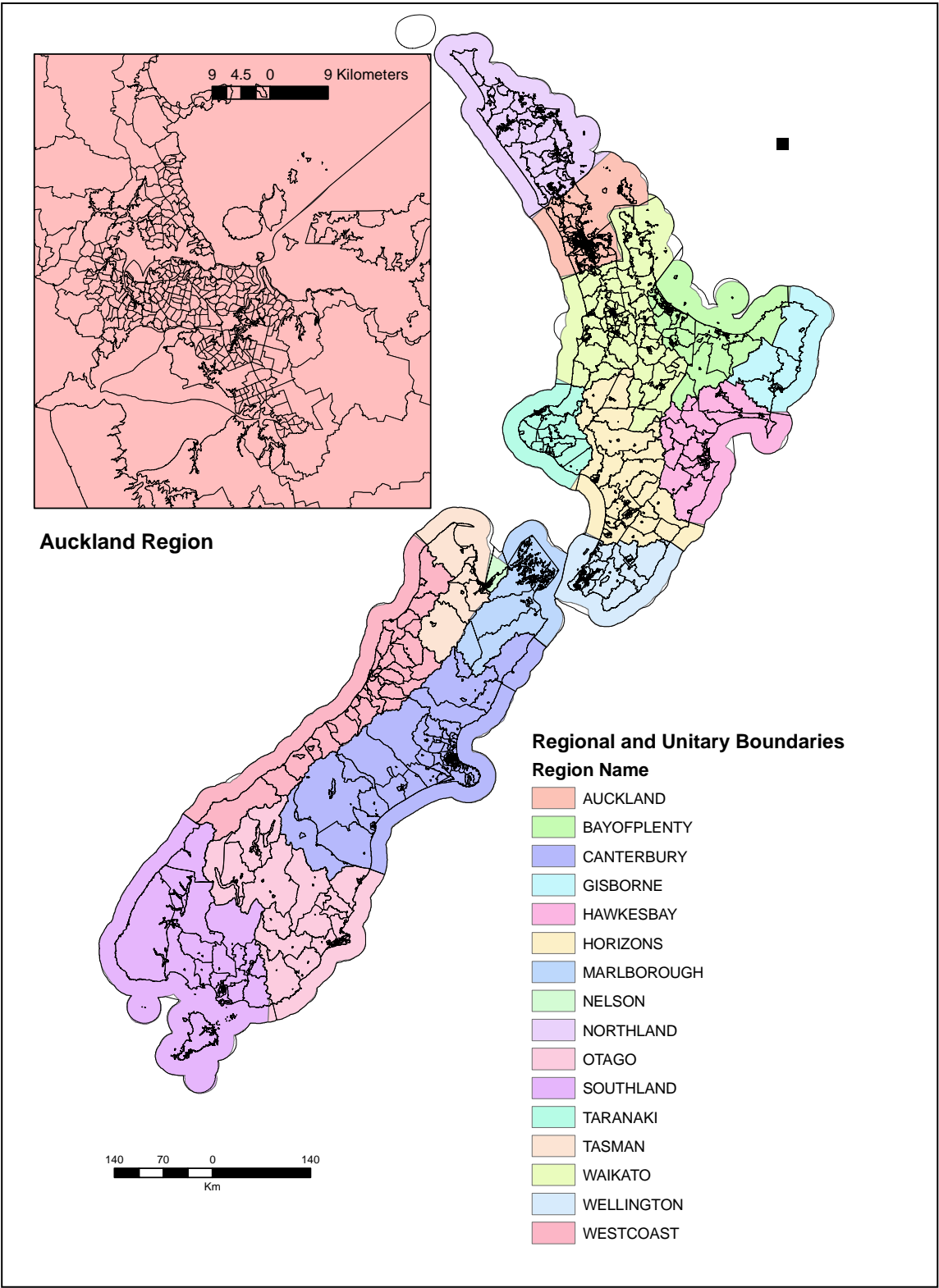




Figure 3: Combined Finfish and Shellfish Fisheries Statistical Areas (FSA) used to map indicators of fisheries value at risk

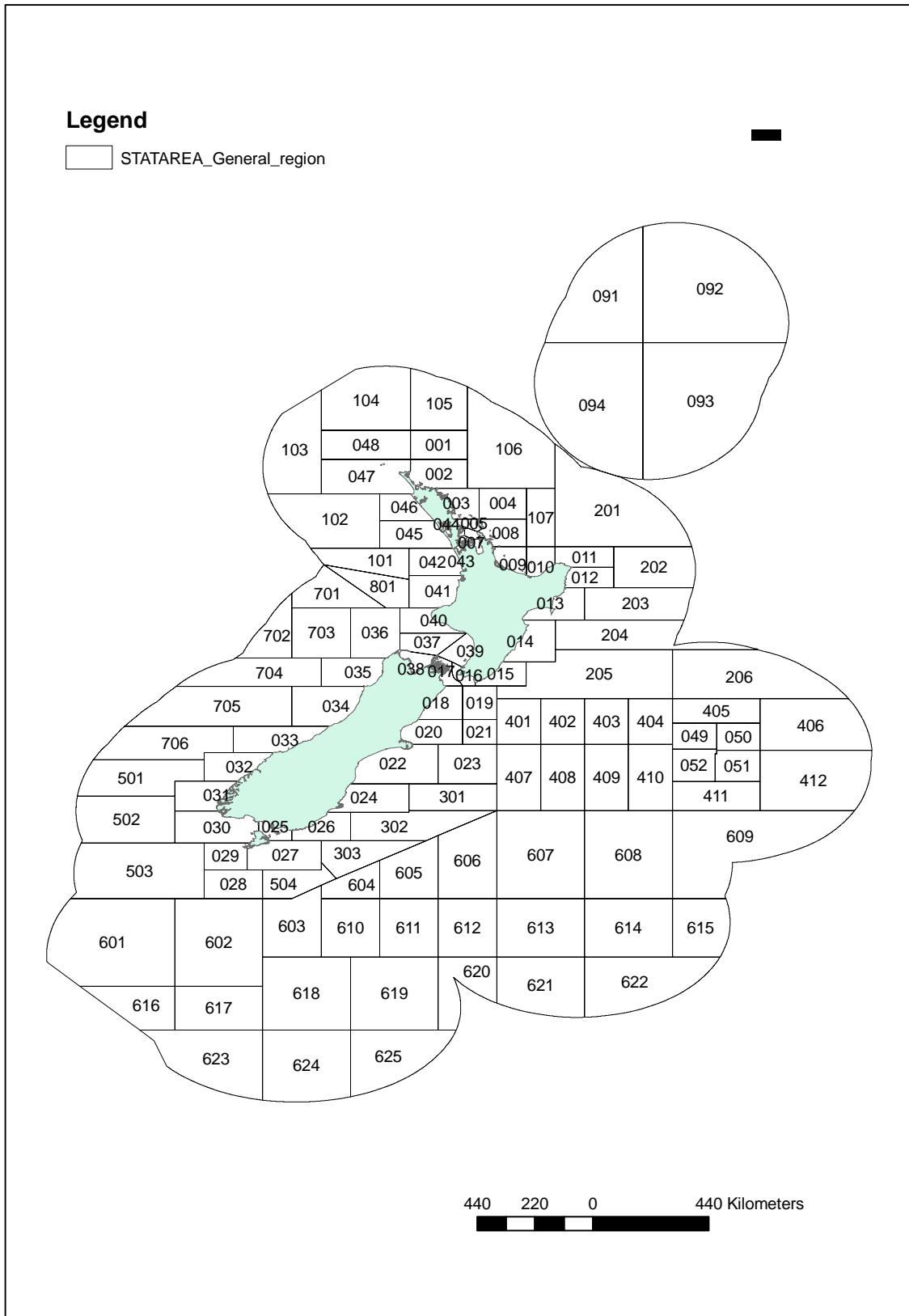


Figure 4: Rock Lobster Fisheries Statistical Areas (FSA) used to map indicators of fisheries value at risk

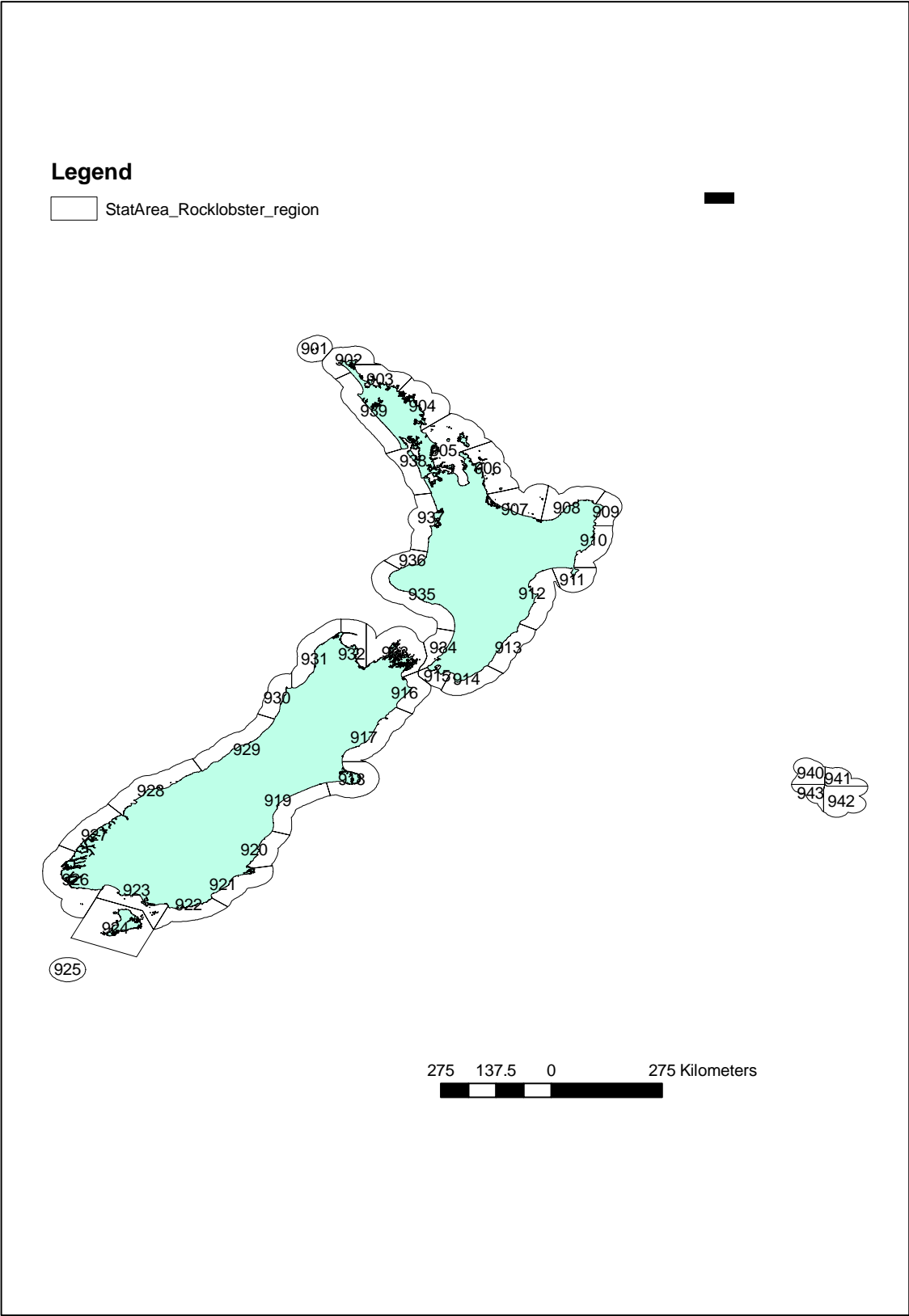
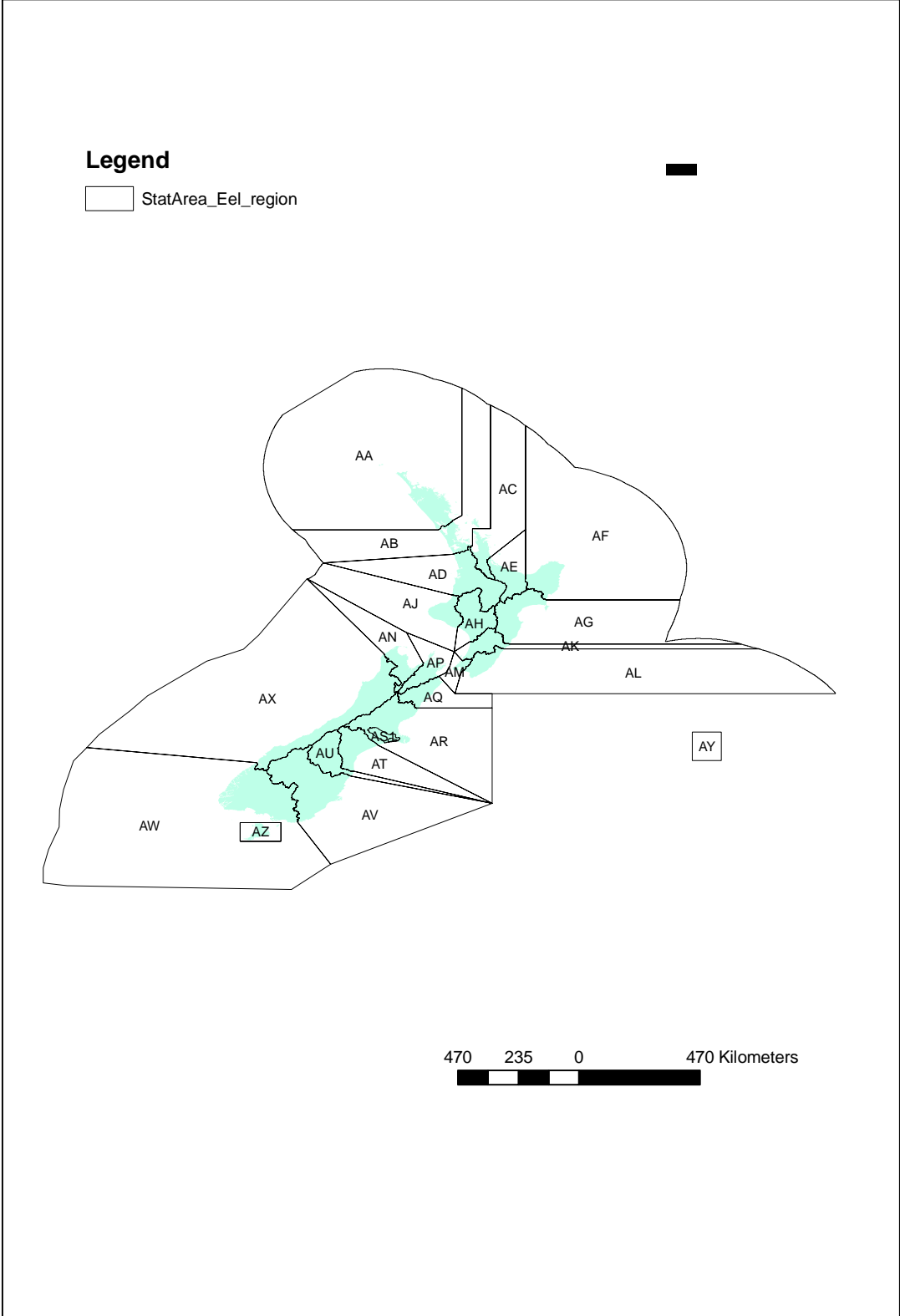


Figure 5: Eel Fisheries Statistical Areas (FSA) used to map indicators of fisheries value at risk



## 2.3 CALCULATION OF COASTAL INDUSTRY ADDED-VALUE

Conceptually, the Added-Value sub-component captures the annual added value of commercial activity that is reliant in some way on coastal or marine resources, where value added is defined as the returns to management (entrepreneurship), labour, capital and natural resources used in a particular year. As calculated, the sub-component provides an indicator of the value added for commercial (market) activities of selected industries associated with the coast.

Broadly speaking, the commercial activities associated with the coast include:

- Primary Industries
  - Fishing
  - Mining (including exploration)
- Manufacturing Industries
  - Fish Processing
  - Ship Building
- Service Industries
  - Accommodation and restaurants
  - Port Services
  - Recreation Industries
  - Mining services
  - Transport services

Value added comprises the returns to labour, capital (equity) and natural resources earned in a particular year. Regionalised value added data can be obtained by multiplying the number of people employed (and self employed) in an activity (industry) by the average labour productivity in that industry.

The population census provided employment numbers by industry in each area unit, as described in Sections 2.3.1 and 2.3.2. Labour productivity was derived from national income accounts data, as described in Section 2.3.3.

### 2.3.1 Selection of industries associated with the coast

The Australian New Zealand Standard Industrial Classification 1996, New Zealand Use (ANZSIC96) was reviewed to select industries that were reliant on or related to the coast. This classification provides a standard framework for classifying business statistical units by industry in official statistics. Businesses are assigned to an industry according to their predominant economic activity, under a structure comprising categories at five levels:

- Level 1 – Divisions (the broadest level)
- Level 2 – Subdivisions
- Level 3 – Groups
- Level 4 – Classes
- Level 5 – Sub-Classes (New Zealand only) (the finest level).

Further details on the classification, including the full industry list, are contained in Appendix A. Table 2 lists the industries selected for this study, and the rationale for their inclusion.

**Table 2: Industries selected to determine Coastal Industry Added-Value**

ANZSIC96 Industry Class (Level 4)		Selection Rationale
A0411	Rock Lobster Fishing	Target species is reliant on coastal habitat for at least part of its life cycle. Harvesting this species is a source of economic value.
A0413	Finfish Trawling	Target species occur within NZ EEZ <sup>a</sup> . Harvesting these species is a source of economic value.
A0414	Squid Jigging	Target species occur within NZ EEZ. Harvesting this species is a source of economic value.
A0415	Line Fishing	Target species occur within NZ EEZ. Harvesting these species is a source of economic value.
A0419	Marine Fishing nec	Target species occur within NZ EEZ. Harvesting these species is a source of economic value.
A0420	Aquaculture	Farming and harvesting these species is a source of economic value.
B1200	Oil and Gas Extraction	The coast is a source of raw materials. Managing and mining these resources is a source of economic value.
B1411	Gravel and Sand Quarrying	The coast is a source of raw materials. Managing and mining these resources is a source of economic value.
B1511	Petroleum Exploration (Own Account)	Many exploration activities occur on or near the coast. Managing and mining these resources is a source of economic value.
B1512	Petroleum Exploration Services	These are ancillary and support activities.
C2173	Seafood Processing	Industry is reliant on raw materials associated with the coast.
C2821	Shipbuilding	Industry is associated with the coast.
C2822	Boatbuilding	Industry is associated with the coast.
F4714	Fish Wholesaling	Industry is reliant on raw materials associated with the coast.
G5245	Marine Equipment Retailing	These are ancillary and support activities.
H5710	Accommodation <sup>b</sup>	The coast is a major tourism destination. Tourists purchasing services associated with their visit is a source of economic value.
H5720	Pubs, Taverns and Bars	
H5730	Cafes and Restaurants	
H5740	Clubs (Hospitality)	
I6301	International Sea Transport	Industry is associated with the coast.
I6302	Coastal Water Transport	Industry is associated with the coast.
I6622	Water Transport Terminals	Industry is typically associated with the coast.
I6623	Port Operations	Industry is associated with the coast.
I6629	Services to Water Transport nec	These are ancillary and support activities.

a. NZ EEZ = New Zealand Exclusive Economic Zone, i.e. the marine area in which the NZ government exercises jurisdiction over marine resources.

b. Accommodation includes Motels and Motor Inns (H571020), Hosted Accommodation (H571030), Backpacker and Youth Hostels (H571040), Caravan Parks and Camping Grounds (H571050), Accommodation nec (H571090)

nec = not elsewhere classified

### 2.3.2 Employed population per industry

For each industry identified in Table 2, data on the number of people employed (including self-employed) were purchased from SNZ from the 2006 Census of Population and Dwellings, conducted on 7 March 2006. Employment data was obtained for each industry, based on the assessment of returns to census questions 34 through 39, in respect of “the job that you worked the most hours in the seven days that ended on Sunday 5 March 2006” (see Figure 6).

SNZ provides employment data based on the area of usual residence and workplace address. All results reported in this report are based on the area of usual residence. This was considered more reliable than workplace addresses entered manually by census respondents, because census forms are generally completed and collected at places of residence.

The initial data request to SNZ was for employed population per unit area for each of the industries in Table 2. However, the application of SNZ’s confidentiality rules (see discussion in Section 4) suppressed a significant proportion of the data. It was therefore necessary in most cases to aggregate either industries (where like industries were grouped together) or areas (where specific industry data was required).

#### *Industries aggregated by industry classification*

Data on the industries in Table 3 were supplied and analysed at group level (Level 3, see Section 2.3.1) for each area unit. In some cases, the group included some industries that were not in the original selection (Table 2) i.e. the reported coastal economic value of these industries is over-stated to some extent by the inclusion of these non-coastal activities.

**Table 3: Industries aggregated by industry classification**

ANZSIC Industry Group (Level 3)		Industry Class (Level 4)	
		Shaded cells indicate industries not originally selected for analysis (see Table 2)	
B120	Oil and Gas Extraction	B1200	Oil and Gas Extraction
B141	Construction Material Mining	B1411	Gravel and Sand Quarrying
		B1420	Construction Material Mining nec
B151	Exploration	B1511	Petroleum Exploration (Own Account)
		B1512	Petroleum Exploration Services
		B1514	Mineral Exploration Services
I630	Water Transport	I6301	International Sea Transport
		I6302	Coastal Water Transport
		I6303	Inland Water Transport
I662	Services to Water Transport	I6621	Stevedoring
		I6622	Water Transport Terminals
		I6623	Port Operations
		I6629	Services to Water Transport nec

nec = not elsewhere classified

### *Industries aggregated by Territorial Local Authority (District)*

To overcome data suppression by SNZ confidentiality rules, data on the industries in Table 4 were supplied and analysed at Class level (Level 4) for each district (i.e. territorial authority area). That is, the employment data was aggregated by summing the employment data for the area units within a territorial local authority area.

**Table 4: Industries aggregated by district**

ANZSIC96 Industry Class (Level 4)	
A0411	Rock Lobster Fishing
A0413	Finfish Trawling
A0414	Squid Jigging
A0415	Line Fishing
A0419	Marine Fishing not elsewhere classified
A0420	Aquaculture
C2173	Seafood Processing
C2821	Shipbuilding
C2822	Boatbuilding
F4714	Fish Wholesaling
G5245	Marine Equipment Retailing

A key feature of the industry employment data is that the census data records the industry in which people were employed in March, the month of the census. This means that seasonal employment activities that peak in other months, such as fishing and aquaculture, are under-represented. This is a key limitation of this data and is discussed further in Section 4.





### 2.3.3 Industry productivity data

Industry value added data were sourced from Table 2 of the National Accounts' Inter-Industry Study 1996 (Statistics New Zealand 2001). The National Accounts are compiled and published by SNZ and record the nation's financial transactions, including gross domestic product (GDP) – the national income earned by production in New Zealand. Detailed industry-by-industry data is compiled periodically (less than annually); therefore data on industry productivity were sourced from the Inter-Industry Study 1996, the last major study of industry groups and classes.

The desired indicator is value added by a given coastal industry in a particular area unit. However, industry value added data is only available at national level and, for most of the coastal industries selected for analysis, only at a higher level of industry aggregation. The indicator was therefore defined as total value added from industry  $i$  in area unit  $j$  ( $TVA_{ij}$ ), as follows:

$$TVA_{i,j} = TVA_i * n_{ij} / N_i \quad (1)$$

where  $TVA_i$  is the total value added in industry  $i$  at a national level,  $n_{ij}$  is the number of employees in industry  $i$  in area unit  $j$ , and  $N_i$  is the total number of employees industry  $i$  at a national level. In other words, the total value added in a given industry is allocated to area units on the basis of the share of that industry's employees who reside in a given area unit.

Because data were only available for highly aggregated industries, a value of labour productivity ( $TVA_i$  per employee) was calculated for each of several high level industries. This value was then multiplied by the number of employees in specific coastal industries that are within the same general industry classification. In other words, the values for  $TVA_{ij}$  were derived by multiplying the number of employees for a given industry  $i$  in area  $j$  by the labour productivity value for the closest corresponding high level industry classification for which total value added data were available. Availability of data at different levels of aggregation meant that an intermediate step was performed, in which a value  $GDP_i$  was calculated as the total value added in an industry divided by the total compensation to employees. To get  $TVA$  per employee,  $GDP_i$  was scaled by a factor ( $k$ ) equal to the total earnings of employees divided by total filled jobs<sup>5</sup>.

The industry definitions used for  $GDP_i$  and  $k$  did not in all cases match exactly. The high level industries that were chosen for this purpose, and the coastal industries for which the derived  $TVA_i$  per person values were applied, are listed in Table 5. When this dataset is updated in future, MAFBNZ should explore with Statistics NZ whether employment and value added data can be obtained at the desired industry level, so that this intermediate step can be avoided.

The results of the coastal industry added-value analysis are presented in Section 3 of this report.

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<sup>5</sup>  $GDP_i$  was calculated from total value added and total compensation by industry from Statistics NZ (2001). Data for total earnings of employees and total filled jobs were obtained from Table 38 (LEED Measures by Industry) of the Statistics New Zealand Table Builder available online at <http://wdmzpub01.stats.govt.nz/wds/TableViewer/tableView.aspx> (last accessed 12 May 2009). The scaling factors 'k' were calculated using the most recent data available, being from the first three quarters of 2007.

**Table 5: Coastal industries and the corresponding high level industries used to derive labour productivity values ( $TVA_i$ /employee)**

Coastal Industry	High level industry for $GDP_i$	$GDP_i$	High level industry for (k)	scaling factor (k)	$TVA_i$ /employee
<i>Industries mapped at area unit level</i>					
MARINE_FIS	Fishing	3.69	Marine fishing	12706	<b>46928.86</b>
AQUACULTUR	Fishing	3.69	Aquaculture	9900	<b>36565.61</b>
OIL_GAS_E	Oil & Gas Extraction	10.43	Mining	23329	<b>243326.23</b>
EXPLORATIO	Oil & Gas Exploration	1.05	Mining	23329	<b>24495.93</b>
CONSTRUCTI	Mining	2.67	Mining	23329	<b>62289.65</b>
CAFES_RES	Bars, Clubs Cafes & Rest	1.55	Bars, Clubs Cafes & Restaurant	5233	<b>8111.32</b>
PUBS_TAVER	Bars, Clubs Cafes & Rest	1.55	Pubs & Taverns	5379	<b>8336.84</b>
ACCOMMODAT	Accommodation	1.81	Accommodation	6256	<b>11323.91</b>
WATER_TRAN	Water & Rail Transport	1.83	Water & Rail Transport	15536	<b>28430.11</b>
CLUBS_HOSP	Bars, Clubs Cafes & Rest	1.55	Bars, Clubs Cafes & Restaurant	5050	<b>7827.56</b>
S_WATER_TR	Water & Rail Transport	1.83	Water & Rail Transport	15536	<b>28430.11</b>
SEAFD_PROC	Seafood Processing	2.25	Meat & Meat Product Mfg	11281	<b>25382.25</b>
<i>Industries mapped at district level</i>					
ROCKLOBSTE	Fishing	3.69	Marine fishing	12706	<b>46928.86</b>
FINFISHTRA	Fishing	3.69	Marine fishing	12706	<b>46928.86</b>
SQUIDJIG	Fishing	3.69	Marine fishing	12706	<b>46928.86</b>
LINEFISH	Fishing	3.69	Marine fishing	12706	<b>46928.86</b>
MARINEF	Fishing	3.69	Marine fishing	12706	<b>46928.86</b>
AQUACULTUR	Fishing	3.69	Aquaculture	9900	<b>36565.61</b>
SHIPBUILDI	Ship & Boat Building	1.50	Other Transport Equipment Mfg	14251	<b>21376.72</b>
BOATBUILD	Ship & Boat Building	1.50	Other Transport Equipment Mfg	14251	<b>21376.72</b>
FISHWHOLES	Fishing	3.69	Farm Produce Wholesaling	12259	<b>45276.04</b>
MAREQUIPR	Fishing	3.69	Recreational Good Retailing	6457	<b>23847.10</b>

\* $TVA_i$ /employee is equal to  $GDP_i$  times the scaling factor k, where k is the earnings per employee in industry i.

## 2.4 CALCULATION OF FISHERIES VALUE AT RISK

### 2.4.1 The conceptual basis for fisheries value at risk

Commercial fisheries represent a significant economic activity that is reliant on the health of marine ecosystems and therefore potentially vulnerable to marine invasive species. The value at risk of commercial fisheries is not well captured by the application of the Value Added approach based on labour productivity, described in the previous section, because many fisheries are seasonal and not necessarily reflected in employment on Census day. In addition, fishing activity is conducted at a distance from the place of residence of employees, which was used in the coastal industries database. Finally, added value figures are annual, whereas for such an important sector it is useful to have an indicator of the longer term value at risk.

Internationally, two broad methods have been developed to assess the depreciation of natural resource stocks: net present value of future resource rents (or net revenues); and net price or rent per stock unit (Crowards 1996, El Sarafy 1989, Landefeld & Hines 1985, Repetto et al. 1989, Solorzano et al. 1990). Guidelines from the United Nations recommend using the second approach where possible, based on market values for transactions for resource stocks, i.e. actual prices, in preference to the net present value approach (United Nations 1979 cited in Tai et al. 2000).

Because commercial fisheries rely on ecological production which itself has time-dependent attributes – inertia, lags, non-linearity, it useful to have a market instrument that reflects the most up to date information on the value of current and future fish stocks. Quota shares in Quota Management System (QMS) fish stocks are such an instrument.

Through trading in quota share markets, the QMS generates a useful indicator of commercial fisheries value at risk. Econometric studies focussing on price formation in QMS markets in fishing rights (Batstone & Sharp 2003, Newell et al. 2005) have found a significant relationship between sales prices for quota leases (ACE) and quota-shares, fishing output and input prices, and market interest rates. This supports the inference from economic theory that prices for quota shares represent the present value of future harvests associated with the quota right. The theoretical basis for the use of quota-share prices in this way was derived by Arnason (1990), based on standard resource economics and financial asset theory.

Therefore indicators were developed for the commercial fisheries value at risk based on quota share prices and export prices (free on board, or FOB<sup>6</sup>) prevailing at the time of the 2006 Census.

Using MFish CELR and quota trading data for a statistical area, the value at risk in a given Fisheries Statistical Area  $FSA$ ,  $VAR^{FSA}$ , was defined as follows:

$$VAR^{FSA} = \sum C_{S,FSA} * KV_S \quad (2)$$

Where  $C_{S,FSA}$  is the catch of species  $S$  in the FSA and  $KV_S$  is the per kilogram value at risk for that species. From equation (2), the indicator of value at risk for each statistical area is the summation of the product of the catch  $C_{S,FSA}$  and the per kilogram value at risk,  $K_S$ , for the species caught in the FSA.

For a given species, we define the indicator of fisheries value at risk ( $KV_S$ ) as the present value of future harvests that would be taken in the EEZ in the absence of the effects from an incursion event. They are derived from prices and catches in the period January 2005 to March 2006.

Indicators for  $KV_S$  were calculated from prices in QMS markets for quota shares.

Where non-QMS species were involved, a proxy for quota prices was derived through the use of a regression relationship between quota share price and FOB export price (see Section 2.4.3).

Data requirements for the calculation of  $KV_S$  are as follows:

- Catches by statistical area and species,
- Quota trading prices for the end of the 2006 fishing year, and,
- Average FOB export prices by species (un-weighted and averaged across product forms and market destination).

Data for catches and quota share values for the 2005/06 fishing year were obtained from MFish. Catches were defined by FSA and species, while quota shares were defined in terms of species and Quota Management Areas (QMAs). MFish provided total quota value per species, using the average across QMAs of the average monthly price for quota for that

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<sup>6</sup> Free on Board, or FOB, prices are a standard measure of the value of exports. FOB prices report the value of exports at point of loading, prior to payment of cargo, insurance and freight charges. For this project, FOB prices of fish products were obtained from Seafood Industry Council (2006).

species in the 2005/06 fishing year, for 20 QMS species whose shares are actively traded. Value at risk per kg was obtained by dividing the total quota value by the total allowable commercial catch (TACC) for a given species in all QMAs during that year. For many species, quota share values vary across QMAs; this diversity was not preserved in the data provided by MFish, but the data still provide an indication of relative value at risk based on the quantity caught within each FSA.

FOB price data for exports in the year January to December 2005 were sourced from the SEAFIC export summary for 2005.

#### 2.4.2 Catch areas

MFish collects information on catch in the EEZ by species according to a system that uses four different sets of geographic definitions of statistical area:

- Finfish
- Eels
- Shellfish
- Rock lobsters.

It is possible to obtain an imprecise correspondence between shellfish and finfish statistical areas, and this has been done for this report. However the geographic definitions of statistical areas for rock lobster species and eels are not amenable to further consolidation. Accordingly, this analysis allocates EEZ commercial fisheries value to three GIS layers according to the following scheme:

- Finfish and shellfish
- Eels
- Rock lobsters.

#### 2.4.3 Catch and value at risk

Catches for the 2005/06 fishing year for each FSA were derived by MFish personnel from CELR records for the 15 highest species by catch weight in each FSA, as agreed between MAFBNZ and Ministry of Fisheries staff. Examination of catch weights by species in each FSA showed that this rule was a cost effective avenue for capturing value at risk while allowing for the diversity of species harvested across FSAs. Because the top 15 species vary by FSA, the resulting catch data includes a total of 125 species across the entire EEZ.

The per kilogram value at risk was derived using market prices. QMS species have the advantage that quota shares are traded in markets, which provide an assessment of the future value of catches in current dollar terms. In economic terms, these rents are the best available estimate of the commercial value at risk for those commercial species, because they represent what commercial entities are prepared to pay for the right to harvest those species.

Figure 7 depicts the process for deriving each species' per kilogram value at risk, where KV = per kilogram value at risk and FOB = average export price for the year January to December 2005 (Seafood Industry Council, 2006). Species included in the analysis fall into two broad categories: the 20 QMS species for which the Ministry of Fisheries supplied quota share price data, and all other species, both QMS and non-QMS. Price data is further subdivided into species-specific, species grouping, and generic product groupings according to the information available on composition of export categories.

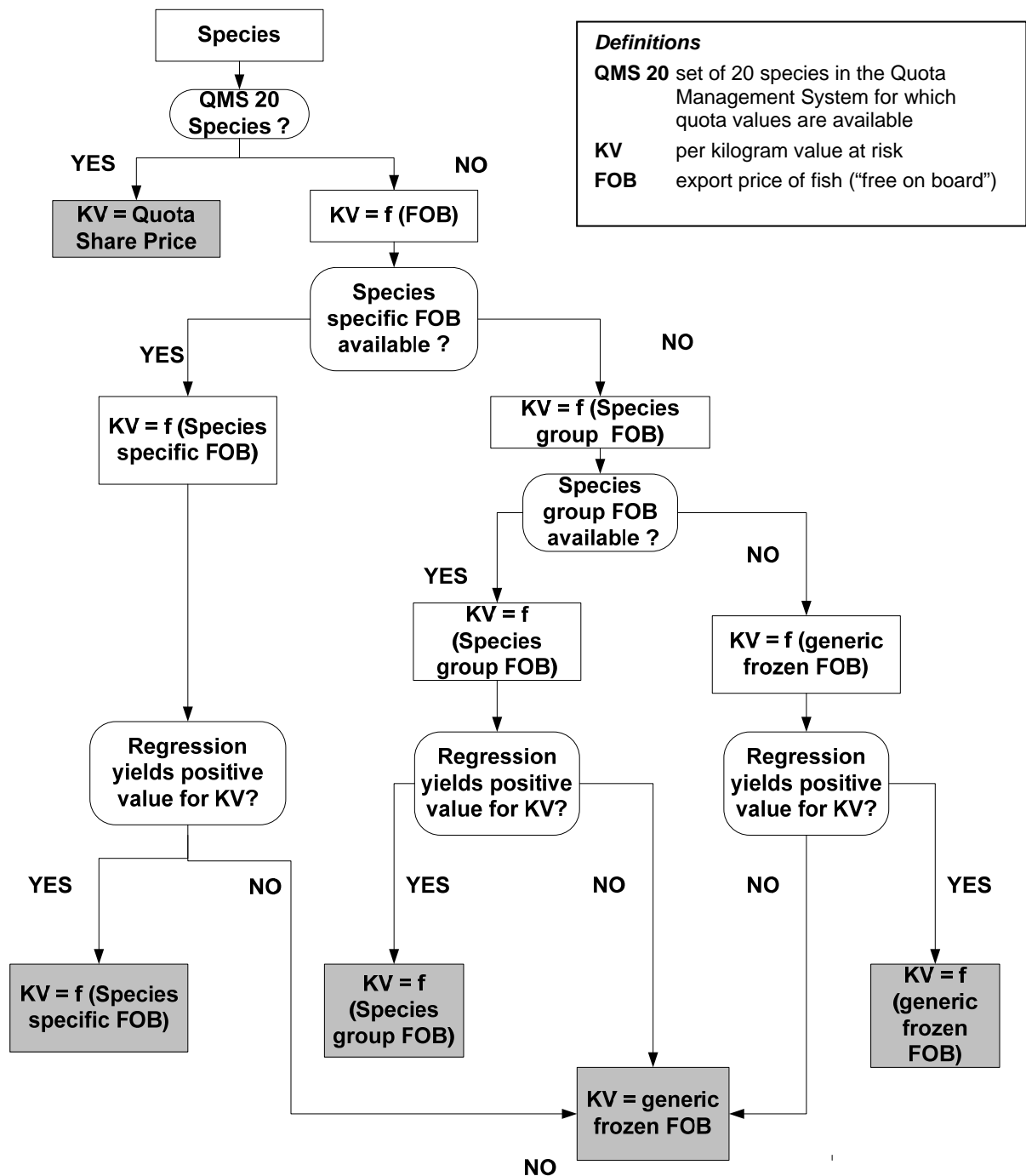


Figure 7: Decision rule for selection of method to estimate Fisheries Value at Risk per kilogram (KV) depending on species and available price data.

In essence, for 20 QMS species, the quota share price was used. For other species, a value was derived using either species specific export price data or, where that was not available, species group or the closest equivalent generic frozen fish product. The derivation was as follows.

Defining  $QV_{S,i}$  as the total value of quota for QMS species  $S$  in QMA  $i$ , based on representative 2006 quota share prices (see above), and  $C_{S,i}$  as the TACC for species  $S$  in QMA  $i$ , then  $KV_S^{QMS}$ , the representative value at risk for QMS species  $S$ , is defined as:

$$KV_S^{QMS} = \frac{\sum_i QV_{S,i}}{\sum_i C_{S,i}} \quad (3)$$

To estimate the value at risk for a non-QMS species,  $KV_S^{NQMS}$ , we first needed to derive a proxy for the present value of future income from the fishery, i.e. an equivalent of quota share price.

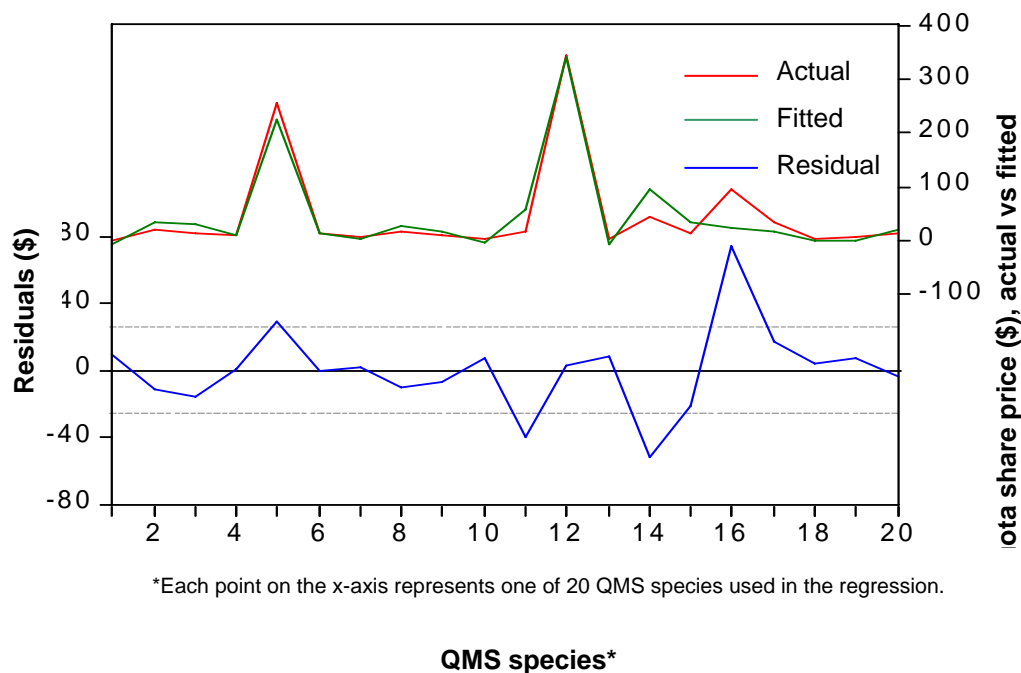
For this purpose, we used regression analysis to estimate the relationship between quota share prices and export prices, following a simplified version of the econometric procedures used by Batstone & Sharp (2003) and Newell et al. (2005). The relationship was estimated as:

$$QP_S = \alpha + \beta * FOB_S + \varepsilon \quad (4)$$

where  $QP_S$  is annual average quota price for species  $S$  and  $FOB_S$  is average annual FOB export price,  $\alpha$  and  $\beta$  are regression coefficients, and  $\varepsilon$  the regression residuals. The regression coefficients were estimated from a data set of 20 QMS species using OLS with a White heteroscedasticity consistent co-variance matrix (White, 1980). A strong correlation between  $QP$  and  $FOB$  was evident ( $r = 0.96$ ), confirming that FOB can be used to derive asset values for non-QMS species.

Figure 8 shows actual versus fitted values and the regression residuals. The explanatory power of the model is reasonable for the purposes of this analysis ( $R^2 = 0.92$ ,  $d = 1.95$ , and  $P = 0.05$  and  $0.01$  for  $\alpha$  and  $\beta$  respectively). The Durbin Watson statistic ( $d$ ) suggests the

Figure 8: Regression Fit for Quota Share Price, used in the calculation of Fisheries Value at Risk



functional form of the model is reasonable and there is no evidence of omitted variables. A small proportion of the species in the sample are not covered by the fitting function: scallops (SCA) and scampi (SCI).

The estimated coefficients  $\alpha$  and  $\beta$  were then used to estimate the value at risk for a non-QMS species,  $KV_S^{NQMS}$ , as follows:

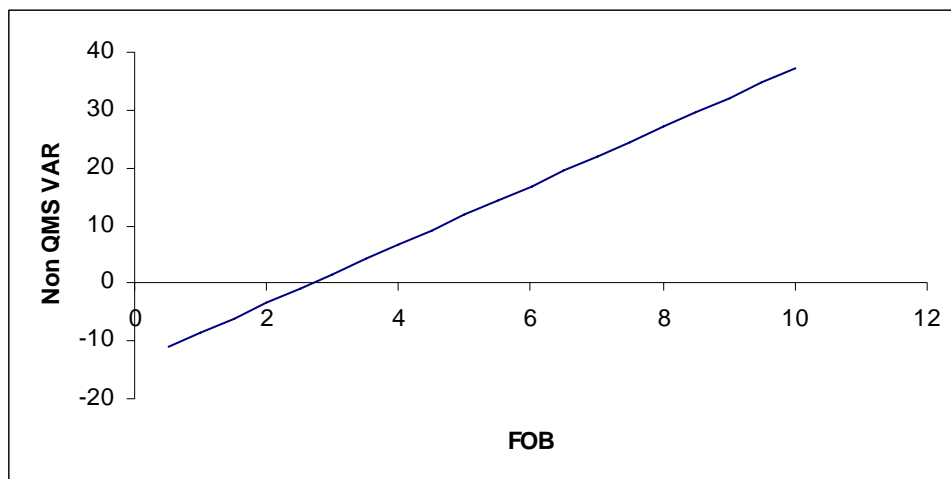
$$KV_S^{NQMS} = \alpha + \beta * FOB_S \quad (5)$$

Equation (6) shows the coefficients estimated from the regression, inserted into equation (5).

$$KV_S^{NQMS} = -13.5714 + 5.0783 * FOB_S \quad (6)$$

Figure 9 describes the relationship between  $KV_S^{NQMS}$  and  $FOB_S$ . It shows that the relationship described by equation (6) is inoperable for  $FOB_S < \$2.67$  per kg since the relationship yields negative values for  $KV_S^{NQMS}$  over that range.

Figure 9: Non QMS Value at Risk (VAR) as a function of free on board (FOB) export price



An alternative functional form of this relationship was estimated that restricted the intercept term to zero to avoid negative values for the per kilogram value at risk. The explanatory power of the model was lower, and examination of the residuals showed violation of at least two of the underlying assumptions behind OLS regression. Accordingly, this alternative was not adopted. Instead, the model specified in equation (6) was adopted where it yielded positive values and a decision rule developed to address negative values; the rule assigned the export value of the species when  $FOB_S < 2.67$ , i.e. in these situations  $KV_S^{NQMS} = FOB_S$ .

For those non-QMS species where a species-specific FOB was not available, the FOB associated with a generic species grouping (e.g. sharks, or tunas) was used, and if the associated FOB was less than \$2.67 per kg the decision rule was implemented.

For those species where neither a species-specific or generic species group FOB price were available, the FOB price corresponding to a generic product form<sup>7</sup> was used, with the decision rule applied for FOB < \$2.67 per kg.

The results of the fisheries value at risk analysis are presented in Section 3.2.

## 2.5 CALCULATION OF RESIDENTIAL LAND VALUE

The coast typically, but not universally, represents some of the higher valued housing services in the residential property market. To provide an indicator of amenity value provided by the coast, residential land value was estimated by using the unimproved value (i.e. “land value” only) of all residential land within 1 km of the coast.

Data was obtained from QV for all residential and lifestyle properties<sup>8</sup> within 1 km of the coastline of New Zealand, aggregated by area units. This includes vacant land that is zoned for residential use.

For some area units, the “number of assessments” field, i.e. the number of properties fitting the selection criteria, returned very low values, e.g. 1 or 2. In some cases this means that the area unit was just on the margin of the 1 km boundary, such that only one residential property was identified by the data query. In other cases it could mean there is only one residential property in the area unit.

In yet other cases, however, an area unit that appears to consist solely of water was included in the database. According to QV staff, these instances are likely to be data errors<sup>9</sup>. Where the descriptor for an area unit is suggestive of a water body (e.g. West Coast-Oceanic) and we were able to confirm that there was no apparent land area in the area unit, we excluded the area unit from the dataset. A list of excluded area units, the associated land value data, is included as Appendix C.

As property value assessments for different councils were struck at different times (up to three years difference), it was important to use a method to equalise these values to an estimated value at a common point in time. A house price index (HPI) was derived for every territorial authority, by calculating the ratio of sales price to capital value using all sales from 1 January 2007 to 1 August 2007. These ratios were then applied to the area unit results to provide a set of equalised values referred as “value adjusted”, as follows.

$$RCLV_i^{adj} = RCLV_i \times \frac{SP_j}{\overline{CV_j}} \quad (7)$$

where  $RCLV_i$  is the total unimproved value of residential land (unadjusted) within 1 km of the coast in area unit  $i$ ,  $SP_j$  is the average sale price for residential properties in territorial authority  $j$  for the 7 months prior to 1 August 2007,  $\overline{CV_j}$  is the average registered capital

<sup>7</sup> The generic product “Other frozen finfish” was used as a proxy for all fish species for which separate price data were not available. The average unit FOB price for this product was \$1.59/kilogram for 2005, calculated as the total weight exported divided by total FOB value obtained (Seafood Industry Council, 2006, p.95).

<sup>8</sup> Other categories of property were excluded: arable, commercial, dairying, forestry, horticulture, industrial, mining, other, pastoral and specialist.

<sup>9</sup> Per Richard Deakin, QV, pers. comm. “With regard to the water based area unit, this appears to be a result of small mapping and matching errors – for example many of these [properties] are right on the coastal boundary and have been mapped onto the adjacent water based SAU in error. Fixing these could be a complex process as they would need to be located manually and their values added to the corresponding area units”.



value of residential properties in territorial authority  $j$ , and where area unit  $i$  is located in territorial authority  $j$ .  $RCLV_i^{adj}$  is therefore the adjusted total unimproved value of residential land within 1 km of the coast in area unit  $i$ .

Table 6 provides an example of the adjusted data, which represent estimated land values as at August 2007. Note that all values are adjusted by HPI, and “Average Land Value” is the average value per property, not per hectare.

Table 6: Example of residential land value data (\$)

AU No	AU Name	Total Capital Value Adjusted	Total Land Value adjusted	Total Improvement Value	Average Land Value	Average Land Area	StdDev Land Area	SP Ratio	TA Number	TA Name
500202	Karikari Peninsula-Maungatani	\$604,595,515	\$341,142,466	\$263,453,049	\$186,621	1.6909	6.8748	1.5436	1	Far North District
500203	Taipa Bay-Mangonui	\$614,233,951	\$339,173,627	\$275,060,324	\$214,531	0.2115	0.7040	1.5436	1	Far North District
500204	Herekino	\$9,145,724	\$5,204,959	\$3,940,765	\$91,315	21.2689	109.1627	1.5436	1	Far North District
500205	Ahipara	\$206,687,351	\$95,402,640	\$111,284,711	\$170,972	0.5629	4.3185	1.5436	1	Far North District
500206	North Cape	\$3,250,784	\$443,780	\$2,807,004	\$12,327	1.5635	4.3402	1.5436	1	Far North District
500207	Houhora	\$121,376,497	\$61,054,078	\$60,322,420	\$143,995	1.5220	3.9234	1.5436	1	Far North District
500208	Motutangi-Kareponia	\$59,316,004	\$25,896,678	\$33,419,326	\$78,713	2.4320	5.6433	1.5436	1	Far North District
500402	Mangapa-Matauri Bay	\$423,374,800	\$268,324,749	\$155,050,051	\$308,774	2.0399	4.7507	1.5436	1	Far North District
500500	Kohukohu	\$15,193,479	\$4,818,292	\$10,375,188	\$44,614	1.5266	2.8356	1.5436	1	Far North District
500600	Rawene	\$33,051,182	\$9,621,148	\$23,430,034	\$48,347	0.2378	0.4085	1.5436	1	Far North District
500700	Omapere and Opononi	\$100,467,133	\$51,652,890	\$48,814,243	\$138,109	0.1572	0.3557	1.5436	1	Far North District
500801	Hokianga North	\$21,493,610	\$8,238,098	\$13,255,512	\$40,582	4.0883	6.1447	1.5436	1	Far North District
500802	Hokianga South	\$77,701,611	\$43,657,906	\$34,043,705	\$110,247	3.0850	6.0530	1.5436	1	Far North District
501807	Ngunguru	\$696,712,697	\$476,410,983	\$220,301,713	\$432,708	0.7052	2.0087	1.1251	2	Whangarei District
501809	Wharekohe-Oakleigh	\$5,416,318	\$2,712,660	\$2,703,659	\$142,772	2.0363	2.6620	1.1251	2	Whangarei District
501811	Waiotira-Springfield	\$78,956,284	\$48,711,986	\$30,244,298	\$242,348	3.0902	4.3335	1.1251	2	Whangarei District
501814	Punaruiki-Kiripaka	\$1,023,928,639	\$826,886,379	\$197,042,260	\$591,901	1.7101	5.7928	1.1251	2	Whangarei District
501815	Bream Bay	\$9,473,494	\$6,620,195	\$2,853,299	\$300,918	3.5660	3.4684	1.1251	2	Whangarei District
501816	Waipu	\$718,421,962	\$565,906,248	\$152,515,714	\$738,781	0.9228	2.3488	1.1251	2	Whangarei District
501817	Pataua-Whareora	\$213,678,706	\$165,764,766	\$47,913,939	\$484,692	1.9138	3.3757	1.1251	2	Whangarei District
501818	Parua Bay	\$471,697,639	\$286,556,314	\$185,141,324	\$351,172	0.9343	2.0892	1.1251	2	Whangarei District
501819	Bream Head	\$465,022,988	\$324,507,671	\$140,515,317	\$390,973	0.9246	2.4565	1.1251	2	Whangarei District
505909	Wade Heads	\$659,250,975	\$360,984,464	\$298,266,511	\$303,603	0.2711	1.0156	1.3456	4	Rodney District
505910	Gulf Harbour	\$875,934,766	\$491,045,062	\$384,889,704	\$384,229	0.2437	0.9417	1.3456	4	Rodney District
506000	Silverdale South	\$418,165,432	\$229,438,366	\$188,727,066	\$364,767	1.2162	2.5764	1.3456	4	Rodney District
506200	Silverdale North	\$176,164,907	\$144,599,387	\$31,565,520	\$1,364,145	7.8927	16.6124	1.3456	4	Rodney District
506300	Dairy Flat-Redvale	\$43,659,424	\$24,832,332	\$18,827,092	\$591,246	2.1282	1.2284	1.3456	4	Rodney District
506400	Paremoremo West	\$226,865,653	\$142,555,480	\$84,310,173	\$750,292	2.8241	2.7583	1.3456	4	Rodney District
506613	Tauhoia-Puhoi	\$226,948,405	\$134,589,085	\$92,359,320	\$353,252	3.9262	7.2666	1.3456	4	Rodney District
506614	Tahekerua	\$6,943,096	\$4,904,571	\$2,038,525	\$700,653	10.7381	9.6327	1.3456	4	Rodney District

## 3 Results

Using ArcMap software, GIS layers and associated maps have been created and displayed for each of the datasets within the three sub-components selected for analysis. This section describes the results and displays some of the data.

### 3.1 COASTAL INDUSTRY ADDED-VALUE

Figures 10-13 present examples of added-value as calculated for the selected coastal industry groups (see Tables 2 & 3 in this report). Employment data for these groups was provided at area unit level. The results for each industry grouping are presented as a GIS layer, showing the added value (in \$Million) for that industry grouping for each area unit.

Figure 10 illustrates the value added by the water transport industry. This industry grouping (I630) comprises international sea transport, coastal water transport and inland water transport, and is closely related to the Services to Water Transport Industry (group I662). Inland water transport was not part of the original coastal industry selection, but was included as a result of the need to aggregate industries to comply with SNZ confidentiality requirements. Inclusion of this data does not significantly skew the data as the resolution at area unit level generally allows the effect of major inland water bodies to be identified. For example, this industry group is shown as significant around the Queenstown Lakes area, but this can easily be discounted by the user as not relevant to marine biosecurity issues. Figure 10 highlights the value added by international sea and coastal water transport at each of the commercial ports of New Zealand, along with locations where tourism involves a significant marine transport component: the Marlborough Sounds, Milford Sound and Stewart Island.

The value added by services to the water transport industry follows a similar pattern to the above. This industry grouping (I662) includes stevedoring, water transport terminals, port operations and other services (e.g. charter boats for recreational fishing). Figure 11 shows a more detailed view of the results for this grouping, concentrating on the areas units in the upper and central North Island, highlighting the significance of Auckland, Tauranga and Taranaki ports. Other areas, away from the central port areas, demonstrate the value of this industry in areas where marine activities (e.g. charter fishing) are an important feature of the area, for example the Northland coast (particularly around Tutukaka, known for fishing and boating, both private and small commercial), the northern Coromandel Peninsula (known for recreational fishing and boating) and in areas on either side of the Kaipara Harbour.

Data was obtained for the industry groups “oil and gas extraction” (B120) and “exploration” (B151) (see Table 3). These industries are not dependent on the coast or marine environment per se, but are often found there or have infrastructure located in the coastal environment that could be affected by marine invasive species, e.g. by growths on equipment or by limitations on vessel movements or practices. Figures 12 and 13 show the value added by the oil and gas extraction, and exploration industries respectively, in the Taranaki region. The value added by the oil and gas exploration industry grouping includes petroleum and mineral exploration.

It is worth noting that an area unit at Kaitake, southwest of New Plymouth reports relatively high values for the oil and gas and related industries shown. Many of the employees in these high value industries reside in the Kaitake area unit, which gives this area a relatively high value compared to neighbouring areas.

Figure 10: Economic value added by Water Transport Industry (international sea transport, coastal water transport and inland water transport), based on employment as at 2006 census (Statistics New Zealand data).

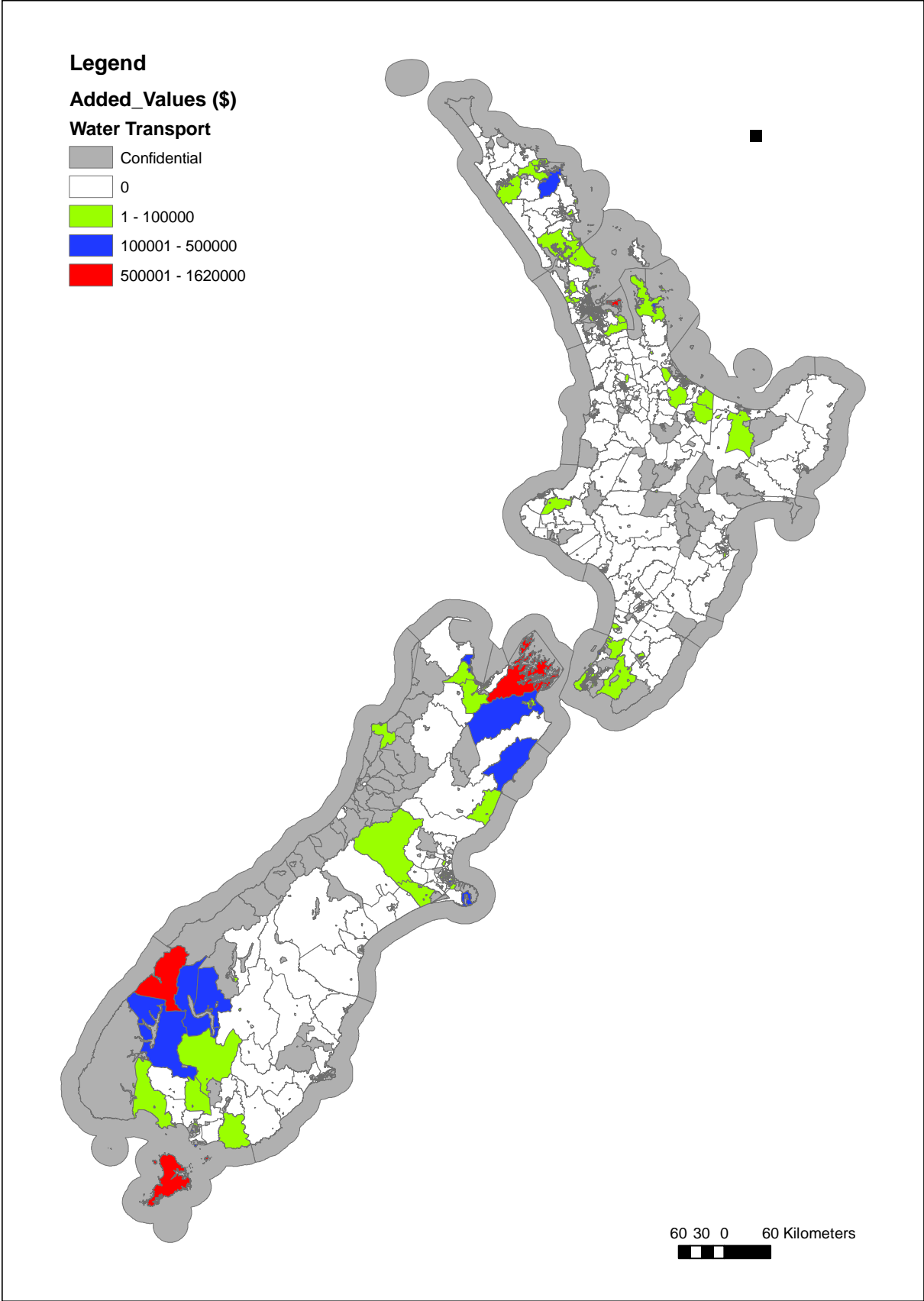


Figure 11: Economic value added by Services to Water Transport Industry (stevedoring, water transport terminals, port operations and services to water transport) in the upper and central North Island, based on employment as at 2006 census (Statistics New Zealand data).

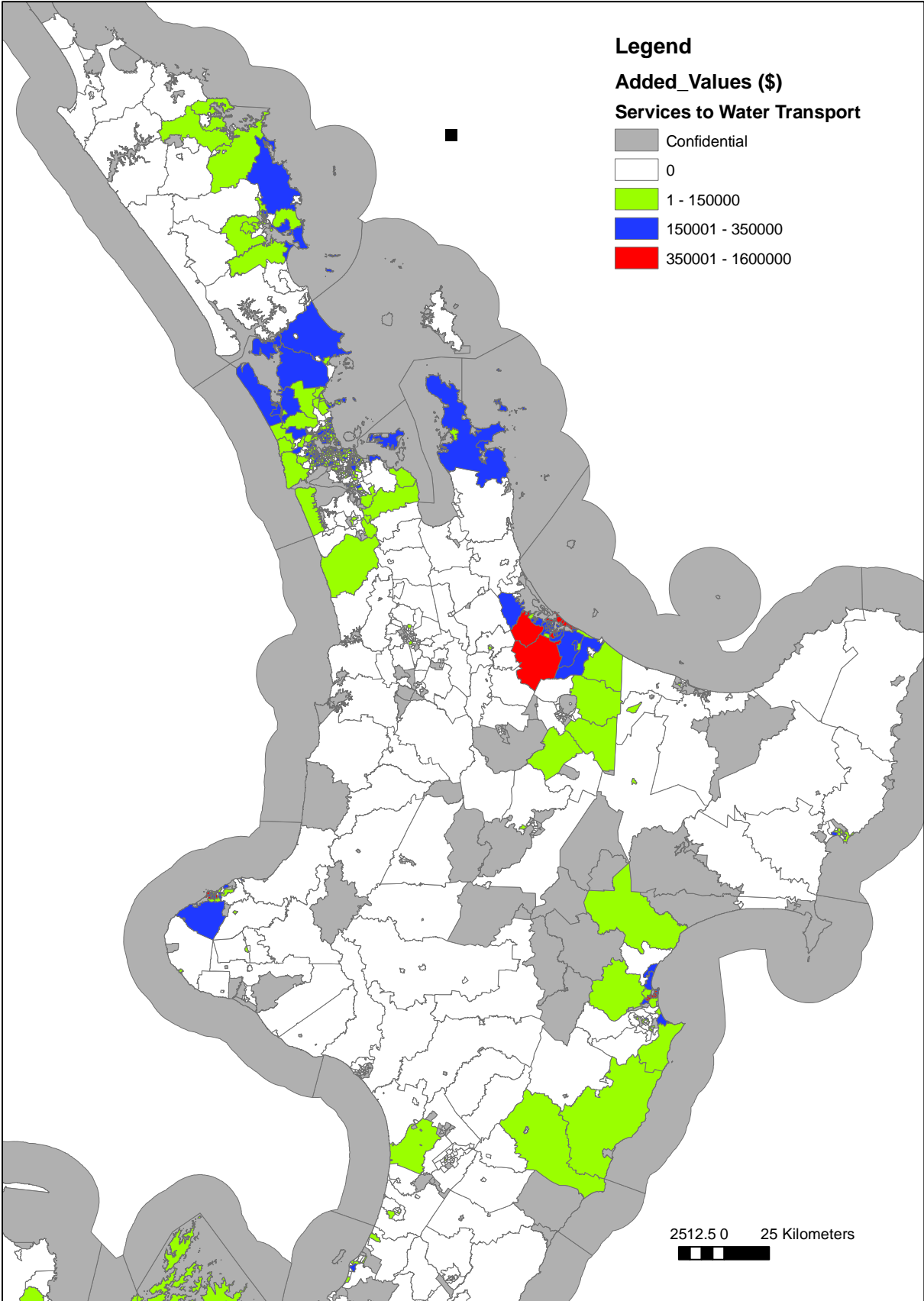


Figure 12: Economic value added by Oil & Gas Extraction Industry in the Taranaki region, based on employment as at 2006 census (Statistics New Zealand data).

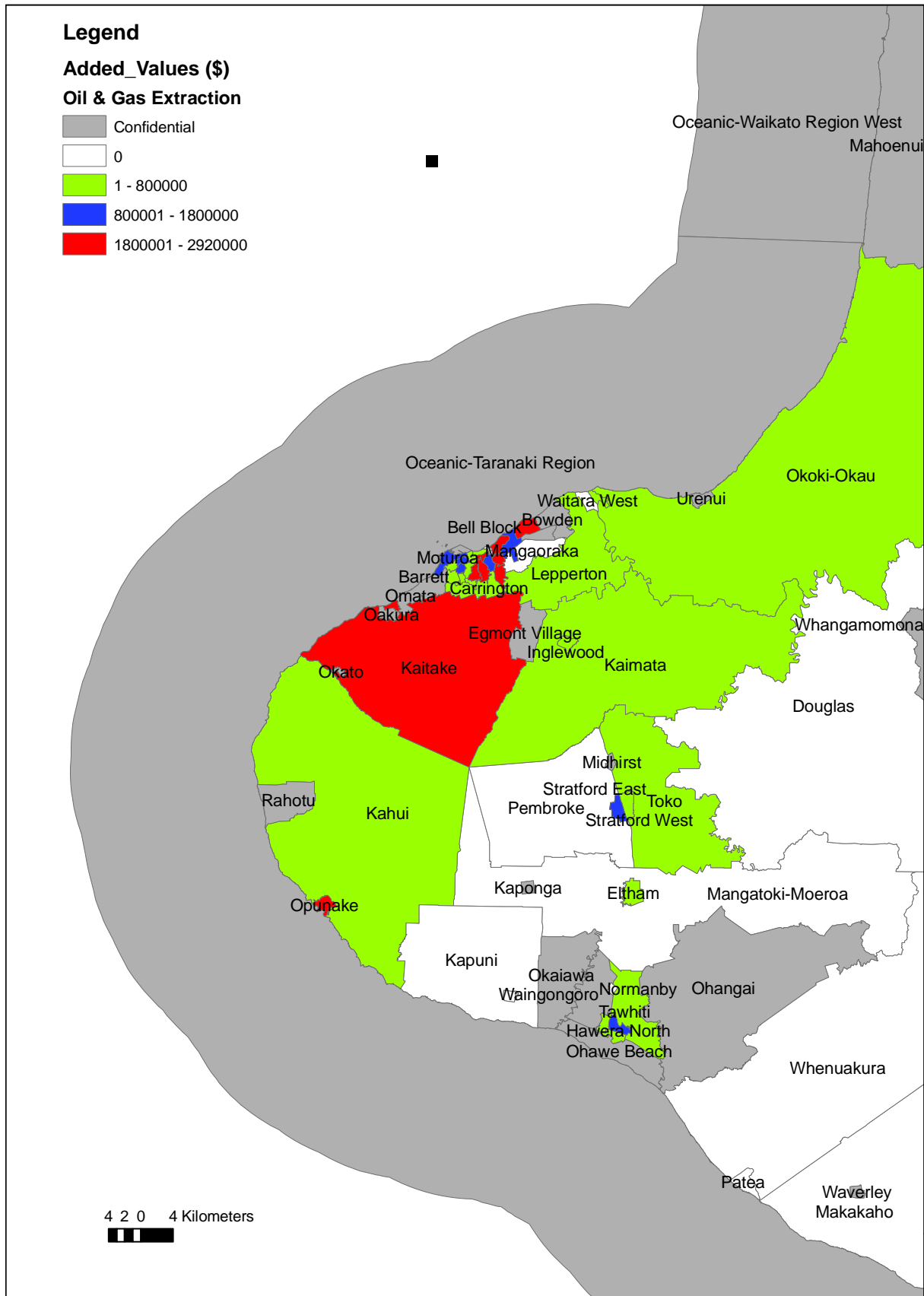
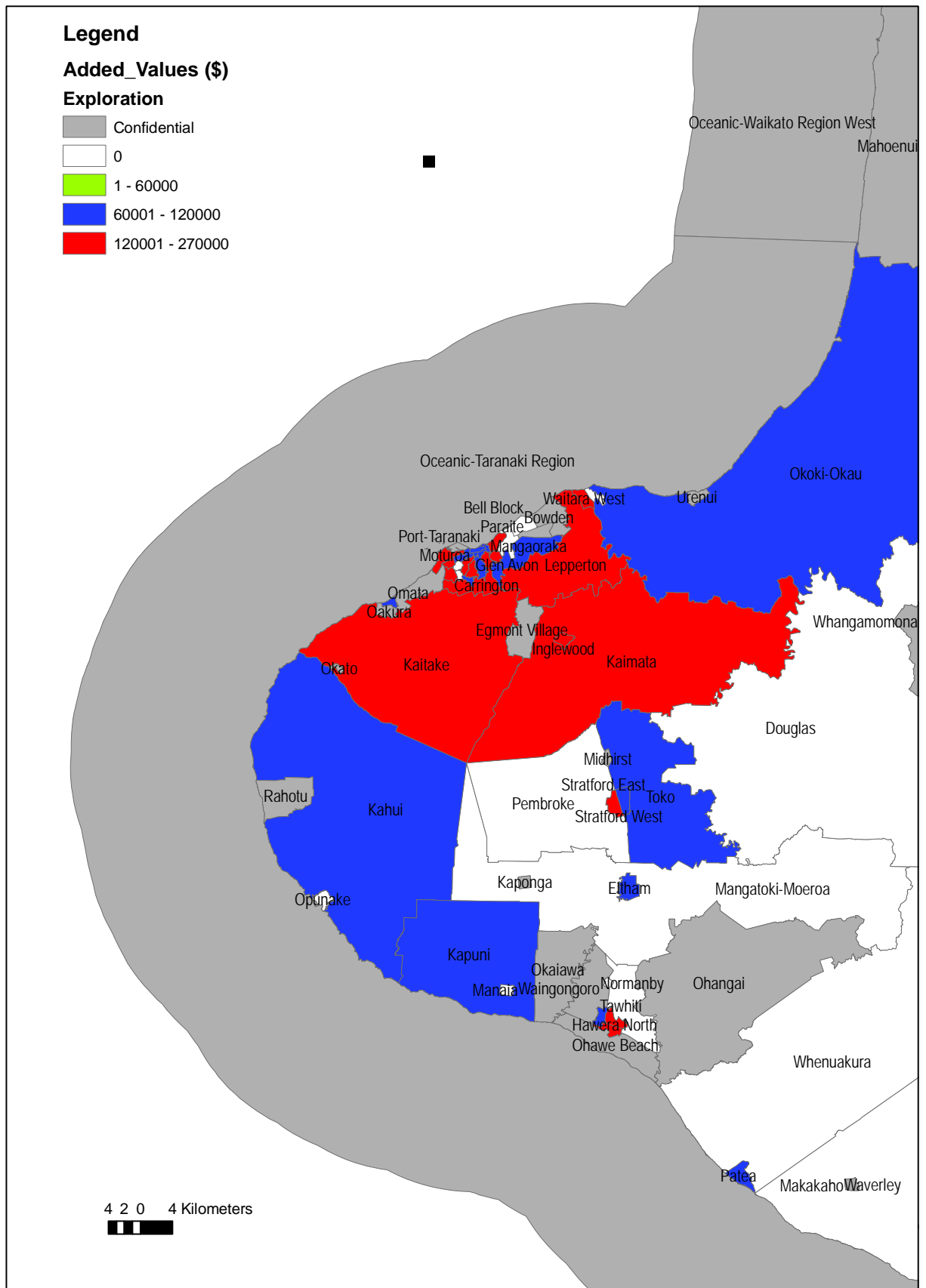


Figure 13: Economic value added by Exploration Industry in the Taranaki region, based on employment as at 2006 census (Statistics New Zealand data).



Figures 14-16 present examples of the value added for the selected coastal industry classes (see Table 4 in this report). In these examples, the employment data was aggregated by summing the employment totals for the area units within a territorial local authority, in order to comply with SNZ confidentiality requirements. For this reason, the results are presented by district (i.e. territorial local authority area).<sup>10</sup>

Example maps have been provided for marine fishing (one of five fishing categories for which data was purchased) and aquaculture. A major limitation is that the fishing and aquaculture data are based on employment as at March 2006, which is not representative of the annual employment pattern. For example, the value added from aquaculture (Figure 15) is likely to understate the full value at risk because of the seasonal nature of aquaculture production (discussed in Section 4). Recognising this limitation, Figure 14 and

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<sup>10</sup> In the case of the Marlborough and Tasman District Councils, which are unitary authorities and thus also have regional council functions, the GIS shape files obtained for this project extend to the limit of the territorial sea, which is the boundary definition for regional councils. The regional boundaries for these two councils are evident in Figures 14, 15 and 16.

Figure 15 show that the Marlborough region is among the most significant nationally, for both marine fishing and aquaculture, followed by Northland and Tasman.



Figure 14: Economic value added by Marine Fishing nec (not elsewhere classified), based on employment as at 2006 census by territorial local authority (Statistics New Zealand data) (In this figure Marine Fishing does not include Rock Lobster Fishing, Finfish Trawling, Squid Jigging or Line Fishing).

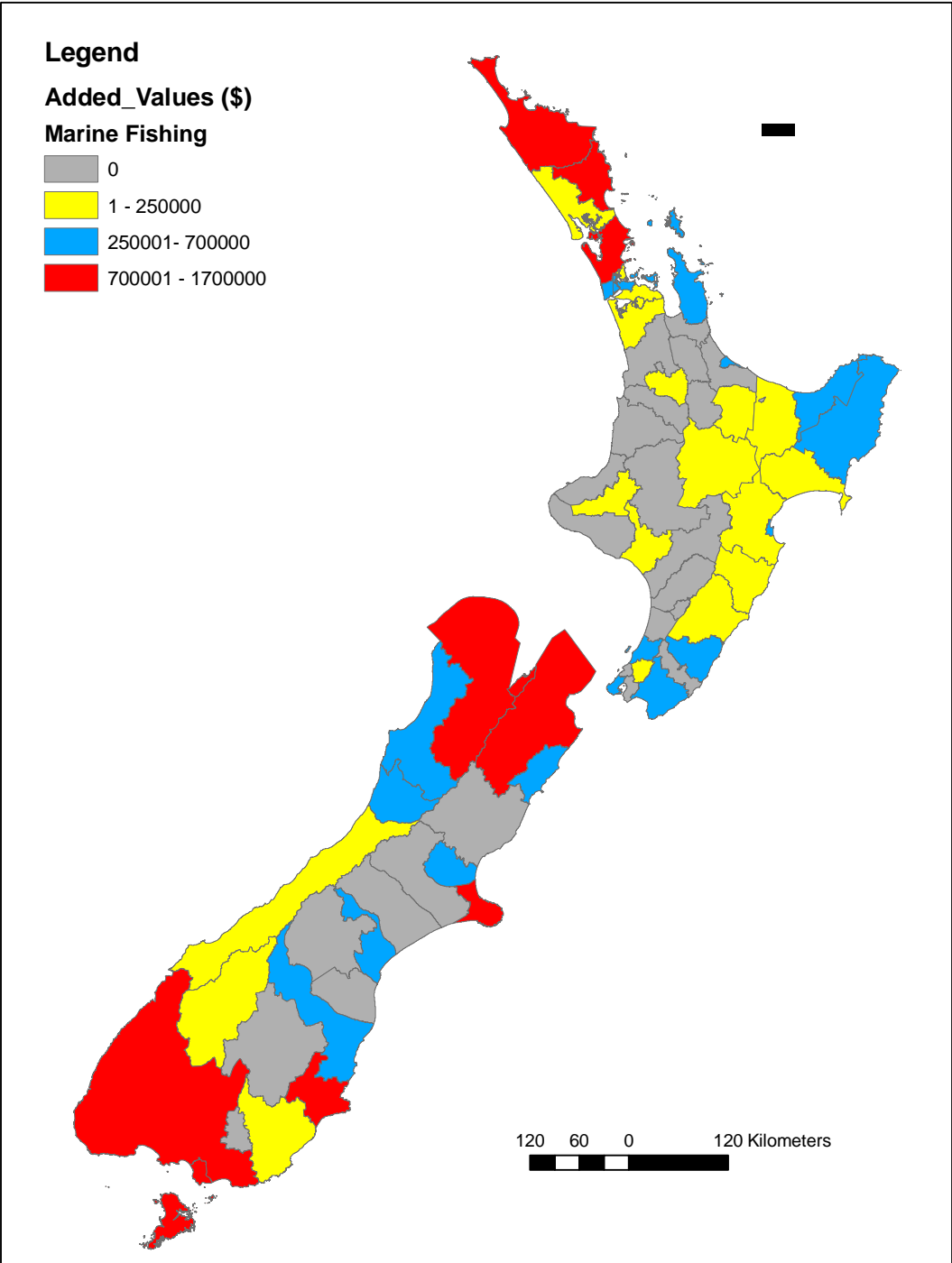


Figure 15: Economic value added by the Aquaculture Industry, based on employment as at 2006 census by territorial local authority (Statistics New Zealand data).

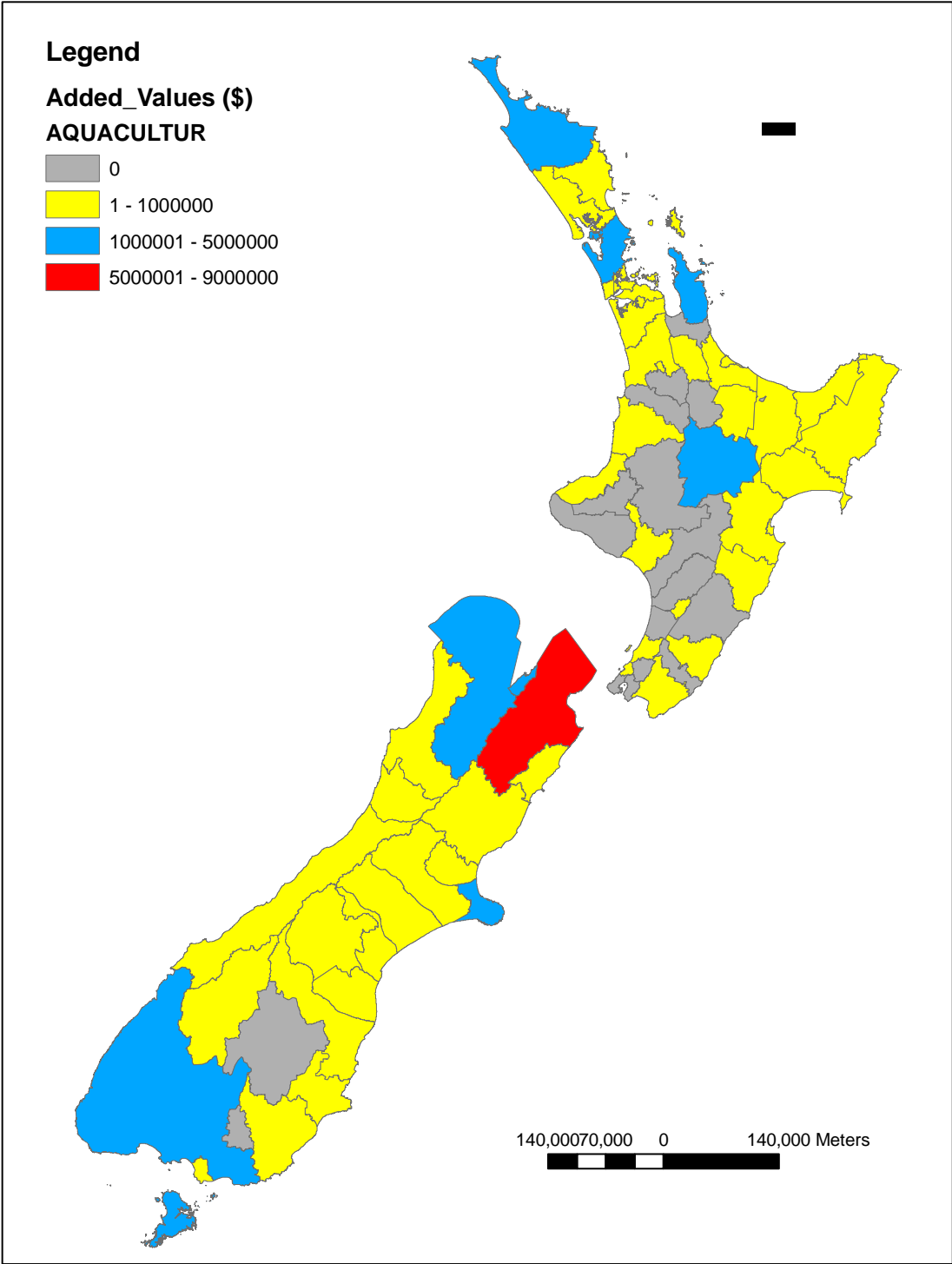
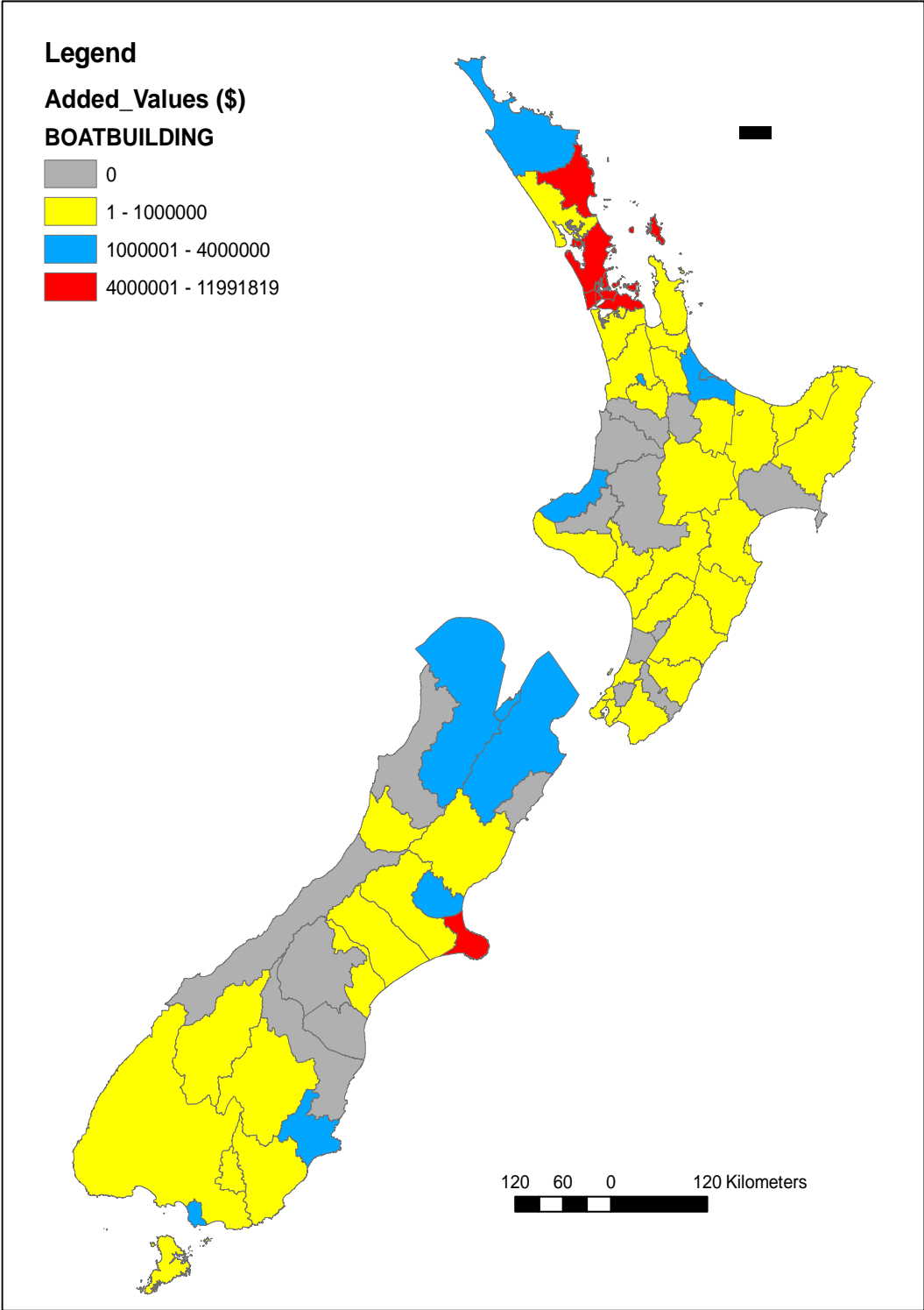


Figure 16: Economic value added by the Boat Building Industry, based on employment as at 2006 census by territorial local authority (Statistics New Zealand data).



## 3.2 FISHERIES VALUE AT RISK

This section describes the outcomes of the calculation of fisheries value at risk for the 125 species generated by selecting the top 15 species in each FSA; the list of 125 species can be found in Appendix B. The tables in Appendix B show the species' MFish code, common name, assigned FOB price (\$), and value at risk ( $KV_S$ ) in dollars per kg.

Using the methodology described in section 2.4, and summing across all areas and all species, the total commercial fisheries value at risk for the NZ EEZ is of the order of NZ\$3.6 billion.

The GIS layers created for Fisheries Value at Risk enable the user to select a single species to display the value at risk by FSA.

Figures 17-19 show the GIS layers created for:

- Finfish and shellfish,
- Eels, and
- Rock lobsters.

Figure 17 shows the value at risk by FSA for marine finfish and shellfish within the EEZ. The high values highlight the economic importance of the coastal zone by virtue of its role in supporting the prosperity of industries directly and indirectly associated with harvest of those species. The highest value occurs off the West Coast of the South Island and in Cook Strait, where the hoki fishery is concentrated. Also noticeable are the productive fishing grounds of the sub-Antarctic islands, where the squid fishery is found, and the Chatham Rise, where orange roughy and other high value species are harvested.

Figure 18 shows the value at risk by FSA for eel species, and Figure 19 shows the value at risk by FSA for rock lobster species<sup>11</sup>. Note that, for historical reasons, these species have unique statistical area unit definitions, which differ markedly from those used for finfish and shellfish.

Figure 18 demonstrates the geographical spread of the eel fishery, with substantial value generated in a range of locations on both of the main islands as well as at the Chathams. Figure 19 shows that the highest value rock lobster fisheries are found along the Wairarapa, Kaikoura and Fiordland coasts, and around Stewart Island and the Chatham Islands.

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<sup>11</sup> The shapefile obtained for the rock lobster statistical areas did not include the portion of the EEZ that surrounds the Kermadec Islands north of New Zealand. This is the CRA10 quota management area, in which a very small portion of the total rock lobster catch is taken (generally less than 0.1% of the total). The fisheries value at risk for this portion of the rock lobster catch has been mapped in the finfish\_shellfish layer under the CRA species code.



Figure 18: Eel Species Value At Risk based on the statistical areas to which catches are reported (Ministry of Fisheries data).

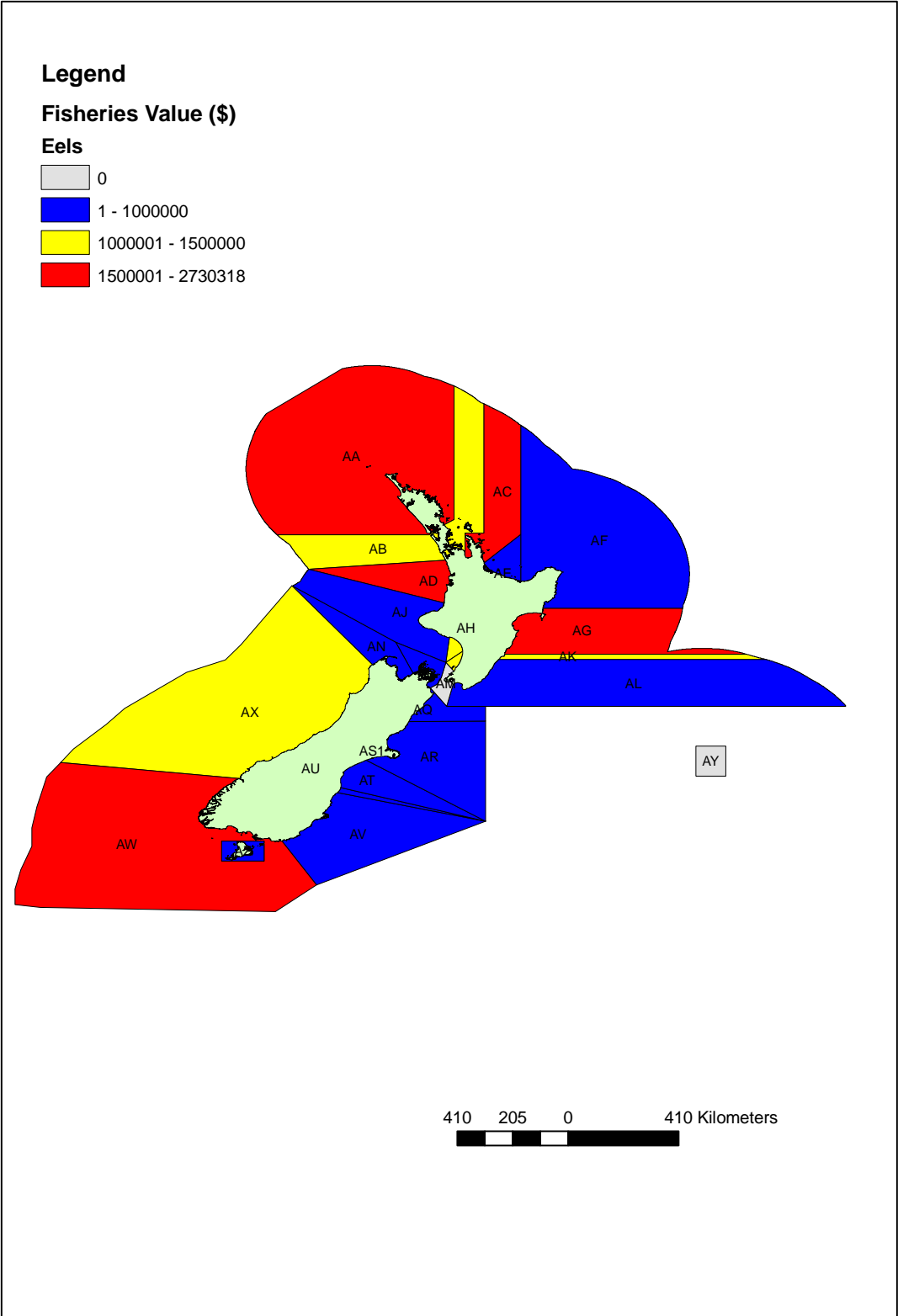
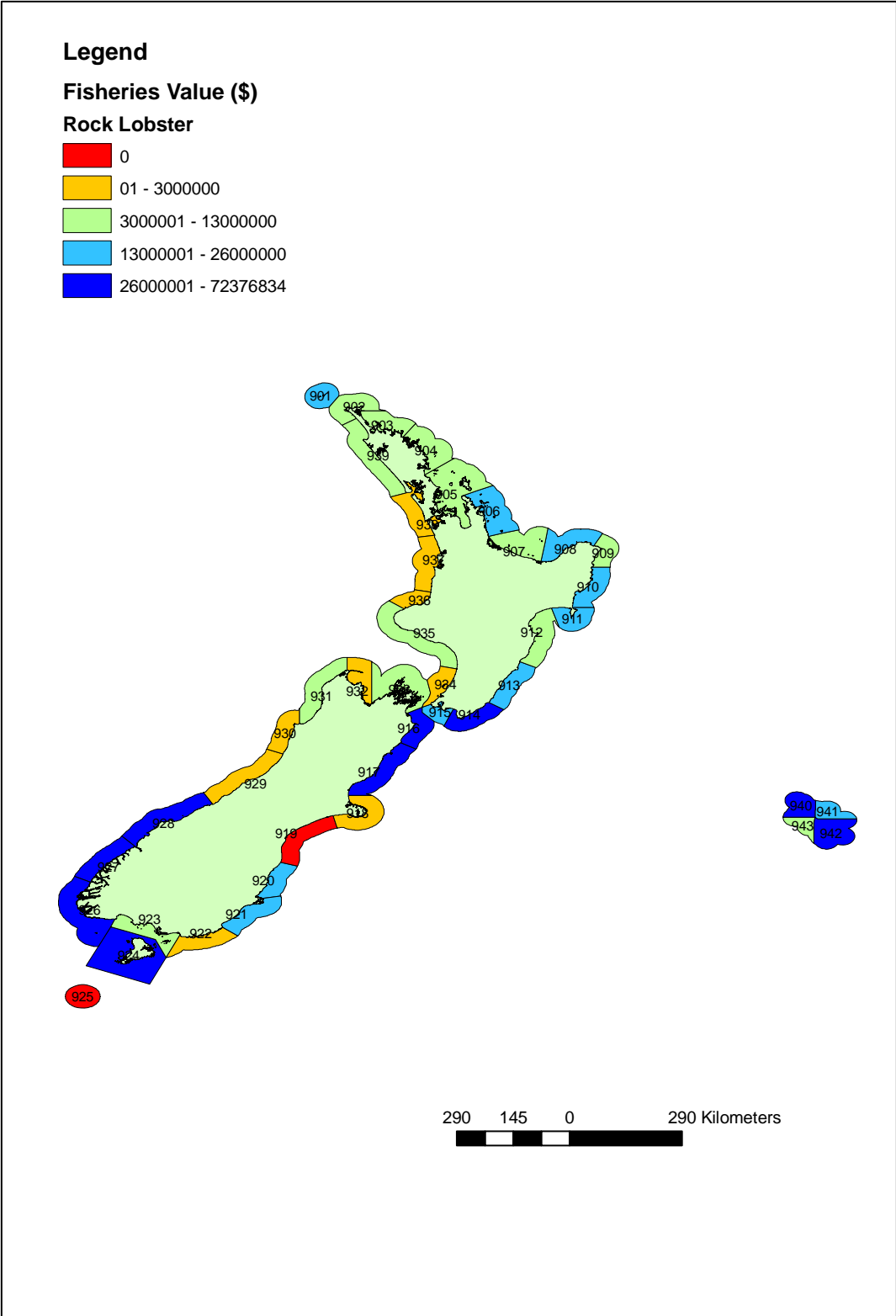


Figure 19: Rock Lobster Species Value At Risk based on the statistical areas to which catches are reported (Ministry of Fisheries data).



### 3.3 RESIDENTIAL LAND VALUE

Figure 20 shows the results of the total residential land value for coastal areas (all residential land within 1 km of the coast) using the GIS quintile analysis. Land value was calculated only for land within 1 km of the coast, however in Figure 20 the shading has been applied to the entire area unit.

The data shows coastal areas of highest land value are on the east coast of the far north (from Auckland extending up to around Kaitaia); on the west and east coast of Auckland; and in premium coastal destinations such as the Coromandel, Bay of Plenty, Marlborough and Golden Bay.

One caution should be noted in interpreting this visual data: Statistics NZ area units significantly vary in size. A large area unit such as Golden Bay can have a similar total residential land value as a much smaller area unit in, say, an urban area, and therefore be mapped in the same colour on the GIS layer, but the value per hectare might differ by an order of magnitude. The QV data obtained for this project does not, unfortunately, enable a per hectare land value to be derived because the valuation data for many area units includes a number of properties for which there is no land area recorded, e.g. because it is for an apartment in a building<sup>12</sup>.

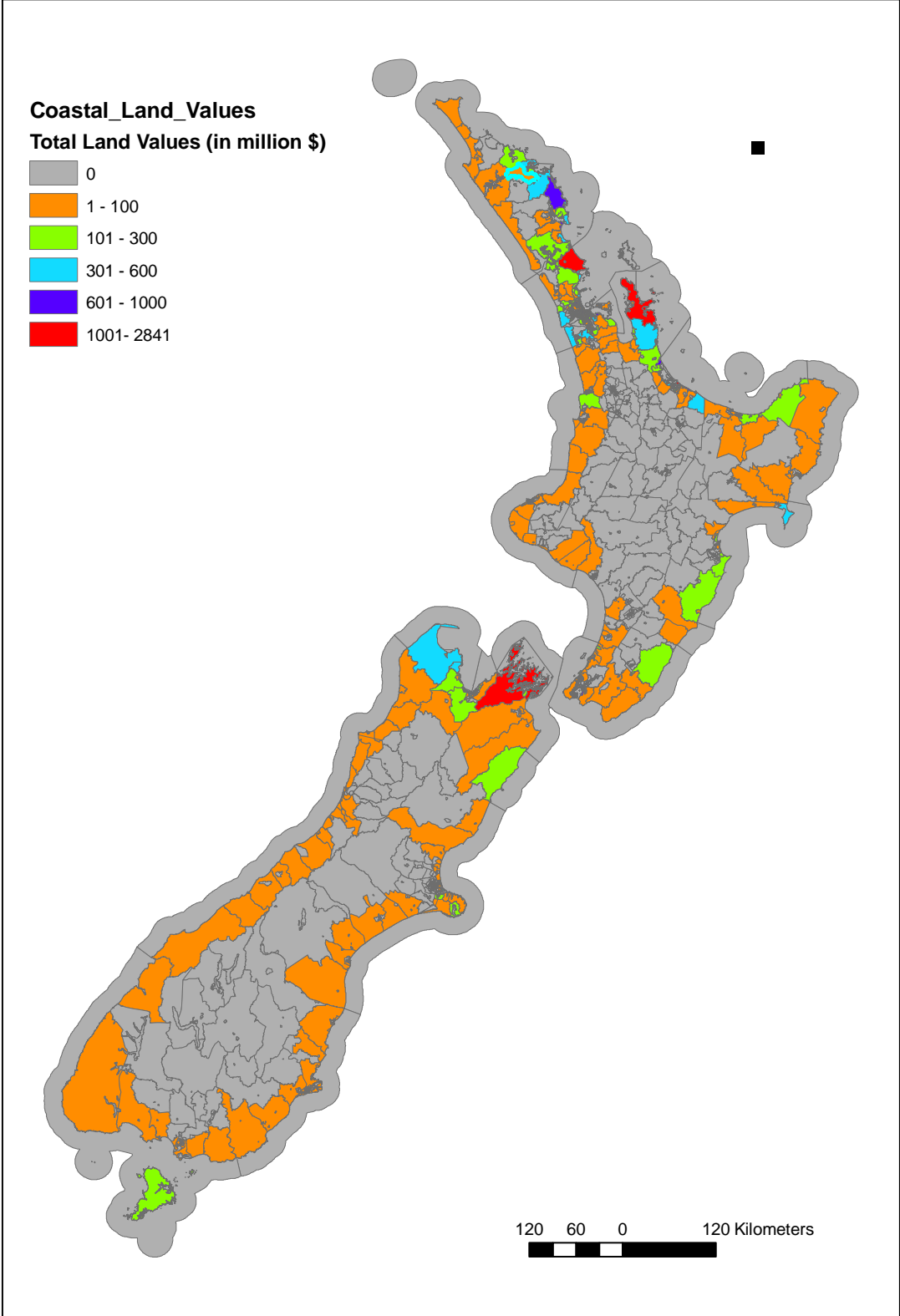
Thus, while the GIS layers give a quick visual indication of areas of concentrated value, it is also important to consider the numerical data when making policy and operational decisions.

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<sup>12</sup> R Deakin, QV, pers. comm.



Figure 20: Total land value for coastal area units based on ArcMap quintile distribution analysis (Quotable Value Ltd data).



## 4 Discussion

Total economic value is a broad concept, and encompasses non-market value as well as value from commercial (i.e. market) activities. This report addresses the economic value that is reflected in market activities, including the sale and purchase of residential property.

While the concepts of economic value arising from these activities are reasonably straightforward, challenges arose when seeking data to measure and map these sources of value. The resulting data are thus best described as *indicators* of economic value rather than as a direct measure of economic value itself. Each indicator has limitations, but was selected as the most cost effective approach within the limitations of data availability.

It was not possible to map all datasets using the same geographical areal basis, for two reasons. Firstly, because the Ministry of Fisheries collects fisheries catch data using different reporting areas than does Statistics NZ, and secondly, because Statistics NZ confidentiality rules (discussed in more detail below) in some cases necessitated aggregating data to the scale of territorial authorities in order to get useful data.

Reporting fisheries data by the marine area units in which catch is taken has the added advantage of showing the value at risk in the actual marine environment where the biological resources actually occur, which can be a significant distance from the land area units in which associated economic activity (e.g. fish processing) occurs.

It should be noted that these sub-components of economic value are not additive. Coastal Industry Added-Value is an estimate of the total annual revenue derived from commercial activity, and therefore includes both the opportunity cost of resources and any economic surplus (pure profit) associated with those activities. Fisheries Value at Risk and Residential Land Value, on the other hand, represent pure rent, i.e. value over and above the normal return to labour and capital, and are estimates of the present value of future income streams over an indefinite period of time, not annual value as represented by the Added-Value component. In other words, the reported added-value for coastal industries in a given area unit cannot be simply added to the reported total residential land value to obtain a total value at risk, primarily because the industry data is an annual flow whereas land value (and the fisheries values) represents an asset.

Further discussion relating to each of the sub-components follows.

### 4.1 COASTAL INDUSTRY ADDED-VALUE

#### Capturing seasonal activities

A significant issue with the use of census employment data to calculate value added for the fishing industry and aquaculture is that it does not cover all relevant activities. The census records employment during the first week of March 2006 and therefore does not capture seasonal trends. For example, fishing activity peaks at different times for different species, and the first week of March is not typical. For this reason, an additional approach, that of calculating fisheries value at risk through quota and export prices, was adopted.

The employment-based value-added data for fishing and aquaculture industries have been provided in this report for information and comparative purposes, with the caveat that it is likely to have a relatively higher margin of error. Before using this data for policy or

operational purposes, officials should investigate whether the industry or fisheries species in question is subject to significant seasonality that would affect interpretation of the data.

### SNZ confidentiality rules

Employment data provided by SNZ was subject to stringent confidentiality rules to protect the confidentiality of respondents<sup>13</sup>.

The rules particularly relevant to the data used in this project are:

- Rule 3 - Mean Cell Size: The essence of this rule is to suppress data unless there are more than twice as many people as categories in each geographic area reported.
- Rule 4 - Random rounding: All published data is randomly rounded to base three as follows:
  - zero counts and counts which are already multiples of three are left unchanged;
  - other counts are randomly rounded to one of the nearest multiples of three.Rounding is carried out on sub-totals and totals. The probabilities of rounding up or down are set so that in the long run, the expected value would approximate the original count. The effect of this rounding on the accuracy of data used in this project was assessed to be insignificant.

An example of the data, as originally received from SNZ, is shown in Table 7. SNZ confidentiality rules have been applied to all cells in this table, including random rounding to base 3. The symbol 'c' represents cells that have been suppressed for confidentiality reasons.

The confidentiality rules resulted in a significant amount of data being suppressed in the original datasets generated for this report, rendering the results of limited use. Therefore, where necessary, some industry classes or areas were aggregated, as described in Section 2.3.2 of this report.

### Residence vs workplace address

As noted in section 2.3.2, the coastal industry value-added data were generated based on employees' usual place of residence because this was considered more reliable than workplace address. However, employment data were also obtained by workplace address and these data have been retained in the datasets submitted along with this report. When this coastal industry analysis is updated in the future, it might be worthwhile to map the data by workplace as well as by residential address of employees, as this would provide an alternative locator of economic value at risk.

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<sup>13</sup> Statistics New Zealand (2008) *2006 Census Confidentiality Rules* <http://www.stats.govt.nz/census/about-2006-census/methodology-papers/confidentiality-rules.htm>

**Table 7: Sample data from 2006 Census, showing population employed per area of usual residence, showing effect of rounding and confidentiality suppression**

Area Units of Usual Residence	Rock Lobster Fishing	Finfish Trawling	Squid Jigging	Line Fishing	Oil and Gas Extraction	Gravel and Sand Quarrying
500100 Awanui	C	C	C	C	C	C
500202 Karikari Peninsula-Maungataniwha	3	3	0	0	3	0
500203 Taipa Bay-Mangonui	C	C	C	C	C	C
500204 Herekino	C	C	C	C	C	C
500205 Ahipara	C	C	C	C	C	C
500206 North Cape	C	C	C	C	C	C
500207 Houhora	C	C	C	C	C	C
500208 Motutangi-Kareponia	C	C	C	C	C	C
500301 Kaitaia West	0	0	0	0	0	0
500302 Kaitaia East	C	C	C	C	C	C
500401 Kaeo	C	C	C	C	C	C
500402 Mangapa-Matauri Bay	3	3	0	3	0	0
500500 Kohukohu	C	C	C	C	C	C
500600 Rawene	C	C	C	C	C	C
500700 Omapere and Opononi	C	C	C	C	C	C
500801 Hokianga North	C	C	C	C	C	C
500802 Hokianga South	C	C	C	C	C	C
500900 Kerikeri	0	0	0	0	0	0
501000 Russell	C	C	C	C	C	C
501100 Paihia	C	C	C	C	C	C
501200 Haruru Falls	C	C	C	C	C	C
501300 Opuā East	C	C	C	C	C	C
501400 Kawakawa	C	C	C	C	C	C
501500 Moerewa	C	C	C	C	C	C

### Use of national productivity measures

New Zealand does not currently have detailed regional statistics on economic activity. Accordingly, the methodology used to derive added-value data for coastal industries was limited to a cost-effective approach that utilises national data. This in turn presents challenges in terms of the precision of the indicators that the project creates. The key enabling assumption that makes the methodology tractable is that of uniform labour productivity across different regions of the country. This assumption enables industry output in value added terms to be allocated to area units on the basis of the population engaged in the industry. Clearly, however, labour productivity is not uniform. It varies as a function of technology, capital, output, and the mode of individual industry engagement – part-time employee, contractor, full time employee, or owner.

The precision of the added-value data was further constrained by the necessity to use high level industry classifications to derive labour productivity values which were then applied to lower level (i.e. more narrowly defined) coastal industries. If this data is updated in the future, that would provide an opportunity to explore whether this data can be obtained at the more disaggregated industry classification level.

Despite these limitations, what is lost in precision is gained in the capacity to express industry output – the value at risk – at an area unit level, and the indicators derived are considered to

provide a reasonable estimate for the intended purpose of informing biosecurity decision-making.

## 4.2 FISHERIES VALUE AT RISK

This study utilised an indicator of the present value of future fisheries harvests as an indicator of economic value arising from a direct use of coastal and marine ecosystems. In contrast to the coastal industry data, which represent annual flows of economic value, fisheries value-at-risk represents a long-term asset value. Asset values are most relevant for assessing potential economic impacts that are long-term in nature, i.e. that are likely to be permanent or last for at least several years. However, asset prices are less likely to react to short-term fluctuations in either catch or price.

Prices of traded quota shares were used to derive these estimates of fisheries value at risk. However, not all species harvested in the EEZ are included in the QMS, which presented a challenge in identifying a corresponding indicator for the non-QMS species. A cross-sectional regression analysis (see section 2.4) established a relationship between quota share prices and export prices that has been utilised to develop an indicator for the value at risk for species for which robust quota prices were not available. While the regression technique used was a standard one, its use to derive implied asset prices for non-quota fisheries is, to the best of our knowledge, a novel application.

The fisheries Value At Risk indicators developed in this analysis for QMS species can be compared to Ministry of Fisheries estimates of the total commercial value of all QMS species, derived from the product of quota share prices and total EEZ catches. The Ministry of Fisheries estimate for the commercial value of QMS fisheries is of the order of \$3.8 billion<sup>14</sup>. The total value at risk for all commercial species as calculated in this analysis is of the order of \$3.6 billion. Given that the MFish figure includes only QMS species, the indicators developed in this project are likely to understate the full extent of the fisheries value at risk.<sup>15</sup>

This in turn signals a fruitful direction for subsequent development of the indicator project, that is, the estimates could be improved with access to the underlying quota trade data. Periodic updating of the relationship between quota share prices and export prices may also be a useful avenue for refinement.

## 4.3 RESIDENTIAL LAND VALUE

The market for residential property in the coastal zone reflects the premium that people attach to the use and amenity values of the coastal marine environment. This component of economic value can therefore be captured in the reported value of residential land.

In principle, the economic value of the coast to residential property holders is the difference between the value of coastal and non-coastal properties that are identical in all other respects, i.e. the coastal premium. An initial proposal to obtain estimates of this coastal premium from a focus group of real estate experts proved unworkable. Premiums vary from one area to the next, estimating these would require local knowledge, and it would be impossible to ensure consistency across local panels even if it were possible to convene a sufficient number of panels to cover the entire coastline.

<sup>14</sup> <http://www.fish.govt.nz/en-nz/SOF/ValueIndicator.htm?DataDomain=SpeciesGroup&DataClass=All> accessed 29 January 2009.

<sup>15</sup> The difference is likely to be due differences in methodology, in that the Ministry would have access to the original data whereas we have had to work with data aggregated to annual prices and species (rather than QMA) level.

Instead, property value data were obtained from QV Ltd, the firm that holds records of all property assessments performed for local authority rating purposes. QV provided data on the value of all residential and lifestyle properties within 1 km of the coast, by area unit. The value of the land only, i.e. excluding the value of any improvements, was taken as the primary indicator, and this was adjusted by a housing price index based on recent sales data to standardise all data to 2007 prices.

While using total land value as the indicator is different than the concept of a coastal premium, the coastal premium itself may understate the value at risk from an invasive marine species. That is, one can imagine a scenario in which an invasive species, e.g. one that has an offensive smell or visual appearance, could reduce the value of a coastal property to less than the value of adjacent non-coastal property. It was, in any event, not possible to estimate the coastal premium from the data acquired for this study, but it would be worth exploring in the future whether such an estimate could be obtained.

The 1 km criterion is admittedly arbitrary. There are almost certainly properties more than 1 km from the coast, e.g. in Coromandel, whose value is nonetheless increased by proximity to the coast, just as there are properties within 1 km, e.g. in downtown Auckland, whose value has little or nothing to do with proximity to the coast.

Thus, if using this data to consider how to respond to a new invasive species, BNZ staff should consider how what effects the species might have and how far inland those effects are likely to be felt and interpret the reported data accordingly.

It is also important to note that a large rural area unit can have a similar total residential land value as a much smaller area unit in, say, an urban area, and therefore be mapped in the same colour on the GIS layer, but the value per hectare might differ by an order of magnitude. Thus, while the GIS layers give a quick visual indication of areas of concentrated value, it is also important to consider the numerical data when making policy and operational decisions.

## 5. Acknowledgements

We would like to acknowledge all those who have contributed to this project. In particular thanks go to: the focus group participants; the data providers – Statistics New Zealand, Ministry of Fisheries, and Quotable Value Ltd; Sara Clarke and Sarah Laing at URS; and MAFBNZ, especially Dr Daniel Kluza and Dr Andrew Bell, for their input to and funding of the project.

## 6. References

- Anon (2004) *How Much is an Ecosystem Worth? Assessing the Economic Value of Conservation*. IUCN/The Nature Conservancy/The World Bank. Washington DC. 33pp.
- Arnason, R (1990) Minimum information management in fisheries. *Canadian Journal of Economics* 23, 630-653.
- Arnold, A (2004) Shining a spotlight on the biodiversity of New Zealand's marine ecoregion: Experts workshop on marine biodiversity, 27-28 May 2003. WWF New Zealand;

Wellington, New Zealand.

- Batstone, CJ; Sharp BMH (2003) Minimum information management systems and ITQ fisheries management. *Journal of Environmental Economics and Management* 45, 492-504.
- Crowards, TM (1996) Natural resource accounting: A case study of Zimbabwe, *Environmental and Resource Economics* 7, 213 -241.
- Delorus, S; Agardy, T; Hillewaert, H; Hostens, K; Jamieson, G; Lieberknecht, L; Mees, J; Moolaert, I; Olenin, S; Paelinckx, D; Rabaut, M; Rachor, E; Roff, J; Steinen, EWM; Van Der Wal, JT; Van Lanker, V; Verfaillie, E; Vincx, M; Weslawski, JM; Degraer, S (2007) A concept for biological valuation in the marine environment. *Oceanologia* 49, 99-128.
- Dziegielewska, D; Tietenberg, T; Niggol Seo S (2007) Total economic value. In Cleveland, CJ (ed) *Encyclopedia of Earth*. Environmental Information Coalition, National Council for Science and the Environment; Washington, D.C  
<[http://www.eoearth.org/article/Total\\_economic\\_value](http://www.eoearth.org/article/Total_economic_value)>
- El Sarafy, S (1989) The proper calculation of income for depletable natural resources. In Ahmad, YJ; El Sarafy, S; Lutz, E (eds) *Environmental Accounting for Sustainable Development*. The World Bank; Washington, DC:
- Emerton, L; Bos, E (2004) *Value: Counting ecosystems as an economic part of water infrastructure*. International Union for Conservation of Nature and Natural Resources; Gland, Switzerland and Cambridge, UK. 88pp.
- Gordon, D (Ed.) (In press) *The New Zealand Inventory of Biodiversity: A Species 2000 Symposium review*. Canterbury University Press; Christchurch, New Zealand
- Groombridge, B (1992) *Global Diversity: Status of the earth's living resources*. Chapman and Hall; London, UK
- Hanley, N; Wright, RE; Adamowicz, V (1998) Using choice experiments to value the environment. *Environmental and Resource Economics* 11(3-4): 413-428.
- Landefeld, JS; Hines, JR (1985) National accounting for non-renewable natural resources in the mining industries. *Review of Income and Wealth* 31(1) 1 – 20.
- Linstone, HA; Turoff, M (1975) *The Delphi Method: Techniques and applications*. Addison-Wesley Educational Publishers; Reading, Massachusetts. Available at <http://is.njit.edu/pubs/delphibook/delphibook.pdf>
- MacCracken, JR; Abaza, H (2001) *Environmental Valuation: A worldwide compendium of case studies*. Earthscan; London, UK.
- Mack, R; Simberloff, D; Lonsdale, W; Evans, H; Clout, M; Bazzaz, F (2000) Biotic invasions: causes, epidemiology, global consequences and control. *Ecological Applications* 10, 689-710

- MacKinnon, K; Bonnardeaux, D; Luz, K; Sobrevila, C (2004) *Ensuring the Future: The World Bank and biodiversity*. The World Bank; Washington DC. 65pp.
- Navrud, S; Ready, RC (eds.) (2002) *Valuing Cultural Heritage: Applying environmental valuation techniques to historic buildings, monuments and artefacts*. Edward Elgar Publishing Ltd; Cheltenham; UK.
- Newell, RG; Sanchirico JN; Kerr S (2005) Fishing quota markets. *Journal of Environmental Economics and Management* 49(3), 437-462.
- Pagiola, S; von Ritter, K; Bishop, J (2004) *Assessing the Economic Value of Ecosystem Conservation*. The World Bank Environment Department Papers. Paper No. 101. 57pp.
- Pearce, DW (1991) An economic approach to saving the tropical forests. In: Helm, D (ed.), *Economic Policy Towards the Environment*. Blackwell; Oxford, UK. pp. 239–262.
- Repetto, R; Magrath, W; Wells, M; Beer, C; Rossini, F (1989) *Wasting Assets: Natural resources in national income accounts*. World Resources Institute; Washington DC.
- Seafood Industry Council (2006) Exports of Seafood Products by Selected Species. Prepared from official export figures collected by NZ Customs and supplied by Statistics New Zealand. 31 August 2006.
- Solorzano, R; de Camino, R; Woodward, R; Tosi, J; Watson, V; Vasquez, A; Villalobos, C; Jimenez, J; Repetto, R; Cruz, W (1991) *Accounts Overdue: Natural resource depletion in Costa Rica*. World Resources Institute; Washington DC.
- Statistics New Zealand (2001) *Inter-Industry Study 1996*. Published August 2001
- Statistics New Zealand (2006) *New Zealand's Marine Economy: 1997-2002*. Statistics New Zealand Environmental Series; Wellington, New Zealand.
- Tai, SY; Noh, KM; Abdullah, NMR (2000) Valuing fisheries depreciation in natural Resource accounting: the pelagic fisheries in northeast peninsular. *Environmental and Resource Economics* 15, 227-241.
- Torras, M (2000). The total economic value of Amazonian deforestation, 1978–1993. *Ecological Economics* 33: 283-297.
- United Nations (1979) *Guidelines on Statistics of Tangible Assets*. Statistical Papers Series - M, no. 68, E 80 XVII, 2, United Nations.
- White, Halbert (1980) A Heteroscedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroscedasticity. *Econometrica* 44, 3 (April): 817-838.
- Wilcove, D; Rothstein, D; Dubow, J; Phillips, A; Losos, E; (1998) Quantifying threats to imperiled species in the United States. *Bioscience* 48, 607-615.



The Australian New Zealand Standard Industrial Classification 1996, New Zealand Use (ANZSIC96) is used for the collection, compilation and publication of statistics relating to industry. This classification is a modification of ANZSIC93 with additional detail for specific New Zealand industries. The classification was developed as part of a co-operative effort with the Australian Bureau of Statistics to harmonise statistics wherever possible and practicable, and is closely based on the international classification ISIC Revision 3. ANZSIC96 provides a standard framework for classifying business statistical units by industry in official statistics. This ensures that each unit is classified to the same industry in all statistical collections in which it is included and that industry statistics are comparable across surveys and between the two countries. Businesses are assigned to an industry according to their predominant economic activity.

The ANZSIC96 New Zealand Use has a structure comprising categories at five levels, namely:

1. Divisions (the broadest level)
2. Subdivisions
3. Groups
4. Classes
5. Sub-Classes (NZ only)

The table is reproduced overleaf. The industries selected for inclusion in this project (as described in Table 2 of this report) are shown in the shaded rows.

Australian and New Zealand Standard Industrial Classification – NZ version 1996 (ANZSIC96)					
Level 1	Level 2	Level 3	Level 4	Level 5	Note: nec = not elsewhere classified
<b>A</b>	<b>Agriculture, Forestry and Fishing</b>				
	A01	Agriculture			
		A011	Horticulture and Fruit Growing		
			A0111	Plant Nurseries	
				A011100	Plant Nurseries
			A0112	Cut Flower and Flower Seed Growing	
				A011200	Cut Flower and Flower Seed Growing
			A0113	Vegetable Growing	
				A011300	Vegetable Growing
			A0114	Grape Growing	
				A011400	Grape Growing
			A0115	Apple and Pear Growing	
				A011500	Apple and Pear Growing
			A0116	Stone Fruit Growing	
				A011600	Stone Fruit Growing
			A0117	Kiwi Fruit Growing	
				A011700	Kiwi Fruit Growing
			A0119	Fruit Growing nec	
				A011910	Citrus Growing
				A011920	Berry Fruit Growing
				A011990	Other Fruit Growing nec
		A012	Grain, Sheep and Beef Cattle Farming		
			A0121	Grain Growing	
				A012100	Grain Growing
			A0122	Grain-Sheep and Grain-Beef Cattle Farming	
				A012200	Grain-Sheep and Grain-Beef Cattle Farming
			A0123	Sheep-Beef Cattle Farming	
				A012300	Sheep-Beef Cattle Farming
			A0124	Sheep Farming	
				A012400	Sheep Farming
			A0125	Beef Cattle Farming	
				A012500	Beef Cattle Farming
		A013	Dairy Cattle Farming		
			A0130	Dairy Cattle Farming	
				A013000	Dairy Cattle Farming
		A014	Poultry Farming		
			A0141	Poultry Farming (Meat)	
				A014100	Poultry Farming (Meat)
			A0142	Poultry Farming (Eggs)	
				A014200	Poultry Farming (Eggs)
		A015	Other Livestock Farming		
			A0151	Pig Farming	
				A015100	Pig Farming
			A0152	Horse Farming	
				A015200	Horse Farming
			A0153	Deer Farming	
				A015300	Deer Farming
			A0159	Livestock Farming nec	
				A015910	Mixed Livestock
				A015930	Beekeeping
				A015990	Livestock Farming nec
		A016	Other Crop Growing		
			A0169	Crop and Plant Growing nec	
				A016910	Tobacco and Hops Growing
				A016920	Cultivated Mushroom Growing
				A016990	Crop and Plant Growing nec
	A02	Services to Agriculture; Hunting and Trapping			
		A021	Services to Agriculture		
			A0212	Shearing	
				A021200	Shearing Services
			A0213	Aerial Agricultural Services	
				A021300	Aerial Agricultural Services

Australian and New Zealand Standard Industrial Classification – NZ version 1996 (ANZSIC96)					
Level 1	Level 2	Level 3	Level 4	Level 5	Note: nec = not elsewhere classified
			A0219	Services to Agriculture nec	
				A021900	Services to Agriculture nec
		A022	Hunting and Trapping		
			A0220	Hunting and Trapping	
				A022000	Hunting and Trapping
	A03	Forestry and Logging			
		A030	Forestry and Logging		
			A0301	Forestry	
				A030100	Forestry
			A0302	Logging	
				A030200	Logging
			A0303	Services to Forestry	
				A030300	Services to Forestry
	A04	Commercial Fishing			
		A041	Marine Fishing		
			A0411	Rock Lobster Fishing	
				A041100	Rock Lobster Fishing
			A0412	Prawn Fishing	
				A041200	Prawn Fishing
			A0413	Finfish Trawling	
				A041300	Finfish Trawling
			A0414	Squid Jigging	
				A041400	Squid Jigging
			A0415	Line Fishing	
				A041500	Line Fishing
			A0419	Marine Fishing nec	
				A041900	Marine Fishing nec
		A042	Aquaculture		
			A0420	Aquaculture	
				A042000	Aquaculture
<b>B</b>	<b>Mining</b>				
	B11	Coal Mining			
		B110	Coal Mining		
			B1101	Black Coal Mining	
				B110100	Black Coal Mining
			B1102	Brown Coal Mining	
				B110200	Brown Coal Mining
	B12	Oil and Gas Extraction			
		B120	Oil and Gas Extraction		
			B1200	Oil and Gas Extraction	
				B120000	Oil and Gas Extraction
	B13	Metal Ore Mining			
		B131	Metal Ore Mining		
			B1311	Iron Ore Mining	
				B131100	Iron Ore Mining
			B1312	Bauxite Mining	
				B131200	Bauxite Mining
			B1313	Copper Ore Mining	
				B131300	Copper Ore Mining
			B1314	Gold Ore Mining	
				B131400	Gold Ore Mining
			B1315	Mineral Sand Mining	
				B131500	Mineral Sand Mining
			B1316	Nickel Ore Mining	
				B131600	Nickel Ore Mining
			B1317	Silver-Lead-Zinc Ore Mining	
				B131700	Silver-Lead-Zinc Ore Mining
			B1319	Metal Ore Mining nec	
				B131900	Metal Ore Mining nec
	B14	Other Mining			
		B141	Construction Material Mining		
			B1411	Gravel and Sand Quarrying	
				B141100	Gravel and Sand Quarrying
			B1419	Construction Material Mining nec	

Australian and New Zealand Standard Industrial Classification – NZ version 1996 (ANZSIC96)					
Level 1	Level 2	Level 3	Level 4	Level 5	Note: nec = not elsewhere classified
				B141900	Construction Material Mining nec
		B142	Mining nec		
			B1420	Mining nec	
				B142000	Mining nec
	B15	Services to Mining			
		B151	Exploration		
			B1511	Petroleum Exploration (Own Account)	
				B151100	Petroleum Exploration (Own Account)
			B1512	Petroleum Exploration Services	
				B151200	Petroleum Exploration Services
			B1514	Mineral Exploration Services	
				B151400	Mineral Exploration Services
		B152	Other Mining		
			B1520	Other Mining Services	
				B152000	Other Mining Services
<b>C</b>	<b>Manufacturing</b>				
	C21	Food, Beverage and Tobacco			
		C211	Meat and Meat Product Manufacturing		
			C2111	Meat Processing	
				C211100	Meat Processing
			C2112	Poultry Processing	
				C211200	Poultry Processing
			C2113	Bacon, Ham and Smallgood Manufacturing	
		C212	Dairy Product Manufacturing		
			C2121	Milk and Cream Processing	
				C212100	Milk and Cream Processing
			C2122	Ice Cream Manufacturing	
				C212200	Ice Cream Manufacturing
			C2129	Dairy Product Manufacturing nec	
				C212900	Dairy Product Manufacturing nec
		C213	Fruit and Vegetable Processing		
			C2130	Fruit and Vegetable Processing	
				C213000	Fruit and Vegetable Processing
		C214	Oil and Fat Manufacturing		
			C2140	Oil and Fat Manufacturing	
				C214000	Oil and Fat Manufacturing
		C215	Flour Mill and Cereal Food Manufacturing		
			C2151	Flour Mill Product Manufacturing	
				C215100	Flour Mill Product Manufacturing
			C2152	Cereal Food and Baking Mix Manufacturing	
				C215200	Cereal Food and Baking Mix Manufacturing
		C216	Bakery Product Manufacturing		
			C2161	Bread Manufacturing	
				C216100	Bread Manufacturing
			C2162	Cake and Pastry Manufacturing	
				C216200	Cake and Pastry Manufacturing
			C2163	Biscuit Manufacturing	
				C216300	Biscuit Manufacturing
		C217	Other Food Manufacturing		
			C2171	Sugar Manufacturing	
				C217100	Sugar Manufacturing
			C2172	Confectionery Manufacturing	
				C217200	Confectionery Manufacturing
			C2173	Seafood Processing	
				C217300	Seafood Processing
			C2174	Prepared Animal and Bird Feed Manufacturing	
				C217400	Prepared Animal and Bird Feed Manufacturing
			C2179	Food Manufacturing nec	
				C217900	Food Manufacturing nec
			C2181	Soft Drink, Cordial and Syrup Manufacturing	
				C218100	Soft Drink, Cordial and Syrup Manufacturing
			C2182	Beer and Malt Manufacturing	
				C218200	Beer and Malt Manufacturing
			C2183	Wine Manufacturing	

Australian and New Zealand Standard Industrial Classification – NZ version 1996 (ANZSIC96)					
Level 1	Level 2	Level 3	Level 4	Level 5	Note: nec = not elsewhere classified
				C218300	Wine Manufacturing
			C2184	Spirit Manufacturing	
				C218400	Spirit Manufacturing
		C219	Tobacco Product Manufacturing		
			C2190	Tobacco Product Manufacturing	
				C219000	Tobacco Product Manufacturing
	C22	Textile, Clothing, Footwear and Leather Manufacturing			
		C221	Textile Fibre, Yarn and Woven Fabric Manufacturing		
			C2211	Wool Scouring	
				C221100	Wool Scouring
			C2212	Synthetic Fibre Textile Manufacturing	
				C221200	Synthetic Fibre Textile Manufacturing
			C2213	Cotton Textile Manufacturing	
				C221300	Cotton Textile Manufacturing
			C2214	Wool Textile Manufacturing	
				C221400	Wool Textile Manufacturing
			C2215	Textile Finishing	
				C221500	Textile Finishing
		C222	Textile Product Manufacturing		
			C2221	Made-Up Textile Product Manufacturing	
				C222100	Made-Up Textile Product Manufacturing
			C2222	Textile Floor Covering Manufacturing	
				C222200	Textile Floor Covering Manufacturing
			C2223	Rope, Cordage and Twine Manufacturing	
				C222300	Rope, Cordage and Twine Manufacturing
			C2229	Textile Product Manufacturing nec	
				C222900	Textile Product Manufacturing nec
		C223	Knitting Mills		
			C2231	Hosiery Manufacturing	
				C223100	Hosiery Manufacturing
			C2232	Cardigan and Pullover Manufacturing	
				C223200	Cardigan and Pullover Manufacturing
			C2239	Knitting Mill Product Manufacturing nec	
				C223900	Knitting Mill Product Manufacturing nec
		C224	Clothing Manufacturing		
			C2240	Clothing Manufacturing	
				C224000	Clothing Manufacturing
		C225	Footwear Manufacturing		
			C2250	Footwear Manufacturing	
				C225000	Footwear Manufacturing
		C226	Leather and Leather Product Manufacturing		
			C2261	Leather Tanning and Fur Dressing	
				C226110	Leather Tanning and Fur Dressing excluding Fellmongery
				C226120	Fellmongery
			C2262	Leather and Leather Substitute Product Manufacturing	
				C226200	Leather and Leather Substitute Product Manufacturing
	C23	Wood and Paper Product Manufacturing			
		C231	Log Sawmilling and Timber Dressing		
			C2311	Log Sawmilling	
				C231100	Log Sawmilling
			C2312	Wood Chipping	
				C231200	Wood Chipping
			C2313	Timber Resawing and Dressing	
				C231300	Timber Resawing and Dressing
		C232	Other Wood Product Manufacturing		
			C2321	Plywood and Veneer Manufacturing	
				C232100	Plywood and Veneer Manufacturing
			C2322	Fabricated Wood Manufacturing	
				C232200	Fabricated Wood Manufacturing
			C2323	Wooden Structural Component Manufacturing	
				C232300	Wooden Structural Component Manufacturing
			C2329	Wood Product Manufacturing nec	
				C232900	Wood Product Manufacturing nec
		C233	Paper and Paper Product Manufacturing		

Australian and New Zealand Standard Industrial Classification – NZ version 1996 (ANZSIC96)					
Level 1	Level 2	Level 3	Level 4	Level 5	Note: nec = not elsewhere classified
			C2331	Pulp, Paper and Paperboard Manufacturing	
				C233100	Pulp, Paper and Paperboard Manufacturing
			C2332	Solid Paperboard Container Manufacturing	
				C233200	Solid Paperboard Container Manufacturing
			C2333	Corrugated Paperboard Container Manufacturing	
				C233300	Corrugated Paperboard Container Manufacturing
			C2334	Paper Bag and Sack Manufacturing	
				C233400	Paper Bag and Sack Manufacturing
			C2339	Paper Product Manufacturing nec	
				C233900	Paper Product Manufacturing nec
	C24	Printing, Publishing and Recorded Media			
		C241	Printing and Services to Printing		
			C2411	Paper Stationery Manufacturing	
				C241100	Paper Stationery Manufacturing
			C2412	Printing	
				C241200	Printing
			C2413	Services to Printing	
				C241300	Services to Printing
		C242	Publishing		
			C2421	Newspaper Printing or Publishing	
				C242100	Newspaper Printing or Publishing
			C2422	Other Periodical Publishing	
				C242200	Other Periodical Publishing
			C2423	Book and other Publishing	
				C242300	Book and other Publishing
		C243	Recorded Media Manufacturing and Publishing		
			C2430	Recorded Media Manufacturing and Publishing	
				C243000	Recorded Media Manufacturing and Publishing
	C25	Petroleum, Coal, Chemical and Associated Product Manufacturing			
		C251	Petroleum Refining		
			C2510	Petroleum Refining	
				C251000	Petroleum Refining
		C252	Petroleum and Coal Product Manufacturing nec		
			C2520	Petroleum and Coal Product Manufacturing nec	
				C252000	Petroleum and Coal Product Manufacturing nec
		C253	Basic Chemical Manufacturing		
			C2531	Fertiliser Manufacturing	
				C253100	Fertiliser Manufacturing
			C2532	Industrial Gas Manufacturing	
				C253200	Industrial Gas Manufacturing
			C2533	Synthetic Resin Manufacturing	
				C253300	Synthetic Resin Manufacturing
			C2534	Organic Industrial Chemical Manufacturing nec	
				C253400	Organic Industrial Chemical Manufacturing nec
			C2535	Inorganic Industrial Chemical Manufacturing nec	
				C253500	Inorganic Industrial Chemical Manufacturing nec
		C254	Other Chemical Product Manufacturing		
			C2541	Explosive Manufacturing	
				C254100	Explosive Manufacturing
			C2542	Paint Manufacturing	
				C254200	Paint Manufacturing
			C2543	Medicinal and Pharmaceutical Product Manufacturing	
				C254300	Medicinal and Pharmaceutical Product Manufacturing
			C2544	Pesticide Manufacturing	
				C254400	Pesticide Manufacturing
			C2545	Soap and Other Detergent Manufacturing	
				C254500	Soap and Other Detergent Manufacturing
			C2546	Cosmetic and Toiletry Preparation Manufacturing	
				C254600	Cosmetic and Toiletry Preparation Manufacturing
			C2547	Ink Manufacturing	
				C254700	Ink Manufacturing
			C2549	Chemical Product Manufacturing nec	
				C254900	Chemical Product Manufacturing nec
		C255	Rubber Product Manufacturing		

Australian and New Zealand Standard Industrial Classification – NZ version 1996 (ANZSIC96)					
Level 1	Level 2	Level 3	Level 4	Level 5	Note: nec = not elsewhere classified
			C2551	Rubber Tyre Manufacturing	
				C255100	Rubber Tyre Manufacturing
			C2559	Rubber Product Manufacturing nec	
				C255900	Rubber Product Manufacturing nec
		C256	Plastic Product Manufacturing		
			C2561	Plastic Blow Moulded Product Manufacturing	
				C256100	Plastic Blow Moulded Product Manufacturing
			C2562	Plastic Extruded Product Manufacturing	
				C256200	Plastic Extruded Product Manufacturing
			C2563	Plastic Bag and Film Manufacturing	
				C256300	Plastic Bag and Film Manufacturing
			C2564	Plastic Product Rigid Fibre Reinforced Manufacturing	
				C256400	Plastic Product Rigid Fibre Reinforced Manufacturing
			C2565	Plastic Foam Product Manufacturing	
				C256500	Plastic Foam Product Manufacturing
			C2566	Plastic Injection Moulded Product Manufacturing	
				C256600	Plastic Injection Moulded Product Manufacturing
	C26	Non-Metallic Mineral Product Manufacturing			
		C261	Glass and Glass Product Manufacturing		
			C2610	Glass and Glass Product Manufacturing	
				C261000	Glass and Glass Product Manufacturing
		C262	Ceramic Manufacturing		
			C2621	Clay Brick Manufacturing	
				C262100	Clay Brick Manufacturing
			C2622	Ceramic Product Manufacturing	
				C262200	Ceramic Product Manufacturing
			C2623	Ceramic Tile and Pipe Manufacturing	
				C262300	Ceramic Tile and Pipe Manufacturing
			C2629	Ceramic Product Manufacturing nec	
				C262900	Ceramic Product Manufacturing nec
		C263	Cement, Lime, Plaster and Concrete Product Manufacturing		
			C2631	Cement and Lime Manufacturing	
				C263100	Cement and Lime Manufacturing
			C2632	Plaster Product Manufacturing	
				C263200	Plaster Product Manufacturing
			C2633	Concrete Slurry Manufacturing	
				C263300	Concrete Slurry Manufacturing
			C2634	Concrete Pipe and Box Culvert Manufacturing	
				C263400	Concrete Pipe and Box Culvert Manufacturing
			C2635	Concrete Product Manufacturing nec	
				C263500	Concrete Product Manufacturing nec
		C264	Non-Metallic Mineral Product Manufacturing nec		
			C2640	Non-Metallic Mineral Product Manufacturing nec	
				C264000	Non-Metallic Mineral Product Manufacturing nec
	C27	Metal Product Manufacturing			
		C271	Iron and Steel Manufacturing		
			C2711	Basic Iron and Steel Manufacturing	
				C271100	Basic Iron and Steel Manufacturing
			C2712	Iron and Steel Casting and Forging	
				C271200	Iron and Steel Casting and Forging
			C2713	Steel Pipe and Tube Manufacturing	
				C271300	Steel Pipe and Tube Manufacturing
		C272	Basic Non-Ferrous Metal Manufacturing		
			C2721	Alumina Production	
				C272100	Alumina Production
			C2722	Aluminium Smelting	
				C272200	Aluminium Smelting
			C2723	Copper, Silver, Lead and Zinc Smelting, Refining	
				C272300	Copper, Silver, Lead and Zinc Smelting, Refining
			C2729	Basic Non-Ferrous Metal Manufacturing nec	
				C272900	Basic Non-Ferrous Metal Manufacturing nec
		C273	Non-Ferrous Basic Metal Product Manufacturing		
			C2731	Aluminium Rolling, Drawing, Extruding	
				C273100	Aluminium Rolling, Drawing, Extruding

Australian and New Zealand Standard Industrial Classification – NZ version 1996 (ANZSIC96)					
Level 1	Level 2	Level 3	Level 4	Level 5	Note: nec = not elsewhere classified
			C2732	Non-Ferrous Metal Rolling, Drawing, Extruding nec	
				C273200	Non-Ferrous Metal Rolling, Drawing, Extruding nec
			C2733	Non-Ferrous Metal Casting	
				C273300	Non-Ferrous Metal Casting
		C274	Structural Metal Product Manufacturing		
			C2741	Structural Steel Fabricating	
				C274100	Structural Steel Fabricating
			C2742	Architectural Aluminium Product Manufacturing	
				C274200	Architectural Aluminium Product Manufacturing
			C2749	Structural Metal Product Manufacturing nec	
				C274900	Structural Metal Product Manufacturing nec
		C275	Sheet Metal Product Manufacturing		
			C2751	Metal Container Manufacturing	
				C275100	Metal Container Manufacturing
			C2759	Sheet Metal Product Manufacturing nec	
				C275900	Sheet Metal Product Manufacturing nec
		C276	Fabricated Metal Product Manufacturing		
			C2761	Hand Tool and General Hardware Manufacturing	
				C276100	Hand Tool and General Hardware Manufacturing
			C2762	Spring and Wire Product Manufacturing	
				C276200	Spring and Wire Product Manufacturing
			C2763	Nut, Bolt, Screw and Rivet Manufacturing	
				C276300	Nut, Bolt, Screw and Rivet Manufacturing
			C2764	Metal Coating and Finishing	
				C276400	Metal Coating and Finishing
			C2765	Non-Ferrous Pipe Fitting Manufacturing	
				C276500	Non-Ferrous Pipe Fitting Manufacturing
			C2769	Fabricated Metal Product Manufacturing nec	
				C276900	Fabricated Metal Product Manufacturing nec
	C28	Machinery and Equipment Manufacturing			
		C281	Motor Vehicle and Part Manufacturing		
			C2811	Motor Vehicle Manufacturing	
				C281100	Motor Vehicle Manufacturing
			C2812	Motor Vehicle Body Manufacturing	
				C281200	Motor Vehicle Body Manufacturing
			C2813	Automotive Electrical and Instrument Manufacturing	
				C281300	Automotive Electrical and Instrument Manufacturing
			C2819	Automotive Component Manufacturing nec	
				C281900	Automotive Component Manufacturing nec
		C282	Other Transport Equipment Manufacturing		
			C2821	Shipbuilding	
				C282100	Shipbuilding
			C2822	Boatbuilding	
				C282200	Boatbuilding
			C2823	Railway Equipment Manufacturing	
				C282300	Railway Equipment Manufacturing
			C2824	Aircraft Manufacturing	
				C282400	Aircraft Manufacturing
			C2829	Transport Equipment Manufacturing nec	
				C282900	Transport Equipment Manufacturing nec
		C283	Photographic and Scientific Equipment Manufacturing		
			C2831	Photographic and Optical Good Manufacturing	
				C283100	Photographic and Optical Good Manufacturing
				C283100	Photographic and Optical Good Manufacturing
			C2832	Medical and Surgical Equipment Manufacturing	
				C283200	Medical and Surgical Equipment Manufacturing
			C2839	Professional and Scientific Equipment Manufacturing nec	
				C283900	Professional and Scientific Equipment Manufacturing nec
		C284	Electronic Equipment Manufacturing		
			C2841	Computer and Business Machine Manufacturing	
				C284100	Computer and Business Machine Manufacturing
			C2842	Telecommunication, Broadcasting and Transceiving Equipment Manufacturing	
				C284200	Telecommunication, Broadcasting and Transceiving Equipment Manufacturing



Australian and New Zealand Standard Industrial Classification – NZ version 1996 (ANZSIC96)					
Level 1	Level 2	Level 3	Level 4	Level 5	Note: nec = not elsewhere classified
			C2849	Electronic Equipment Manufacturing nec	
				C284900	Electronic Equipment Manufacturing nec
		C285	Electrical Equipment and Appliance Manufacturing		
			C2851	Household Appliance Manufacturing	
				C285100	Household Appliance Manufacturing
			C2852	Electric Cable and Wire Manufacturing	
				C285200	Electric Cable and Wire Manufacturing
			C2853	Battery Manufacturing	
				C285300	Battery Manufacturing
			C2854	Electric Light and Sign Manufacturing	
				C285400	Electric Light and Sign Manufacturing
			C2859	Electrical Equipment Manufacturing nec	
				C285900	Electrical Equipment Manufacturing nec
		C286	Industrial Machinery and Equipment Manufacturing		
			C2861	Agricultural Machinery Manufacturing	
				C286100	Agricultural Machinery Manufacturing
			C2862	Mining and Construction Machinery Manufacturing	
				C286200	Mining and Construction Machinery Manufacturing
			C2863	Food Processing Machinery Manufacturing	
				C286300	Food Processing Machinery Manufacturing
			C2864	Machine Tool and Part Manufacturing	
				C286400	Machine Tool and Part Manufacturing
			C2865	Lifting and Material Handling Equipment Manufacturing	
				C286500	Lifting and Material Handling Equipment Manufacturing
			C2866	Pump and Compressor Manufacturing	
				C286600	Pump and Compressor Manufacturing
			C2867	Commercial Space Heating and Cooling Equipment Manufacturing	
				C286700	Commercial Space Heating and Cooling Equipment Manufacturing
			C2869	Industrial Machinery and Equipment Manufacturing nec	
				C286900	Industrial Machinery and Equipment Manufacturing nec
	C29	Other Manufacturing			
		C291	Prefabricated Building Manufacturing		
			C2911	Prefabricated Metal Building Manufacturing	
				C291100	Prefabricated Metal Building Manufacturing
			C2919	Prefabricated Building Manufacturing nec	
				C291900	Prefabricated Building Manufacturing nec
		C292	Furniture Manufacturing		
			C2921	Wooden Furniture and Upholstered Seat Manufacturing	
				C292100	Wooden Furniture and Upholstered Seat Manufacturing
			C2922	Sheet Metal Furniture Manufacturing	
				C292200	Sheet Metal Furniture Manufacturing
			C2923	Mattress Manufacturing (except Rubber)	
				C292300	Mattress Manufacturing (except Rubber)
			C2929	Furniture Manufacturing nec	
				C292900	Furniture Manufacturing nec
		C294	Other Manufacturing		
			C2941	Jewellery and Silverware Manufacturing	
				C94100	Jewellery and Silverware Manufacturing
			C2942	Toy and Sporting Good Manufacturing	
				C294200	Toy and Sporting Good Manufacturing
			C2949	Manufacturing nec	
				C294900	Manufacturing nec
<b>D</b>	<b>Electricity, Gas and Water Supply</b>				
	D36	Electricity and Gas Supply			
		D361	Electricity Supply		
			D3610	Electricity Supply	
				D361000	Electricity Supply
		D362	Gas Supply		
			D3620	Gas Supply	
				D362000	Gas Supply
	D37	Water Supply, Sewerage and Drainage Services			
		D370	Water Supply, Sewerage and Drainage Services		
			D3701	Water Supply	
				D370100	Water Supply

Australian and New Zealand Standard Industrial Classification – NZ version 1996 (ANZSIC96)					
Level 1	Level 2	Level 3	Level 4	Level 5	Note: nec = not elsewhere classified
			D3702	Sewerage and Drainage Services	
				D370200	Sewerage and Drainage Services
<b>E</b>	<b>Construction</b>				
	E41	General Construction			
		E411	Building Construction		
			E4111	House Construction	
				E411100	House Construction
			E4112	Residential Building Construction nec	
				E411200	Residential Building Construction nec
			E4113	Non-Residential Building Construction	
				E411300	Non-Residential Building Construction
		E412	Non-Building Construction		
			E4121	Road and Bridge Construction	
				E412100	Road and Bridge Construction
			E4122	Non-Building Construction nec	
				E412200	Non-Building Construction nec
	E42	Construction Trade Services			
		E421	Site Preparation Services		
			E4210	Site Preparation Services	
				E421000	Site Preparation Services
		E422	Building Structure Services		
			E4221	Concreting Services	
				E422100	Concreting Services
			E4222	Bricklaying Services	
				E422200	Bricklaying Services
			E4223	Roofing Services	
				E422300	Roofing Services
			E4224	Structural Steel Erection Services	
				E422400	Structural Steel Erection Services
		E423	Installation Trade Services		
			E4231	Plumbing Services	
				E423100	Plumbing Services
			E4232	Electrical Services	
				E423200	Electrical Services
			E4233	Air Conditioning and Heating Services	
				E423300	Air Conditioning and Heating Services
			E4234	Fire and Security System Services	
				E423400	Fire and Security System Services
		E424	Building Completion Services		
			E4241	Plastering and Ceiling Services	
				E424100	Plastering and Ceiling Services
			E4242	Carpentry Services	
				E424200	Carpentry Services
			E4243	Tiling and Carpeting Services	
				E424300	Tiling and Carpeting Services
			E4244	Painting and Decorating Services	
				E424400	Painting and Decorating Services
			E4245	Glazing Services	
				E424500	Glazing Services
		E425	Other Construction Services		
			E4251	Landscaping Services	
				E425100	Landscaping Services
			E4259	Construction Services nec	
				E425900	Construction Services nec
<b>F</b>	<b>Wholesale Trade</b>				
	F45	Basic Material Wholesaling			
		F451	Farm Produce Wholesaling		
			F4511	Wool Wholesaling	
				F451100	Wool Wholesaling
			F4512	Cereal Grain Wholesaling	
				F451200	Cereal Grain Wholesaling
			F4519	Farm Produce and Supplies Wholesaling nec	
				F451900	Farm Produce and Supplies Wholesaling nec
		F452	Mineral, Metal and Chemical Wholesaling		

Australian and New Zealand Standard Industrial Classification – NZ version 1996 (ANZSIC96)					
Level 1	Level 2	Level 3	Level 4	Level 5	Note: nec = not elsewhere classified
			F4521	Petroleum Product Wholesaling	
				F452100	Petroleum Product Wholesaling
			F4522	Metal and Mineral Wholesaling	
				F452200	Metal and Mineral Wholesaling
			F4523	Chemical Wholesaling	
				F452300	Chemical Wholesaling
		F453	Builders Supplies Wholesaling		
			F4531	Timber Wholesaling	
				F453100	Timber Wholesaling
			F4539	Building Supplies Wholesaling nec	
				F453900	Building Supplies Wholesaling nec
	F46	Machinery and Motor Vehicle Wholesaling			
		F461	Machinery and Equipment Wholesaling		
			F4611	Farm and Construction Machinery Wholesaling	
				F461100	Farm and Construction Machinery Wholesaling
			F4612	Professional Equipment Wholesaling	
				F461200	Professional Equipment Wholesaling
			F4613	Computer Wholesaling	
				F461300	Computer Wholesaling
			F4614	Business Machine Wholesaling nec	
				F461400	Business Machine Wholesaling nec
			F4615	Electrical and Electronic Equipment Wholesaling nec	
				F461500	Electrical and Electronic Equipment Wholesaling nec
			F4619	Machinery and Equipment Wholesaling nec	
				F461900	Machinery and Equipment Wholesaling nec
		F462	Motor Vehicle Wholesaling		
			F4621	Car Wholesaling	
				F462100	Car Wholesaling
			F4622	Commercial Vehicle Wholesaling	
				F462200	Commercial Vehicle Wholesaling
			F4623	Motor Vehicle New Part Dealing	
				F462300	Motor Vehicle New Part Dealing
			F4624	Motor Vehicle Dismantling and Used Part Dealing	
				F462400	Motor Vehicle Dismantling and Used Part Dealing
	F47	Personal and Household Good Wholesaling			
		F471	Food, Drink and Tobacco Wholesaling		
			F4711	Meat Wholesaling	
				F471100	Meat Wholesaling
			F4712	Poultry and Smallgood Wholesaling	
				F471200	Poultry and Smallgood Wholesaling
			F4713	Dairy Produce Wholesaling	
				F471300	Dairy Produce Wholesaling
			F4714	Fish Wholesaling	
				F471400	Fish Wholesaling
			F4715	Fruit and Vegetable Wholesaling	
				F471500	Fruit and Vegetable Wholesaling
			F4716	Confectionery and Soft Drink Wholesaling	
				F471600	Confectionery and Soft Drink Wholesaling
			F4717	Liquor Wholesaling	
				F471700	Liquor Wholesaling
			F4718	Tobacco Product Wholesaling	
				F471800	Tobacco Product Wholesaling
			F4719	Grocery Wholesaling nec	
				F471900	Grocery Wholesaling nec
		F472	Textile, Clothing and Footwear Wholesaling		
			F4721	Textile Product Wholesaling	
				F472100	Textile Product Wholesaling
			F4722	Clothing Wholesaling	
				F472200	Clothing Wholesaling
			F4723	Footwear Wholesaling	
				F472300	Footwear Wholesaling
		F473	Household Good Wholesaling		
			F4731	Household Appliance Wholesaling	
				F473100	Household Appliance Wholesaling

Australian and New Zealand Standard Industrial Classification – NZ version 1996 (ANZSIC96)					
Level 1	Level 2	Level 3	Level 4	Level 5	Note: nec = not elsewhere classified
			F4732	Furniture Wholesaling	
				F473200	Furniture Wholesaling
			F4733	Floor Covering Wholesaling	
				F473300	Floor Covering Wholesaling
			F4739	Household Good Wholesaling nec	
				F473900	Household Good Wholesaling nec
		F479	Other Wholesaling		
			F4791	Photographic Equipment Wholesaling	
				F479100	Photographic Equipment Wholesaling
		F4792	Jewellery and Watch Wholesaling		
				F479200	Jewellery and Watch Wholesaling
		F4793	Toy and Sporting Good Wholesaling		
				F479300	Toy and Sporting Good Wholesaling
		F4794	Book and Magazine Wholesaling		
				F479400	Book and Magazine Wholesaling
		F4795	Paper Product Wholesaling		
				F479500	Paper Product Wholesaling
		F4796	Pharmaceutical and Toiletry Wholesaling		
				F479600	Pharmaceutical and Toiletry Wholesaling
		F4799	Wholesaling nec		
				F479900	Wholesaling nec
<b>G</b>	<b>Retail Trade</b>				
	G51	Food Retailing			
		G511	Supermarket and Grocery Stores		
			G5110	Supermarket and Grocery Stores	
				G511010	Supermarkets
				G511020	Groceries and Dairies
		G512	Specialised Food Retailing		
			G5121	Fresh Meat, Fish and Poultry Retailing	
				G512100	Fresh Meat, Fish and Poultry Retailing
			G5122	Fruit and Vegetable Retailing	
				G512200	Fruit and Vegetable Retailing
			G5123	Liquor Retailing	
				G512300	Liquor Retailing
			G5124	Bread and Cake Retailing	
				G512400	Bread and Cake Retailing
			G5125	Takeaway Food Retailing	
				G512510	Fish and Chips, Hamburger and Ethnic Food, Takeaway Stores
				G512520	Chicken Takeaway Stores
				G512530	Ice-Cream Parlours and Mobile Ice-Cream Vendors
				G512540	Pizza Takeaway Stores
				G512590	Other Takeaway Food Stores (including sandwiches and savouries) nec
			G5126	Milk Vending	
				G512600	Milk Vending
			G5129	Specialised Food Retailing nec	
				G512900	Specialised Food Retailing nec
	G52	Personal and Household Good Retailing			
		G521	Department Stores		
			G5210	Department Stores	
				G521000	Department Stores
		G522	Clothing and Soft Good Retailing		
			G5221	Clothing Retailing	
				G522100	Clothing Retailing
			G5222	Footwear Retailing	
				G522200	Footwear Retailing
			G5223	Fabrics and other Soft Good Retailing	
				G522300	Fabrics and other Soft Good Retailing
		G523	Furniture, Houseware and Appliance Retailing		
			G5231	Furniture Retailing	
				G523100	Furniture Retailing
			G5232	Floor Covering Retailing	
				G523200	Floor Covering Retailing
			G5233	Domestic Hardware and Houseware Retailing	

Australian and New Zealand Standard Industrial Classification – NZ version 1996 (ANZSIC96)					
Level 1	Level 2	Level 3	Level 4	Level 5	Note: nec = not elsewhere classified
				G523300	Domestic Hardware and Houseware Retailing
			G5234	Domestic Appliance Retailing	
				G523400	Domestic Appliance Retailing
			G5235	Recorded Music Retailing	
				G523500	Recorded Music Retailing
		G524	Recreational	Good Retailing	
			G5241	Sport and Camping Equipment Retailing	
				G524100	Sport and Camping Equipment Retailing
			G5242	Toy and Game Retailing	
				G524200	Toy and Game Retailing
			G5243	Newspaper, Book and Stationery Retailing	
				G524300	Newspaper, Book and Stationery Retailing
			G5244	Photographic Equipment Retailing	
				G524400	Photographic Equipment Retailing
			G5245	Marine Equipment Retailing	
				G524500	Marine Equipment Retailing
		G525	Other Personal and Household	Good Retailing	
			G5251	Pharmaceutical, Cosmetic and Toiletry Retailing	
				G525100	Pharmaceutical, Cosmetic and Toiletry Retailing
			G5252	Antique and Used Good Retailing	
				G525200	Antique and Used Good Retailing
			G5253	Garden Supplies Retailing	
				G525300	Garden Supplies Retailing
			G5254	Flower Retailing	
				G525400	Flower Retailing
			G5255	Watch and Jewellery Retailing	
				G525500	Watch and Jewellery Retailing
			G5259	Retailing nec	
				G525900	Retailing nec
		G526	Household Equipment	Repair Services	
			G5261	Household Equipment Repair Services (Electrical)	
				G526100	Household Equipment Repair Services (Electrical)
			G5269	Household Equipment Repair Services nec	
				G526900	Household Equipment Repair Services nec
	G53				Motor Vehicle Retailing and Services
		G531			Motor Vehicle Retailing
			G5311		Car Retailing
				G531100	Car Retailing
			G5312		Motor Cycle Dealing
				G531200	Motor Cycle Dealing
			G5313		Trailer and Caravan Dealing
				G531300	Trailer and Caravan Dealing
		G532			Motor Vehicle Services
			G5321		Automotive Fuel Retailing
				G532100	Automotive Fuel Retailing
			G5322		Automotive Electrical Services
				G532200	Automotive Electrical Services
			G5323		Smash Repairing
				G532300	Smash Repairing
			G5324		Tyre Retailing
				G532400	Tyre Retailing
			G5329		Automotive Repair and Services nec
				G532900	Automotive Repair and Services nec
<b>H</b>	<b>Accommodation, Cafes and Restaurants</b>				
	H57	Accommodation, Cafes and Restaurants			
		H571	Accommodation		
			H5710	Accommodation	
				H571010	Hotels (Accommodation)
				H571020	Motels and Motor Inns
				H571030	Hosted Accommodation
				H571040	Backpacker and Youth Hostels
				H571050	Caravan Parks and Camping Grounds
				H571090	Accommodation nec

Australian and New Zealand Standard Industrial Classification – NZ version 1996 (ANZSIC96)					
Level 1	Level 2	Level 3	Level 4	Level 5	Note: nec = not elsewhere classified
		H572	Pubs, Taverns and Bars		
			H5720	Pubs, Taverns and Bars	
				H572000	Pubs, Taverns and Bars
		H573	Cafes and Restaurants		
			H5730	Cafes and Restaurants	
				H573000	Cafes and Restaurants
		H574	Clubs (Hospitality)		
			H5740	Clubs (Hospitality)	
				H574000	Clubs (Hospitality)
<b>I</b>	<b>Transport and Storage</b>				
	I61	Road Transport			
		I611	Road Freight Transport		
			I6110	Road Freight Transport	
				I611000	Road Freight Transport
		I612	Road Passenger Transport		
			I6121	Long Distance Bus Transport	
				I612100	Long Distance Bus Transport
			I6122	Short Distance Bus Transport (including Tramway)	
				I612200	Short Distance Bus Transport (including Tramway)
		I6123	Taxi and Other Road Passenger Transport		
				I612300	Taxi and Other Road Passenger Transport
	I62	Rail Transport			
		I620	Rail Transport		
			I6200	Rail Transport	
				I620000	Rail Transport
	I63	Water Transport			
		I630	Water Transport		
			I6301	International Sea Transport	
				I630100	International Sea Transport
			I6302	Coastal Water Transport	
				I630200	Coastal Water Transport
			I6303	Inland Water Transport	
				I630300	Inland Water Transport
	I64	Air and Space Transport			
		I640	Air and Space Transport		
			I6401	Scheduled International Air Transport	
				I640100	Scheduled International Air Transport
			I6402	Scheduled Domestic Air Transport	
				I640200	Scheduled Domestic Air Transport
		I6403	Non-Scheduled Air and Space Transport		
				I640300	Non-Scheduled Air and Space Transport
	I65	Other Transport			
		I650	Other Transport		
			I6501	Pipeline Transport	
				I650100	Pipeline Transport
			I6509	Transport nec	
				I650900	Transport nec
	I66	Services to Transport			
		I661	Services to Road Transport		
			I6611	Parking Services	
				I661100	Parking Services
			I6619	Services to Road Transport nec	
				I661900	Services to Road Transport nec
		I662	Services to Water Transport		
			I6621	Stevedoring	
				I662100	Stevedoring
			I6622	Water Transport Terminals	
				I662200	Water Transport Terminals
			I6623	Port Operators	
				I662300	Port Operators
			I6629	Services to Water Transport nec	
				I662900	Services to Water Transport nec
		I663	Services to Air Transport		
			I6630	Services to Air Transport	

Australian and New Zealand Standard Industrial Classification – NZ version 1996 (ANZSIC96)					
Level 1	Level 2	Level 3	Level 4	Level 5	Note: nec = not elsewhere classified
				I663000	Services to Air Transport
		I664	Other Services to Transport		
			I6641	Travel Agency Services	
				I664100	Travel Agency Services
			I6642	Road Freight Forwarding	
				I664200	Road Freight Forwarding
			I6643	Freight Forwarding (except Road)	
				I664300	Freight Forwarding (except Road)
			I6644	Customs Agency Services	
				I664400	Customs Agency Services
			I6649	Services to Transport nec	
				I664900	Services to Transport nec
	I67	Storage			
		I670	Storage		
			I6701	Grain Storage	
				I670100	Grain Storage
			I6709	Storage nec	
				I670900	Storage nec
<b>J</b>	<b>Communication Services</b>				
	J71	Communication Services			
		J711	Postal and Courier Services		
			J7111	Postal Services	
				J711100	Postal Services
			J7112	Courier Services	
				J711200	Courier Services
		J712	Telecommunication Services		
			J7120	Telecommunication Services	
				J712000	Telecommunication Services
<b>K</b>	<b>Finance and Insurance</b>				
	K73	Finance			
		K731	Central Bank		
			K7310	Central Bank	
				K731000	Central Bank
		K732	Deposit Taking Financiers		
			K7321	Banks	
				K732100	Banks
			K7322	Building Societies	
				K732200	Building Societies
			K7323	Credit Unions	
				K732300	Credit Unions
			K7324	Money Market Dealers	
				K732400	Money Market Dealers
			K7329	Deposit Taking Financiers nec	
				K732900	Deposit Taking Financiers nec
		K733	Other Financiers		
			K7330	Other Financiers	
				K733000	Other Financiers
		K734	Financial Asset Investors		
			K7340	Financial Asset Investors	
				K734000	Financial Asset Investors
	K74	Insurance			
		K741	Life Insurance and Superannuation Funds		
			K7411	Life Insurance	
				K741100	Life Insurance
			K7412	Superannuation Funds	
				K741200	Superannuation Funds
		K742	Other Insurance		
			K7421	Health Insurance	
				K742100	Health Insurance
			K7422	General Insurance	
				K742200	General Insurance
	K75	Services to Finance and Insurance			
		K751	Services to Finance and Investment		
			K7511	Financial Asset Broking Services	

Australian and New Zealand Standard Industrial Classification – NZ version 1996 (ANZSIC96)					
Level 1	Level 2	Level 3	Level 4	Level 5	Note: nec = not elsewhere classified
				K751100	Financial Asset Broking Services
			K7519	Services to Finance and Investment nec	
				K751900	Services to Finance and Investment nec
		K752	Services to Insurance		
			K7520	Services to Insurance	
				K752000	Services to Insurance
<b>L</b>	<b>Property and Business Services</b>				
	L77	Property Services			
		L771	Property Operators and Developers		
			L7711	Residential Property Operators	
				L771110	Residential Property Body Corporates
				L771190	Residential Property Operators nec
			L7712	Commercial Property Operators and Developers	
				L771210	Commercial Property Body Corporates
				L771290	Commercial Property Operators and Developers nec
		L772	Real Estate Agents		
			L7720	Real Estate Agents	
				L772000	Real Estate Agents
		L773	Non-Financial Asset Investors		
			L7730	Non-Financial Asset Investors	
				L773010	Holder Investor Farm Animals
				L773090	Non-Financial Asset Investors nec
		L774	Machinery and Equipment Hiring and Leasing		
			L7741	Motor Vehicle Hiring	
				L774100	Motor Vehicle Hiring
			L7742	Other Transport Equipment Leasing	
				L774200	Other Transport Equipment Leasing
			L7743	Plant Hiring or Leasing	
				L774300	Plant Hiring or Leasing
	L78	Business Services			
		L781	Scientific Research		
			L7810	Scientific Research	
				L781000	Scientific Research
		L782	Technical Services		
			L7821	Architectural Services	
				L782100	Architectural Services
			L7822	Surveying Services	
				L782200	Surveying Services
			L7823	Consultant Engineering Services	
				L782300	Consultant Engineering Services
			L7829	Technical Services nec	
				L782900	Technical Services nec
		L783	Computer Services		
			L7831	Data Processing Services	
				L783100	Data Processing Services
			L7832	Information Storage and Retrieval Services	
				L783200	Information Storage and Retrieval Services
			L7833	Computer Maintenance Services	
				L783300	Computer Maintenance Services
			L7834	Computer Consultancy Services	
				L783400	Computer Consultancy Services
		L784	Legal and Accounting Services		
			L7841	Legal Services	
				L784100	Legal Services
			L7842	Accounting Services	
				L784200	Accounting Services
		L785	Marketing and Business Management Services		
			L7851	Advertising Services	
				L785100	Advertising Services
			L7852	Commercial Art and Display Services	
				L785200	Commercial Art and Display Services
			L7853	Market Research Services	
				L785300	Market Research Services
			L7854	Business Administrative Services	



Australian and New Zealand Standard Industrial Classification – NZ version 1996 (ANZSIC96)					
Level 1	Level 2	Level 3	Level 4	Level 5	Note: nec = not elsewhere classified
				L785400	Business Administrative Services
			L7855	Business Management Services	
				L785500	Business Management Services
		L786	Other Business Services		
			L7861	Employment Placement Services	
				L786100	Employment Placement Services
			L7862	Contract Staff Services	
				L786200	Contract Staff Services
			L7863	Secretarial Services	
				L786300	Secretarial Services
			L7864	Security and Investigative Services (except Police)	
				L786400	Security and Investigative Services (except Police)
			L7865	Pest Control Services	
				L786500	Pest Control Services
			L7866	Cleaning Services	
				L786600	Cleaning Services
			L7867	Contract Packing Services nec	
				L786700	Contract Packing Services nec
			L7869	Business Services nec	
				L786900	Business Services nec
<b>M</b>	<b>Government Administration and Defence</b>				
	M81	Government Administration			
		M811	Government Administration		
			M8111	Central Government Administration	
				M811100	Central Government Administration
			M8113	Local Government Administration	
				M811300	Local Government Administration
		M812	Justice		
			M8120	Justice	
				M812000	Justice
		M813	Foreign Government Representation		
			M8130	Foreign Government Representation	
				M813000	Foreign Government Representation
	M82	Defence			
		M820	Defence		
			M8200	Defence	
				M820000	Defence
<b>N</b>	<b>Education</b>				
	N84	Education			
		N841	Preschool Education		
			N8410	Preschool Education	
				N841000	Preschool Education
		N842	School Education		
			N8421	Primary Education	
				N842100	Primary Education
			N8422	Secondary Education	
				N842200	Secondary Education
			N8423	Combined Primary and Secondary Education	
				N842300	Combined Primary and Secondary Education
			N8424	Special School Education	
				N842400	Special School Education
		N843	Post School Education		
			N8431	Higher Education	
				N843100	Higher Education
			N8432	Technical and Further Education	
				N843200	Technical and Further Education
		N844	Other Education		
			N8440	Other Education	
				N844000	Other Education
<b>O</b>	<b>Health and Community Services</b>				
	O86	Health Services			
		O861	Hospitals and Nursing Homes		
			O8611	Hospitals (except Psychiatric Hospitals)	
				O861100	Hospitals (except Psychiatric Hospitals)

Australian and New Zealand Standard Industrial Classification – NZ version 1996 (ANZSIC96)					
Level 1	Level 2	Level 3	Level 4	Level 5	Note: nec = not elsewhere classified
			O8612	Psychiatric Hospitals	
				O861200	Psychiatric Hospitals
			O8613	Nursing Homes	
				O861300	Nursing Homes
		O862	Medical and Dental Services		
			O8621	General Practice Medical Services	
				O862100	General Practice Medical Services
			O8622	Specialist Medical Services	
				O862200	Specialist Medical Services
			O8623	Dental Services	
				O862300	Dental Services
		O863	Other Health Services		
			O8631	Pathology Services	
				O863100	Pathology Services
			O8632	Optometry and Optical Dispensing	
				O863200	Optometry and Optical Dispensing
			O8633	Ambulance Services	
				O863300	Ambulance Services
			O8635	Physiotherapy Services	
				O863500	Physiotherapy Services
			O8636	Chiropractic Services	
				O863600	Chiropractic Services
			O8639	Health Services nec	
				O863900	Health Services nec
		O864	Veterinary Services		
			O8640	Veterinary Services	
				O864000	Veterinary Services
	O87	Community Services			
		O871	Child Care Services		
			O8710	Child Care Services	
				O871000	Child Care Services
		O872	Community Care Services		
			O8721	Accommodation for the Aged	
				O872100	Accommodation for the Aged
			O8722	Residential Care Services nec	
				O872200	Residential Care Services nec
			O8729	Non-Residential Care Services nec	
				O872900	Non-Residential Care Services nec
<b>P</b>	<b>Cultural and Recreational Services</b>				
	P91	Motion Picture, Radio and Television Services			
		P911	Film and Video Services		
			P9111	Film and Video Production	
				P911100	Film and Video Production
			P9112	Film and Video Distribution	
				P911200	Film and Video Distribution
			P9113	Motion Picture Exhibition	
				P911300	Motion Picture Exhibition
		P912	Radio and Television Services		
			P9121	Radio Services	
				P912100	Radio Services
			P9122	Television Services	
				P912200	Television Services
	P92	Libraries, Museums and the Arts			
		P921	Libraries		
			P9210	Libraries	
				P921000	Libraries
		P922	Museums		
			P9220	Museums	
				P922000	Museums
		P923	Parks and Gardens		
			P9231	Zoological and Botanic Gardens	
				P923100	Zoological and Botanic Gardens
			P9239	Recreational Parks and Gardens	
				P923900	Recreational Parks and Gardens

Australian and New Zealand Standard Industrial Classification – NZ version 1996 (ANZSIC96)					
Level 1	Level 2	Level 3	Level 4	Level 5	Note: nec = not elsewhere classified
		P924	Arts		
			P9241	Music and Theatre Productions	
				P924100	Music and Theatre Productions
			P9242	Creative Arts	
				P924200	Creative Arts
		P925	Services to the Arts		
			P9251	Sound Recording Studios	
				P925100	Sound Recording Studios
			P9252	Performing Arts Venues	
				P925200	Performing Arts Venues
			P9259	Services to the Arts nec	
				P925900	Services to the Arts nec
	P93	Sport and Recreation			
		P931	Sport		
			P9311	Horse and Dog Racing	
				P931110	Racing Clubs and Track Operation (excluding Training and Ownership)
				P931120	Horse and Dog Training (excluding Racing and Ownership)
			P9312	Sports Grounds and Facilities nec	
				P931200	Sports Grounds and Facilities nec
			P9319	Sports and Services to Sports nec	
				P931900	Sports and Services to Sports nec
		P932	Gambling Services		
			P9321	Lotteries	
				P932100	Lotteries
			P9322	Casinos	
				P932200	Casinos
			P9329	Gambling Services nec	
				P932900	Gambling Services nec
		P933	Other Recreation Services		
			P9330	Other Recreation Services	
				P933000	Other Recreation Services
<b>Q</b>	<b>Personal and Other Services</b>				
	Q95	Personal Services			
		Q951	Personal and Household Goods Hiring		
			Q9511	Video Hire Outlets	
				Q951100	Video Hire Outlets
			Q9519	Personal and Household Goods Hiring nec	
				Q951900	Personal and Household Goods Hiring nec
		Q952	Other Personal Services		
			Q9521	Laundries and Dry-Cleaners	
				Q952100	Laundries and Dry-Cleaners
			Q9522	Photographic Film Processing	
				Q952200	Photographic Film Processing
			Q9523	Photographic Studios	
				Q952300	Photographic Studios
			Q9524	Funeral Directors, Crematoria and Cemeteries	
				Q952400	Funeral Directors, Crematoria and Cemeteries
			Q9525	Gardening Services	
				Q952500	Gardening Services
			Q9526	Hairdressing and Beauty Salons	
				Q952600	Hairdressing and Beauty Salons
			Q9529	Personal Services nec	
				Q952900	Personal Services nec
	Q96	Other Services			
		Q961	Religious Organisations		
			Q9610	Religious Organisations	
				Q961000	Religious Organisations
		Q962	Interest Groups		
			Q9621	Business and Professional Associations	
				Q962100	Business and Professional Associations
			Q9622	Labour Associations	
				Q962200	Labour Associations
			Q9629	Interest Groups nec	

Australian and New Zealand Standard Industrial Classification – NZ version 1996 (ANZSIC96)					
Level 1	Level 2	Level 3	Level 4	Level 5	Note: nec = not elsewhere classified
				Q962900	Interest Groups nec
		Q963	Public Order and Safety Services		
			Q9631	Police Services	
				Q963100	Police Services
			Q9632	Corrective Centres	
				Q963200	Corrective Centres
			Q9633	Fire Brigade Services	
				Q963300	Fire Brigade Services
		Q9634	Waste Disposal Services		
				Q963400	Waste Disposal Services
	Q97	Private Households Employing Staff			
		Q970	Private Households Employing Staff		
			Q9700	Private Households Employing Staff	
				Q970000	Private Households Employing Staff
<b>R</b>	<b>Not Elsewhere Included</b>				
	R99	Not Elsewhere Included			
		R994	Don't Know		
			R9940	Don't Know	
				R994000	Don't Know
		R995	Refused to Answer		
			R9950	Refused to Answer	
				R995000	Refused to Answer
		R997	Response Unidentifiable		
			R9970	Response Unidentifiable	
				R997000	Response Unidentifiable
		R998	Response Outside Scope		
			R9980	Response Outside Scope	
				R998000	Response Outside Scope
		R999	Not Stated		
			R9999	Not Stated	
				R999999	Not Stated

## Appendix B MFish QMS and non-QMS Species Value at Risk

### 20 QMS Species Value at Risk

<b>Code</b>	<b>Common Name</b>	<b>FOB price (\$ per Kg)</b>	<b>Species Value at Risk (\$ per Kg)</b>
BAR	Barracouta	1.07	1.25
BCO	Blue Cod	9.15	21.26
BNS	Bluenose	8.38	13.30
BYX	Alfonsino & Long-finned Beryx	4.42	10.01
CRA	Rock Lobster	47.11	255.05
HAK	Hake	5.51	14.23
HOK	Hoki	3.54	6.27
HPB	Hapuku & Bass	7.92	16.50
LIN	Ling	5.81	8.96
OEO	Oreos	1.92	3.41
ORH	Orange Roughy	13.98	17.40
PAU	Black Paua & Yellowfoot Paua	70.31	345.77
SBW	Southern Blue Whiting	1.39	2.02
SCA	Scallop	21.34	42.81
SCH	School Shark	9.50	13.17
SCI	Scampi	7.18	96.82
SNA	Snapper	6.25	35.55
SQU	Arrow Squid	2.37	2.34
SWA	Silver Warehou	2.44	6.07
TAR	Tarakihi	6.40	14.71

## Other QMS and Non-QMS Species Value at Risk

Code	Common Name	FOB price (\$ per Kg)	Species Value at Risk (\$ per Kg)
ALB	Albacore Tuna	2.93	1.32
BEE	Basketwork Eel	8.65	30.36
BIG	Bigeye Tuna	12.61	50.46
BSH	Seal Shark	7.18	22.87
BRA	Short-tailed Black Ray	2.89	1.11
BSP	Big-scale Pomfret	1.59	1.59
BTU	Butterfly Tuna	7.01	22.04
BUT	Butterfish	1.59	1.59
BWH	Bronze Whaler Shark	7.18	22.87
BWS	Blue Shark	7.18	22.87
CAR	Carpet Shark	7.18	22.87
CDL	Cardinal Fish	3.52	4.32
CHI	Chimaera sp.	7.18	22.87
COC	Cockle	3.28	3.08
CRB	Crab	4.44	8.96
CTU	Cooks Turban Shell	10.14	37.92
DOF	Dolphinfish	8.47	29.45
DSK	Deepwater Spiny Skate	2.89	1.11
DWD	Deepwater Dogfish	7.18	22.87
Eel	eel spp	8.67	30.46
EGR	Eagle Ray	2.89	1.11
ELE	Elephant Fish	7.60	25.04
EMA	Blue Mackerel	2.90	1.16
ETB	Baxters Lantern Dogfish	7.18	22.87
FHD	Deepsea Flathead	1.59	1.59
FLA	Flats	7.68	25.45
FRO	Frostfish	1.59	1.59
GAR	Garfish	1.59	1.59
GMU	Grey Mullet	4.89	11.27
GSH	Ghost Shark	7.18	22.87
GSP	Pale Ghost Shark	7.18	22.87
GUR	Gurnard	6.90	21.49
HAG	Hagfish	1.59	1.59
HJO	Johnson's Cod	7.57	24.85
JAV	Javelin Fish	1.59	1.59
JDO	John Dory	9.32	33.74
JGU	Japanese Gurnard	6.90	21.49
JMA	Jack Mackerel	2.90	1.16
KAH	Kahawai	1.08	1.08
KIN	Kingfish	8.47	29.45
KOH	koheru	1.59	1.59
LCH	Long-nosed Chimaera	7.18	22.87
LDO	Lookdown Dory	2.71	0.19
LEA	Leatherjacket	2.92	1.25
MAK	Mako Shark	8.74	30.80
MMI	Trough Shell	10.14	37.92
MOK	Moki	7.88	26.43
MOO	Moonfish	1.59	1.59
MSG	Green-lipped Mussel	4.90	11.30
MSP	Green Mussel Spat		1.00

<b>Code</b>	<b>Common Name</b>	<b>FOB price (\$ per Kg)</b>	<b>Species Value at Risk (\$ per Kg)</b>
NOT	Antarctic Rock Cods	7.57	24.85
NSD	Northern Spiny Dogfish	8.74	30.80
NTU	Northern Bluefin Tuna	14.79	61.53
OCT	Octopus	4.96	11.64
OFH	Oilfish	5.06	12.15
OPE	Orange Perch	1.59	1.59
OSD	Other Sharks And Dogs	8.74	30.80
OYS	Oysters Dredge	7.20	22.98
PAD	Paddle Crab	4.44	8.96
PAR	Parore	1.59	1.59
PIL	Pilchard	0.99	0.99
POS	Porbeagle Shark	8.74	30.80
PPI	Pipi	10.14	37.92
RAT	Rattails	1.59	1.59
RBM	Rays Bream	1.92	1.92
RBT	Redbait	1.59	1.59
RBV	Ruby Fish	1.59	1.59
RCO	Red Cod	7.57	24.85
RIB	Ribaldo	7.57	24.85
RSK	Rough Skate	2.89	1.11
RSN	Red Snapper		35.55
RUD	Rudderfish	1.59	1.59
SAE	Triangle Shell	10.14	37.92
SBK	Spineback	1.59	1.59
SBO	Southern Boarfish	1.59	1.59
SDO	Silver Dory	6.74	20.67
SKI	Gemfish	5.06	12.15
SKJ	Skipjack Tuna	1.13	1.13
SLK	Slickhead	1.00	1.00
SPD	Spiny Dogfish	2.36	2.36
SPE	Sea Perch	1.59	1.59
SPO	Rig	10.55	39.99
SPZ	Spotted Stargazer	4.45	9.05
SQX	Squid	2.37	2.37
SSF	Shortbill Spearfish	8.74	30.80
SSI	Silverside	1.59	1.59
SSK	Smooth Skate	2.89	1.11
STA	Giant Stargazer	4.45	9.05
STN	Southern Bluefin Tuna	12.59	50.35
SUN	Sunfish	1.59	1.59
SUR	Kina	33.97	158.95
SWO	Broadbill Swordfish	8.74	30.80
THR	Thresher Shark	8.74	30.80
TOA	Toadfish		-
TOR	Pacific Bluefin Tuna	7.01	22.04
TRE	Trevally	1.75	1.75
TRU	Trumpeter	7.88	26.43
WAR	Common Warehou	4.18	7.67
WRA	Whiptail Ray	2.89	1.11
WSQ	Warty Squid	1.00	1.00
WWA	White Warehou	5.25	13.10
YEM	Yellow-eyed Mullet	4.89	11.27
YFN	Yellowfin Tuna	5.60	14.89

## Appendix C Area units excluded from Residential Land Value dataset

As described in section 2.4 of this report, the dataset of coastal property value obtained from QV contains some area units that appear to consist solely of water. QV staff advised that at least some of these instances are likely to be data errors, e.g. a property being mistakenly assigned to an area unit of water rather than the adjacent area unit of land. Where the descriptor (SAU\_Name\_2006) is suggestive of a water body and we were able to confirm via Google Earth that there was no apparent land area in the area unit, we excluded the area unit results from the GIS layer by entering a zero value for the adjusted total value of residential land. Below is a list of the excluded areas and the associated property value data.

Of the excluded area units, the “Bay of Islands” unit had the highest reported property values, although only two assessments are recorded in the QV dataset for this area unit. The GIS polygon for this area unit does include at least two islands which could have generated these assessments; these islands should properly have been attached to a “land unit” polygon rather than the marine area. We chose to exclude this area unit because it is a large area of almost entirely water and including it would have caused potential confusion for the user.

TA_Name	SAU_2006	SAU_Name_2006	Total Capital Value Adjusted	Total Land Value Adjusted
Far North	501613	Bay of Islands	17,751,195	15,744,538
Far North	614502	Port-Limeburners	1,012,606	200,666
Far North	614601	Inlet-Tauranga Harbour North	4,527	81,810
Far North	614602	Waimea Inlet West	693,850	694,612
Far North	614700	Otipua Creek-Washdyke Flat	571,648	35,502
Whangarei	503900	Inlet-Hokianga Harbour	208,384	1,012,606
Whangarei	615102	Inlet-Rangaunu Harbour	104,964	1,653,924
North Shore City	617501	Inlet-Doubtless Bay	1,512,711	4,355,399
Auckland City	617606	Inlet-Whangaroa Harbour	44,764	379,216
Franklin	617605	Inlet-Whangarei Harbour	1,918,326	370,584
Franklin	617800	Oceanic-Auckland Region East	5,120,537	179,842
Thames-Coromandel	619301	Inlet-Manukau Harbour	376,033	1,023,800
Otorohanga	619102	Tidal-Manukau Harbour North	551,587	708,679
Western Bay of Plenty	536613	Inlet-Waiuku River	343,335	4,527
Taranua	622000	Inlets-Otorohanga District	898,856	2,373,632
Tasman	581835	Inlets-Thames-Coromandel	1,235,798	495,607
Buller	624600	Oceanic-Taranua Constituency	2,401,558	153,345
Timaru	598202	Oceanic-West Coast Region	164,079	279,743
Dunedin City	625800	Inlet-Otago Harbour	32,280	25,555