Refer Question 10

The Contribution of Antarctic-Related Activities to the New Zealand Economy

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Client Report

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1. Introduction

1.1 Background to this report

In 2007, the AERU at Lincoln University was commissioned by the Canterbury Development Corporation (funded by Antarctica New Zealand) to prepare a report on *The Contribution of Antarctic-Related Activities to the Canterbury and New Zealand Economies* (Saunders *et al*, 2007). That report concentrated on the local and national impacts of Antarctic-related activities based in Canterbury. Thus, it included Antarctic-related research at the Gateway Antarctica programme of the University of Canterbury, for example, but not research at the Antarctic Research Centre of Victoria University of Wellington.

The 2007 study found that the direct impact on the Canterbury economy was at least $87.6 million per annum, which was estimated to be associated with 676 full-time equivalent jobs in the region. The direct impact on the New Zealand economy was estimated to be $133.2 million, supporting 965 full-time equivalent jobs. Taking into account multiplier impacts, the direct, indirect and induced impacts amounted to $155.1 million in Canterbury and $282.0 million in New Zealand.

In 2013, Antarctica New Zealand commissioned the AERU to update and extend its 2007 study. In particular, the AERU was asked to consider significant Antarctic-related activities outside as well as inside the Canterbury region. The role of Christchurch as a 'gateway city' to the Antarctic means that his report retains a focus on the Canterbury region, but the authors have attempted a wider national scope in its analysis.

1.2 Research methods

The research methods followed those used for the 2007 report. The project began by drawing up a representative list of key people and organisations to be interviewed for background information and data about their Antarctic-related activities. All of the people approached to be interviewed were very helpful, although in a couple of instances conflicting demands meant that a meeting could not be arranged. The AERU research team is grateful to all those who participated in this part of the research (a list of organisations who took part is provided in Appendix 1 of this report).

The semi-structured guide for these interviews is reproduced in Appendix 2. In most cases, the interviews took place at the participant's place of business attended by both Professor Caroline Saunders and Professor Paul Dalziel. A small number of interviews were conducted by telephone. Handwritten notes were made during the interviews (which were not recorded), which became the basis for some of the material contained in this report after checking by the research team with web-based documents.

The second part of the project involved a standard economic impact analysis of economic-related activities in New Zealand. This required gathering data on revenues generated from these activities. For example, the project identified over 600 firms that supply goods and services for New Zealand and United States science programmes and it was possible to obtain data on these items aggregated by industry sector (to maintain privacy). Antarctica New Zealand was able to provide data on significant research programmes by New Zealand Universities and Crown Research Institutes. Other information was obtained from the interviews and web-based sources. These expenditure flows were sorted by location, either to Canterbury, New Zealand or overseas. Antarctic-related activity from companies or organisations located overseas was not included in this study. The allocation of an organisation's expenditure to Canterbury required that the supplying firm operate more than just a local sales office. In other words, the organisation was required to have a locally operating business unit.

The data collected from the interviews, databases and other sources were used to estimate the economic contribution provided by Antarctic-related activity to the Canterbury and New Zealand economies. Three types of contribution – the direct, indirect and induced impacts- were calculated for the total value of output.

1. *Direct impact* – this is a result of direct revenue injected into the local and national economy by Antarctic-related activities.

2. *Indirect impact* – this is a result of downstream revenue created by other firms selling goods and services organisations operating in the Antarctic-related sector.

3. *Induced impacts* – these are the effects of the above two contributions on further household spending which generates revenue as a result of increased purchases of household goods and services.

Multipliers for the indirect and induced expenditure flows in Canterbury were obtained from output multiplier tables presented in Butcher (2007) while multipliers for expenditure in New Zealand were derived from Butcher (2005). The multiplier tables for Canterbury were composed of 114 sectors, while multiplier tables for New Zealand consisted of 53 sectors. Thus, sectors from the Canterbury multiplier tables had to be mapped to the sectors in the multiplier tables for New Zealand and sector composites for the Canterbury multipliers had to be created using averages.

Employment estimates associated with the total expenditure – including the direct, indirect and induced impacts – were calculated for the different categories using relevant multipliers obtained from Butcher (2007) for Canterbury and Butcher (2005) for New Zealand. The multiplier tables estimate the average number of employees required to produce a million dollars of output by industry. These multipliers were applied to the direct, indirect and induced impacts of expenditure on Antarctic-related activities to obtain estimates of employment for firms supplying or servicing these activities.

1.3 Structure of the report

The main body of the report is presented in three chapters. Chapter 2 provides an overview of significant Antarctic-related activities that materially involve New Zealand. These activities are classified under eight headings:

1. Scientific research and innovation
2. Historical heritage and conservation
3. Natural environment and protection
4. Cultural exploration and education
5. International diplomacy and profiling
6. Gateway logistics and business support
7. Antarctic-related tourism and events
8. Southern Ocean commercial fishing

Chapter 3 presents the economic impact analysis. It estimates that the aggregated direct economic impact of the surveyed Antarctic-related activities is $102.9 million for the Canterbury economy and $161.7 million for the New Zealand economy. These are significant increases on the values estimated in Saunders *et al*. (2007), although for the New Zealand economy this is partly due to a wider scope taken in this current report. The chapter shows that Accommodation, Restaurants and Bars is the largest sector in the Canterbury region, reflecting the importance of accommodation (and associated spending) for Antarctic personnel and for tourists attracted by Antarctic themes. For the national economy, fishing is the sector that has the largest direct impact, estimated as contributing $71.0 million of the $161.7 million (43.9 per cent).

The report finishes in Chapter 4 with a discussion of potential issues concerning Antarctic-related activities in New Zealand, drawing on the interviews undertaken for this project. The chapter comments that the positive aspects reported from the interviews in the 2007 study have been justified by events over the last six years. Between 2007 and 2012, the National Antarctic Programmes continued to develop, tourism benefits increased, as did the Sub-Antarctic Ocean and Ross Sea fisheries, and the resources devoted to Antarctic research (including from philanthropists) grew. Against that positive background, this chapter comments on three major themes that emerged from the interviews for further consideration by Antarctica New Zealand: (1) a whole-of-government response capability; (2) investment in multi-purpose infrastructure for the Gateway City; and (3) contribution to the profile of New Zealand Inc.

2. New Zealand's Involvement in Antarctic-Related Activities

New Zealand's geographical position means that it has enjoyed a long association with Antarctica, arguably going back to 1642 when Abel Tasman's sighted the west coastline of New Zealand during his expedition in search for the unknown southern continent, the Terra Australis. Similarly, James Cook circumnavigated and landed on New Zealand in 1769 following orders to search for the Terra Australis after sailing to Tahiti. In December 1901, the British National Antarctic Expedition led by Commander Robert Scott (the Discovery Expedition) spent three weeks in New Zealand preparing for the trip south. Since then, Lyttelton Harbour and the Christchurch International Airport have been important gateways for travellers to Antarctica.

The purpose of this chapter is to provide an overview of significant Antarctic-related activities that materially involve New Zealand. It is based on interviews undertaken for this project, complemented with desk-based research by the AERU research team. It is convenient to classify the activities under eight headings, although as chapter 4 will discuss, there are considerable synergies among these different categories. The eight headings are:

1. Scientific research and innovation
2. Historical heritage and conservation
3. Natural environment and protection
4. Cultural exploration and education
5. International diplomacy and profiling
6. Gateway logistics and business support
7. Antarctic-related tourism and events
8. Southern Ocean commercial fishing

2.1 Scientific research and innovation

All of New Zealand's universities and many of its Crown Research Institutes are engaged in Antarctic research, including some recognised centres of research excellence. The oldest dedicated centre is the Antarctic Research Centre, established by Professor Peter Barrett in the Department of Geology at Victoria University of Wellington in 1972, building on a research programme going back to 1957 shortly after Scott Base was opened in December the previous year (see Hatherton, 1967, and Clark, 1967). The current director is Professor Timothy Naish. The centre's mission is "to better understand Antarctic climate history and processes, and their influence on the global climate system, especially in New Zealand and the southwest Pacific region" (see www.victoria.ac.nz/antarctic).

The most recent research centre is the New Zealand Antarctic Research Institute, which is a charitable trust launched by Prime Minister John Key on 20 August 2012, made possible by a donation of $5.3 million from New York philanthropist, Julian Robertson. The Director of the Institute is Professor Gary Wilson of the University of Otago (see http://nzari.aq/). The Institute has completed one round of research grants for Antarctic research and at the time of writing is calling for proposals in a second round. The University of Otago has a longstanding research theme on Polar Environments, which it describes as "a multidisciplinary synthesis of life, earth and physical sciences research applied to Antarctica and the oceans of the Southern Hemisphere" (http://polarresearch.otago.ac.nz/).

The University of Canterbury is based in Christchurch and has established Gateway Antarctica as a centre for Antarctic studies and research (see www.anta.canterbury.ac.nz/). Led by Professor Bryan Storey, its purpose is to "contribute to increased understanding and more effective management of the Antarctic and the Southern Ocean by being a focal point and a catalyst for Antarctic scholarship, attracting national and international participation in collaborative research, analysis, learning and networking".

At the University of Waikato, the International Center for Terrestrial Antarctic Research (ICTAR; see www.ictar.aq/) "aims to provide the science that will underpin the conservation, protection, and management of terrestrial ecosystems of the Ross Sea region". The Director of ICTAR is Professor Craig Cary. Its mission is "to promote the protection of Antarctica through integrated international research into Antarctic terrestrial ecosystems assuring New Zealand's continued leadership in this area".

Crown Research Institutes in New Zealand have invested in dedicated facilities for Antarctic research. In 2007, for example, GNS Science in partnership with Victoria University of Wellington (called the Joint Antarctic Research Institute) opened a $1.4 million laboratory facility for the safe long-term storage and analysis of hundreds of metres of ice core from Antarctica and New Zealand glaciers (see www.gns.cri.nz/Home/News-and-Events/Media-Releases/Climate-research-centre-opens). NIWA scientists work on Antarctic atmospheric processes and aquatic ecosystems, with its research vessel RV Tangaroa providing logistical support for scientific studies and hydrographic surveys in the Southern Ocean (see www.niwa.co.nz/our-science/oceans/antarctica).

New Zealand has a permanent research support station located on Ross Island in the Ross Sea region of Antarctica, managed by Antarctica New Zealand (http://antarcticanz.govt.nz/scott-base). Scott Base was originally constructed in connection with the Trans-Antarctic Expedition and the International Geophysical Year of 1956-59. All but three of the original buildings were replaced with a larger base in the late 1970s, which was further extended with the opening of the Hillary Field Centre in 2005. Scott Base now caters for up to 85 people during the summer research season. The New Zealand government (2011, p. 11) has identified three key high level research outcomes for New Zealand's Antarctic and Southern Ocean science within a unifying theme of global change:

- Climate, Cryosphere, Atmosphere and Lithosphere
- Inland and Coastal Ecosystems
- Marine Systems

On 1 May 2013, the government announced ten research areas identified as New Zealand's first National Science Challenges. One of the ten is *The Deep South* – understanding the role of the Antarctic and the Southern Ocean in determining our climate and our future environment. The report of the National Science Challenges Panel (2013) noted that this challenge will contribute to New Zealand's global leadership position in Antarctic and climate change issues. It also noted that New Zealand has the opportunity to become a global centre for research in the Southern Ocean. It offered as a science goal (idem, p. 23):

> To determine how the Antarctic influences the oceanic/climate interfaces through the Southern Ocean to build predictive models of potential impacts on marine resources and understand interactions between the Antarctic Circumpolar Current and wider climate systems and their potential impacts on New Zealand.

This would contribute to the following societal goals (ibid):

> To contribute to policy development in international fora responding and adapting to climate change and to the management of marine resources. To ensure our society understands the critical role of the Southern Ocean to our economic and environmental wellbeing. To have a better understanding of our environmental future.

The construction and maintenance of Scott Base requires considerable technological innovation. A New Zealand firm, Meridian, has constructed the world's southernmost wind farm to power Scott Base and the nearby American base at McMurdo Station (see www.meridianenergy.co.nz/about-us/generating-energy/wind/ross-island/). Foundations for the three turbines were laid in November 2008 and the wind farm was fully operational by December 2009. The turbines had to be designed to operate in low temperatures, which means they have no gearboxes; instead the shaft is directly connected to the generator. The wind farm has reduced the carbon footprint and environmental risks of New Zealand's Antarctic operations.

Another example of advanced technological innovation is the design and maintenance of communications between Scott Base and New Zealand. In 1991, Telecom commissioned a satellite earth station near Arrival Heights overlooking McMurdo Station (www.scottbase50years.co.nz/history/arrival/info.htm), which allows high speed links via satellite for scientific data. A further example is the Scott Base energy management systems, which were designed, installed and maintained by Setpoint from its Christchurch offices. In both the Telecom and the Setpoint cases, the systems have to be resilient to the demanding conditions of Antarctica.

2.2 Historical heritage and conservation

The Antarctic Heritage Trust (www.nzaht.org/) is a registered charity established in 1987 to care for four expedition bases in the Ross Sea region. It has a twofold mission: to ensure the expedition bases and the thousands of associated artefacts survive for the benefit of future generations; and to inspire people through the values associated with adventure, discovery and endurance. The four sites are:

- Carsten Borchgrevink's Hut, Cape Adare
- Robert Falcon Scott's Hutt, Hut Point
- Ernest Shackleton's Hut, Cape Royds
- Robert Falcon Scott's Hut, Cape Evans

Prior to 2001, basic maintenance was carried out, but in 2002 the Trust launched a major international Ross Sea Heritage Restoration Project with the support of HRH Princess Anne. The Getty Foundation provided significant funding for this project and the four sites were listed in 2008 on the World Monuments Fund's 100 most endangered sites.

The Canterbury Museum in Christchurch has identified seven key collecting themes, the first of which is Antarctica. The Antarctic display has a large impact on visitors, consistently rated as one of the top three attractions (alongside Māori history and Canterbury history). It is easily the most important collection in the world of Antarctic artefacts from the heroic age of Antarctic exploration, outside the four huts above. Some of these artefacts are among those described by their curators as of inordinately high value.

For the centennial of Scott's death (2012), the Canterbury Museum and the Antarctic Heritage Trust collaborated with the Natural History Museum in London to create an exhibition on *Scott's Last Expedition*, curated by Elin Simonsson. This included a replica of the Cape Evans hut. This exhibition appeared at the Australian National Maritime Museum as well as at Canterbury Museum and the Natural History Museum.

2.3 Natural environment and protection

The New Zealand government maintains a very strong commitment to protection of the Antarctic natural environment. The seriousness of this commitment is reflected in the Antarctica (Environmental Protection) Act 1994, for example, which is "an Act to provide for the comprehensive protection of the Antarctic environment and to recognise Antarctica as a natural reserve devoted to peace and science and to implement the Protocol on Environmental Protection to the Antarctic Treaty" (the Act can be seen at www.legislation.govt.nz/act/public/1994/0119/latest/DLM342783.html).

This commitment continues to be restated in official strategic documents. In 2002, the Revised New Zealand Statement of Strategic Interest declared "that New Zealand is committed to conservation of the intrinsic and wilderness values of Antarctica and the Southern Ocean, for the benefit of every country and for present and future generations of New Zealanders", supported by seven specific interests (see www.mfat.govt.nz/Foreign-Relations/Antarctica/1-New-Zealand-and-Antarctica/1-NZ-Strategy-in-Antarctic.php):

i. National and international peace and security through a commitment to keeping Antarctica peaceful, nuclear free, and its environment protected

ii. Continued influence in Antarctica governance through maintaining an effective role in the Antarctic Treaty System, and maintaining its long term interest, commitment to and credible presence in the Ross Dependency

iii. Conserving, protecting and understanding the biodiversity of Antarctica and the Southern Ocean, in particular the biodiversity of the Ross Sea region, including the promotion, protection, and management of representative special areas, and enhancing biosecurity

iv. Conservation and sustainable management of the marine living resources of the Southern Ocean, and in particular the Ross Sea, in accordance with CCAMLR and the Antarctica Environmental Protocol, and within this context supporting strong environmental standards and sustainable economic benefits

v. Supporting and where appropriate leading, high quality Antarctic and Southern Ocean science that benefits from the unique research opportunities provided by Antarctica

vi. Demonstrating and advocating for best practice in environmental stewardship and all other activities throughout Antarctica, and in particular the Ross Sea region

vii. Ensuring all activity is undertaken in a manner consistent with Antarctica's status as a natural reserve devoted to peace and science.

On 27 April 2011, the New Zealand Government published *The New Zealand Antarctic and Southern Ocean Science Directions and Priorities 2010-2020* document. The Foreword by the three relevant Ministers (Hon Murray McCully, Hon Dr Wayne Mapp and Hon Phil Heatley) summarised the commitment to natural environment conservation as follows (New Zealand Government, 2011, p. 2):

> Antarctica is a unique and fragile environment. It is also part of our heritage and part of our future as New Zealanders. As the key Ministers responsible for New Zealand's investment in Antarctic and Southern Ocean science, we expect that the science undertaken within this framework will contribute to the protection and wise stewardship of the continent and surrounding environs. We encourage all those involved in the implementation of this framework to be guided by its priorities and directions to ensure we deliver the best science outcomes we can for the benefit of New Zealanders and the wider international community who share our fascination with this special part of the world.

2.4 Cultural exploration and education

Even before humans set foot on the continent, Antarctica has been a place where imagination is able to run rife. Its isolation and wilderness remain as sources of inspiration for artists and their audiences. Since 1997/98, Antarctica New Zealand (originally with the support of Creative New Zealand) has operated an artists and writers programme that each season invites two to three writers, poets, composers, painters, ceramicists, photographers, sculptors, choreographers, jewellers or designers to spend time at Scott Base. A list of alumni is maintained at http://antarcticanz.govt.nz/scholarships-fellowships/alumni.

Antarctica also remains a place of exploration and adventure. As recently as January 2007, Jamie Fitzgerald and Kevin Biggar became the first New Zealanders to travel unassisted from the Antarctic coast to the South Pole, dragging their 160kg sleds for 52 days over 1,200 kilometres as they moved from 80 degrees south to 90 degrees south to get there. Only a very small number of people are able to attempt such a journey, but a much larger number enjoy or are motivated by the adventurer's speaking engagements or Kevin Biggar's (2010) book *Escape to the Pole: Two Kiwi Guys Dodge Crevasses, Starvation and Marriage*.

Mention should be made of the documentary film *Antarctica: A Year on Ice* produced by Anthony Powell and premiered at the Civic Theatre in Auckland on 21 July 2013 as part of the New Zealand International Film Festival. This film has won a host of awards at film festivals around the world, including the Audience Choice Award at 2013 Calgary International Film Festival (see www.frozensouth.com/).

Antarctica is part of New Zealand's cultural heritage available to be passed on to following generations. There are several programmes offering educational resources on Antarctica (see, for example, the lists maintained at http://antarcticanz.govt.nz/resources/education and at www.nzaht.org/AHT/FurtherInfo/). The International Antarctic Centre in Christchurch offers education programmes for groups of students (www.iceberg.co.nz/pages/8/education.htm). Kelly Tarlton's Sea Life Aquarium in Auckland also offers access for school parties, including a day visit called Antarctica & Explorers (www.kellytarltons.co.nz/schools/excursions-info/) and the possibility of a curriculum-based classroom lesson. The Aquarium has zones devoted to Scott Base, Antarctic Ice Adventure and NIWA Southern Oceans Discovery.

A number of organisations (the Antarctic Attraction, Antarctic Heritage Trust, Antarctica New Zealand, APECS, Canterbury Museum, the Christchurch City Council, Gateway Antarctica at the University of Canterbury, GNS, Information Matters, LEARNZ, NIWA, RSNZ, University of Otago and Victoria University of Wellington) combined to create the Antarctic Hub website (www.antarctichub.org/) with the mission "to coordinate activities and share information in order to create greater awareness about Antarctica and the Southern Ocean among New Zealanders". The website remains accessible, but is not being regularly updated at the time of this report.

2.5 International diplomacy and profiling

On 1 December 1959, twelve countries who had a scientific presence in or around Antarctica during the International Geophysical Year of 1957-58 signed the Antarctic Treaty. New Zealand was one of those original signatories along with Argentina, Australia, Belgium, Chile, France, Japan, Norway, Russia, South Africa, United Kingdom and United States. Since then, a further 17 countries have been accepted as consultative parties (indicating substantial research activity in the region) along with 21 non-consultative parties, so that there are now 50 signatories to the Antarctic Treaty (www.ats.aq/).

The Ministry of Foreign Affairs and Trade is the government agency responsible for New Zealand's overall interests in Antarctica and the Southern Ocean (www.mfat.govt.nz/Foreign-Relations/Antarctica/index.php). The Ministry comments:

> Antarctic cooperation is an important part of New Zealand's relations with other countries. For example, New Zealand, the United States and Italy share resources by operating a joint logistics pool out of Christchurch in support of their respective Antarctic programmes. New Zealand scientists cooperate on Antarctic research with scientists from many countries.
>
> Involvement in Antarctica offers New Zealand the opportunity to play a constructive and influential role in a region of direct interest to it, which is managed according to principles of international cooperation, environmental protection and pursuit of scientific knowledge.

COMNAP is the Council of Managers of National Antarctic Programs, made up of all the consultative parties to the Treaty (https://www.comnap.aq/SitePages/Home.aspx). The purpose of COMNAP is to "develop and promote best practice in managing the support of scientific research in Antarctica". The Secretariat for COMNAP has been located at Gateway Antarctica (University of Canterbury) since 2009, with Michelle Rogan-Finnemore being its Executive Secretary.

In the course of the interviews for this project, several people discussed the possibility of using New Zealand's history and connections with Antarctica for international profiling of New Zealand expertise. Campaigns such as "New Zealand 100% Pure" and "New Zealand New Thinking" could be potentially supported with references to the countries research and technology activities in Antarctica. Christchurch, for example, is recognised as a cluster of electronics and software enterprises; this could be enhanced with profiling of the cluster's involvement in Antarctic projects.

2.6 Gateway logistics and business support

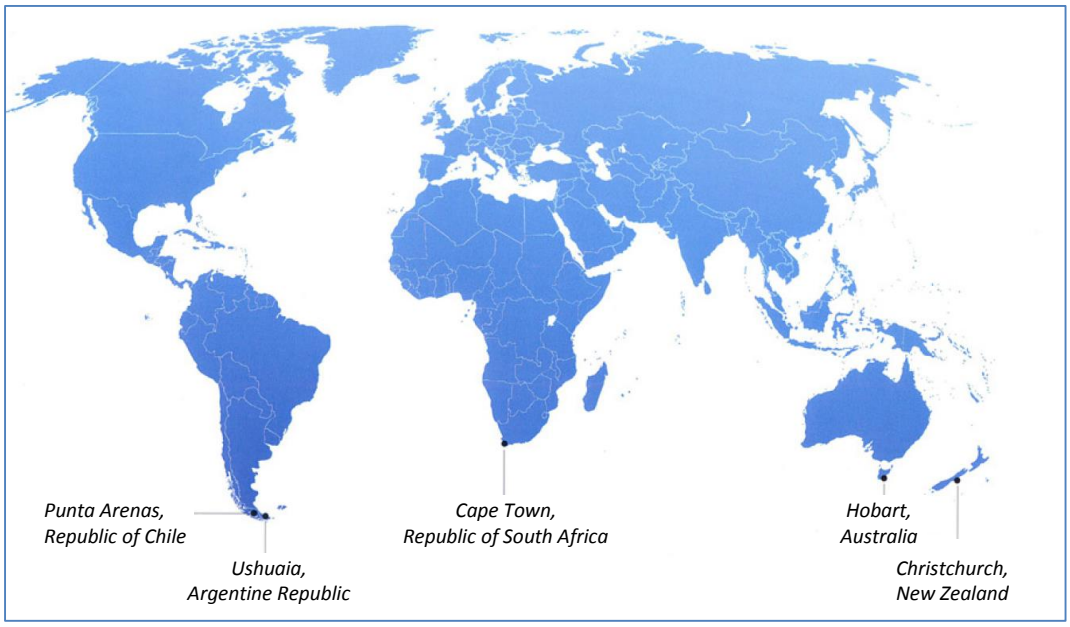
There are five gateway cities to Antarctica (see Figure 1): Christchurch, New Zealand; Hobart, Australia; Ushuaia, Argentina; Punta Arenas, Chile; and Cape Town, South Africa. Christchurch hosted a gathering of civic representatives from these five cities in September 2009, at which a Statement of Intent was signed, committing the cities to "a joint exploration into the benefits of a cooperative programme of academic and best practice exchange", particularly in the areas of education, workforce development, tourism and economic development.

A feature of Christchurch's city's gateway position is its role in the large national Antarctic research programmes of New Zealand and of the United States. As shown in Figure 2, Scott Base and McMurdo Station are located close to each other at the southern-most point of Ross Island. There is a long history of cooperation between the two programmes (the 50th Anniversary was commemorated in January 2007) and they operate a joint logistics pool based at Christchurch International Airport.

Participants in the national Antarctic research programme of Italy (based at the Mario Zucchelli research station at Terra Nova Bay) also pass through Christchurch. Further, the Republic of Korea signed an Antarctic Co-operation Agreement with New Zealand in 2012. The Korean Antarctic Program (KOPRI) will service its new base Jang Bogo Station, Terra Nova Bay, from Christchurch. Both these programmes use Lyttelton for their Antarctic vessels (Italica and Araon).

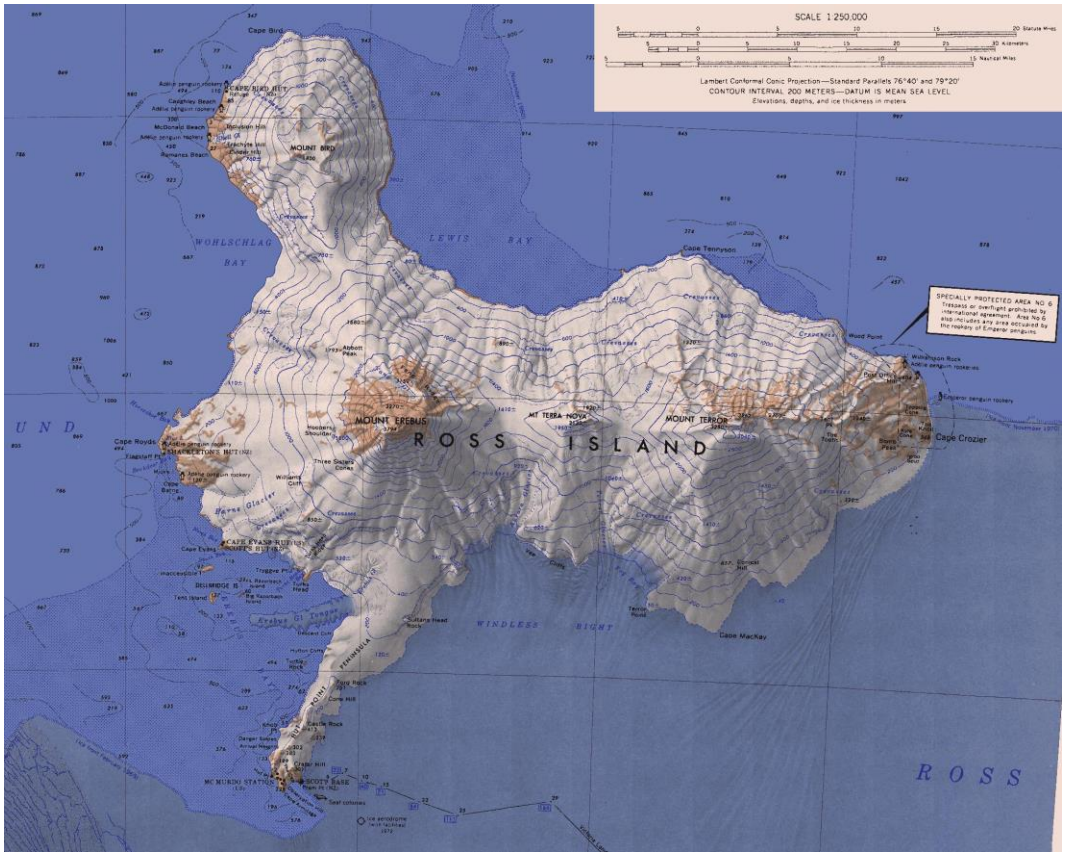
As noted in our previous report (Saunders *et al*, 2007, p. 12), the combined infrastructure of Lyttelton Port and Christchurch International Airport was a key factor influencing the original choice in the 1950s of Christchurch as the gateway for the United States Antarctic Programme. The people interviewed for this current report continued to suggest that the combination of Christchurch's international airport, sea port, dry dock and engineering facilities provide effective support for Antarctic activities, but should not be taken for granted.

Figure 1: The Five Gateway Cities



Source: *Gateway Cities to the Antarctic: Statement of Intent between the Southern Rim Gateway Cities to the Antarctic*.

Figure 2: Ross Island



Source: http://usarc.usgs.gov/drg_dload.shtml.

The logistical requirements of Antarctica New Zealand and the United States Antarctic Programme provide opportunities for New Zealand businesses, particularly in Christchurch and Canterbury. The analysis in chapter 4 estimates that the direct spending in New Zealand from these programmes is about $46.5 million per annum, with more than 80 per cent of that expenditure accruing to Canterbury suppliers. An informal network of Antarctic suppliers (CABIN) was created to strengthen links between these businesses, but people interviewed for this project advised that it no longer meets.

A larger network, Antarctic Link Canterbury, was created in 2000 and continues to thrive, currently chaired by Duncan Sandeman of the Christchurch City Council. The network meets regularly, involving representatives from the full range of organisations in Christchurch that have an interest in Antarctic-related activities. These include Antarctica New Zealand and the United States Antarctic Programme, the Christchurch City Council and the Canterbury Development Corporation, Gateway Antarctica and COMNAP, Christchurch International Airport and the Lyttelton Port Company, the Antarctic Heritage Trust and the New Zealand Antarctic Society, the International Antarctic Attraction and Canterbury Museum, and Wild Earth Travel and Heritage Expeditions.

2.7 Antarctic-related tourism and events

The heading of Antarctic-related tourism and events covers several categories of economically important activities:

- Travellers on commercial sea cruises to Antarctica and Sub-Antarctic islands;
- Tourists spending extra time in Christchurch because they want to experience the Antarctic-related facilities in the city;
- International scientists and support personnel choosing to spend time touring New Zealand as tourists on their way to or from Antarctica; and
- People travelling to New Zealand to participate in an Antarctic-related conference or event.

The New Zealand Ministry of Foreign Affairs and Trade has noted the large growth in tourism to the Antarctic region, with visitor numbers increasing from around 6,700 in 1992 to more than 35,000 in 2008 (see www.mfat.govt.nz/Foreign-Relations/Antarctica/3-New-Zealand-Procedures-for-Visitors-to-Antarctica/index.php). The New Zealand Government adopted in 2003 a policy statement committing itself "to limit tourism and other non-governmental activities in Antarctica, and to ensure that where they do occur they are conducted in a safe and environmentally responsible manner".

The major New Zealand based provider of sea cruises to Antarctica and New Zealand's Sub-Antarctic islands is Heritage Expeditions, based in Christchurch (see www.heritage-expeditions.com/). It is a short season, but the company is able to fill its two annual expeditions with people willing to pay for quality experiences. The company arranges for its dry docking and ship maintenance work to be done at Lyttelton, and speaks very highly of the facilities and the work of Start Bros Ltd (a marine engineering firm) at the port.

Section 2.4 has already made mention of tourist attractions such as Kelly Tarlton's Sea Life Aquarium in Auckland and the International Antarctic Centre in Christchurch. The Canterbury Museum, the Air Force Museum of New Zealand and Ferrymead Heritage Park also offer Antarctic-themed exhibits for visitors. A free Penguin Express takes visitors from the Canterbury Museum to the International Antarctic Centre on the hour between 10am and 4pm, returning on the half hour. The International Antarctic Centre attracts more than 200,000 visits a year, illustrating the significance of this activity.

The United States Antarctic Programme reports that about 3,000 science and operations personnel participate in Antarctic activities during the summer season, with about 70 per cent of the science personnel and more than 90 per cent of the operations personnel transiting through New Zealand (www.nsf.gov/geo/plr/antarct/treaty/opp10001/big_print_0910/bigprint0910_5.jsp). As well as their spending during the transit, many of these people take time to tour New Zealand, contributing to the country's international tourism sector.

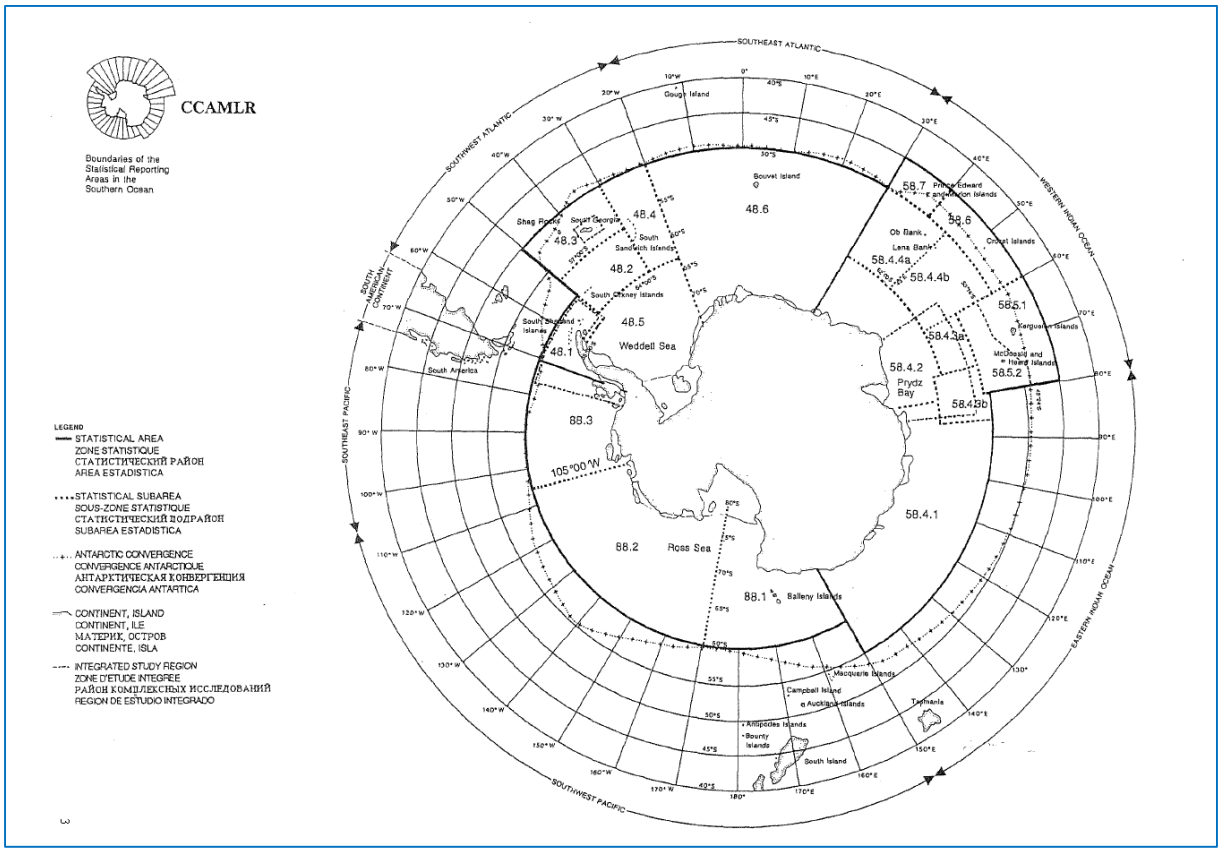
New Zealand's links with Antarctica mean that it regularly hosts conferences and other events related to Antarctic themes. Antarctica New Zealand hosts an annual conference at one of New Zealand's universities each year, attracting up to 180 delegates including several international visitors. An Antarctic Treaty Consultative Meeting in 1997 attracted about 400 delegates to Christchurch. An Antarctic Treaty Meeting of Experts on Tourism in Wellington in 2009 involved approximately 100 delegates. In 2014, the Royal Society of New Zealand, sponsored by Antarctica New Zealand is hosting the XXXIII Scientific Committee for Antarctic Research (SCAR) Biennial Meeting and Open Science Conference in Auckland, which is expected to involve in the order of 1,000 scientists, followed by the COMNAP Symposium 2014 (http://www.scar2014.com/).

Christchurch launched the New Zealand IceFest in 2012, building on the Christchurch Antarctic Festival that began in 2006. The IceFest is a programme of Antarctic themed events held in the city (but with a national focus) every two years. The 2012 IceFest attracted 97,000 people, including 60 overseas guests. At the time of writing this report, planning for the 2014 festival is under way (http://nzicefest.co.nz/).

2.8 Southern Ocean commercial fishing

Commercial fishing in Antarctic waters is regulated by the Convention on the Conservation of Antarctic Marine Living Resources, which is supervised by the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) based in Hobart. New Zealand was one of the original signatories to this convention, which was concluded in Canberra in 1980. The CCAMLR collects and publishes catch data categorised into statistical reporting areas; the Ross Sea fishery is reported in areas 88.1 and 88.2 (see Figure 3). The predominant species caught in the Ross Sea is the Antarctic Toothfish (*Dissostichus mawsoni*). The CCAMLR reports that in 2011/12, 3,602 tonnes of this species were caught in areas 88.1 and 88.2 by vessels from six countries: New Zealand (27.0%); Norway (5.0%); Republic of Korea (24.5%); Russian Federation (14.5%), Spain (14.5%) and the United Kingdom (14.5%) (CCAMLR, 2013, Table 7.1).

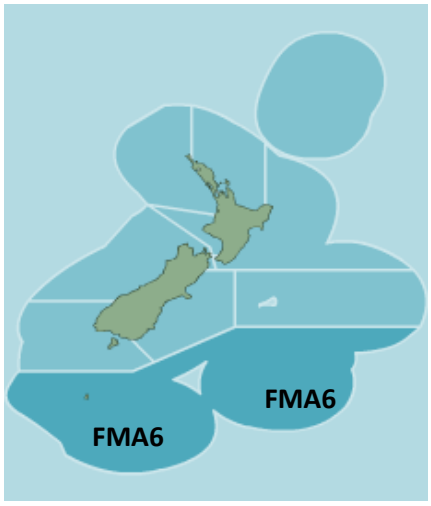
Figure 3: Antarctic Statistical Reporting Areas 88.1 and 88.2



Source: CCAMLR (2012, p. 3).

As well as the Antarctic fishery, this study also includes New Zealand's Sub-Antarctic Fisheries Management Area (FMA 6) shown in Figure 4. Southern Blue Whiting and Squid are the two principal species caught in FMA6.

Figure 4: Sub-Antarctic Fisheries Management Area (FMA 6)



Source: http://fs.fish.govt.nz/Page.aspx?pk=41&tk=414&fyk=56.

3. Economic Benefits to Canterbury and New Zealand

The economic impact analysis was carried out using the same five headings adopted in Saunders *et al*. (2007). This is to allow a simple comparison with the findings in that report. The five headings are:

- National Antarctic Programmes
- Tourism and Events
- Fishing
- Education and Research
- Antarctic Heritage

The sections in this chapter provide a description of how the calculations were made for each of these headings. The final section then presents the aggregated tables with a commentary on the significance of the figures.

3.1 National Antarctic Programmes

The analysis covered four international Antarctic programmes: New Zealand, United States, Italy and the Republic of Korea. The New Zealand and American programmes provided data on their expenditure on goods and services (including the Christchurch office costs of Antarctica New Zealand), aggregated by industry sector using standard categories determined by the AERU. Estimates were made for the major expenditures in Christchurch of the Italian and Korea programmes and fuel purchases for all four programmes were estimated based on estimated fuel use per trip between Christchurch and Antarctica.

Based on these calculations, the annual total direct expenditure of the programmes in Canterbury is estimated to be $38.7 million and in New Zealand estimated to be $46.5 million.

3.2 Tourism and Events

The United States Antarctic Programme was able to advise how many extra nights their personnel spent in New Zealand following the end of their duties on the programme. The total expenditure from these tourist nights were valued using the Ministry of Business, Innovation and Employment's (2013) *International Visitor Survey*.

Antarctic Heritage was able to provide an estimate of tourism expenditure associated with cruises to Antarctica and Sub-Antarctic Islands, and it was further assumed that each of its passengers spent on average one night in New Zealand before or after the cruise.

The International Antarctic Centre was able to offer estimates of the revenue generated from their business from international visitors. It was assumed that these visitors spent an extra night in Canterbury as a result of spending a day at the Centre, but that this meant they spend one less night in the rest of New Zealand during their stay. The Canterbury Museum was able to provide an estimate of the proportion of its annual budget is devoted to their Antarctic collection. The researchers did not attempt to estimate the value of the Antarctic and Sub-Antarctic themed exhibits at Kelly Tarlton's Sea Life Aquarium.

The Christchurch City Council was able to advise the total budget for the New Zealand IceFest. This event is held every two years, and so half this figure is included in the calculations. As noted in Chapter 2, international conferences on Antarctica are commonly held in New Zealand, but this feature was not valued for this study.

Based on these calculations, the annual total direct expenditure of the programmes in Canterbury is estimated to be $31.8 million and in New Zealand estimated to be $29.0 million. The Canterbury figure is higher than the New Zealand figure because of the assumption that the Canterbury-based attractions keep some international tourists in Canterbury for an extra night at the expense of the rest of the country.

3.3 Fishing

The Ministry of Primary Industries provided an estimate of the average annual catch in the 2007/08 to 2010/11 fishing seasons in its Fisheries Management Area FMA6. The analysis assumed that 35 per cent of the catch was landed in Canterbury and 65 per cent in the rest of the country. This allocation is based on actual data used in the Saunders *et al*. (2007) report.

The Commission for the Conservation of Antarctic Marine Living Resources records that New Zealand vessels caught 972 tonnes of Antarctic Toothfish in the 2011/12 season. It proved difficult to obtain a reliable market value for this catch, and indeed fisheries experts advised that its value can fluctuate. Nevertheless, a meeting of the Standing Committee on Implementation and Compliance of CCAMLR in October 2011 estimated that 35 tonnes of illegally caught Antarctic Toothfish was worth US$500,000. Based on that estimate, 972 tonnes would be worth US$13.9 million. A figure of NZ$15 million was therefore used to estimate the value of this catch (it would have been worth NZ$19.6 million using the price in the 2007 report. Again following the 2007 report, this was allocated 25 per cent to Canterbury and 75 per cent to the rest of New Zealand.

Based on these calculations, the annual total direct expenditure of the programmes in Canterbury is estimated to be $17.7 million and in New Zealand estimated to be $71.0 million.

3.4 Education and Research

Antarctica New Zealand provided access to its database of significant research projects related to Antarctica for the year 2009/10. No updated figures were available, so this amount was used in the analysis after allowing for an extra $500,000 per annum from NZARI (2013) funds introduced in 2013.

Allowance was also made for PhD students in New Zealand focusing on Antarctic research at the four University centres described in section 2.1, plus Lincoln University. This uncovered 33 PhD students. The value of their work was taken to be the SAC subsidy (from the Student Achievement Component fund) for a science postgraduate degree (approximately $14,500) plus the approximate domestic fee paid by the student ($6,500).

Based on these calculations, the annual total direct expenditure of the programmes in Canterbury is estimated to be $4.9 million and in New Zealand estimated to be $9.8 million.

3.5 Antarctic Heritage

The value of Antarctic heritage activities was taken from the *Annual Report* of the Antarctic Heritage Trust (2013) based on the average of the Trust's 2012 and 2013 revenue. This source does not provide a detailed breakdown of expenditure and so the analysis adopted the same distribution between Canterbury and the rest of New Zealand (75 per cent and 25 per cent respectively) as was adopted in Saunders *et al*. (2007). This produced a figure for Canterbury of $4.1 million and for New Zealand of $5.5 million

3.6 Aggregated Economic Impacts

Table 1 summarises the direct economic impacts explained in the previous sections of this chapter. It estimates that the aggregated direct economic impact is $102.9 million for the Canterbury economy and $161.7 million for the New Zealand economy. It also shows that the Southern Ocean and Ross Sea fisheries are particularly important, accounting for 43.9 per cent of the total value at the national level. A further 28.8 per cent comes from the National Antarctic Programmes, but these programmes amount to 40.0 per cent of the value in Canterbury. Tourism is also particularly important in the Canterbury region (33.0 per cent of the value compared to 17.9 per cent nationally).

In order to compare these findings with those in the AERU's earlier study, Table 2 reproduces the same table from Saunders et al. (2007). That analysis did not cover as much of the activities in the rest of New Zealand, so that part of the increase from $133.2 million in 2007 to $161.7 million is due to the wider scope of this current project. Nevertheless, the analysis records a 17.5 per cent increase in the direct impact in Canterbury, with increases in every category.

The AERU research team analysed the above expenditures by industry category to show how the economic impact is distributed in different parts of the Canterbury and national economies. These aggregate values are shown in Table 3. Again fishing dominates the New Zealand impacts (recorded under the Primary Industries heading). In the Canterbury region, Accommodation, Restaurants and Bars is the largest sector, reflecting the importance of accommodation (and associated spending) for Antarctic personnel and for tourists attracted by Antarctic themes.

Table 1: Direct Impacts of Antarctic-Related Activities in Canterbury and New Zealand, 2013c, Millions of New Zealand Dollars

Industry Sector	Canterbury	Rest of NZ	New Zealand
National Antarctic Programmes	38.7	7.8	46.5
Tourism	31.8	-2.8	29.0
Fishing	23.3	47.6	71.0
Education and Research	4.9	4.8	9.8
Antarctic Heritage	4.1	1.4	5.5
TOTALS	**102.9**	**58.8**	**161.7**

Note: The Rest of NZ figure for tourism is negative because it is assumed that the Antarctic tourism attractions in Christchurch result in some tourists spending an extra night in Canterbury at the expense of the rest of the country.

Source: AERU calculations.

Table 2: Direct Impacts of Antarctic-Related Activities in Canterbury and New Zealand, 2007c, Millions of New Zealand Dollars

Industry Sector	Canterbury	Rest of NZ	New Zealand
National Antarctic Programmes	34.2	4.8	39.1
Tourism	29.1	-9.1	20.0
Fishing	21.8	45.9	67.7
Education and Research	1.8	3.7	5.5
Antarctic Heritage	0.8	0.3	1.0
TOTALS	**87.6**	**45.6**	**133.2**

Notes: The original report emphasised that the estimates for the Rest of New Zealand (and therefore for New Zealand) were partial, so readers should not be surprised at the amount of the increase in these two columns compared to Table 1. The authors had access to more detailed data about the catch in FMA6 (particularly its distribution between Canterbury and the Rest of New Zealand), so that the apparent

Source: Saunders *et al*. (2007, p. 8).

Table 3: Antarctic-Related Activities Expenditure Analysed by Industry Sector, 2013c, New Zealand Dollars

Industry Sector	Canterbury	New Zealand
Primary Industries	17,837,821	71,183,475
Manufacturing	1,046,661	1,618,069
Utilities	4,537	317,195
Construction	245,324	276,586
Wholesale and Retail Trade	21,381,880	22,203,190
Accommodation, Restaurants and Bars	34,612,830	32,139,452
Transport	10,932,742	11,977,653
Communication Services	492,190	784,367
Finance, Insurance and Property	170,697	287,943
Business Services	5,080,311	10,607,016
Cultural and Recreational Services	4,877,644	6,255,697
Other services	635,697	4,048,167
TOTALS	**97,318,334**	**161,698,811**

Source: AERU calculations.

The final stage of the analysis is to use standard multipliers (drawn from Butcher, 2005 and 2007) to estimate the downstream and household expenditure consequences of the direct impacts. It is important that this multiplier analysis is properly interpreted. It shows how Antarctic-related activities currently have flow-on effects through the economy, but it does *not* show what would happen if those activities ended. Over time, the gap would be filled by other activities as market prices adjusted (perhaps slowly) to the shock. The AERU has not attempted to analyse the outcome of such an adjustment.

The analysis has been undertaken separately for Canterbury and for New Zealand, using regional and national multipliers respectively. In both tables, the direct impact is taken from Table 1; these figures show the revenue received by suppliers of goods and services to the five categories of activities. These suppliers demand goods and services from their own supply chain, and this impact is known as the indirect impact. Finally, households receiving income from the direct and indirect impacts spend some of that income on further consumption goods and services; this is known as the induced impact. The sum of the direct, indirect and induced impacts is termed the total impact.

Finally, it is possible to use another set of multipliers (again provided by Butcher, 2005 and 2007) to estimate the impact that these impacts have on full-time equivalent employment. This is based on current employment ratios in the economy. The final column of Tables 4 and 5 show the number of full-time equivalent employment associated with the total impact.

Table 4: Direct, Indirect, Induced, Total and Employment Impacts of Antarctic-Related Activities in Canterbury, 2013c, Millions of New Zealand Dollars and FTE Jobs

Industry Sector	Direct Impacts	Indirect Impacts	Induced Impacts	Total Impacts	Total Employment Impact (FTE)
NAPs	38.7	26.7	6.7	72.2	765
Tourism	31.8	24.5	6.1	62.4	1,239
Fishing	23.3	11.5	1.7	36.5	120
Research	4.9	3.4	0.9	9.1	88
Heritage	4.1	2.5	0.6	7.3	94
TOTALS	102.9	68.7	16.0	187.6	2,307

Source: AERU calculations.

Table 5: Direct, Indirect, Induced, Total and Employment Impacts of Antarctic-Related Activities in New Zealand, 2013c, Millions of New Zealand Dollars and FTE Jobs

Industry Sector	Direct Impacts	Indirect Impacts	Induced Impacts	Total Impacts	Total Employment Impact (FTE)
NAPs	46.5	40.8	24.1	111.4	1,681
Tourism	29.0	27.4	15.0	71.5	1,422
Fishing	71.0	77.3	27.7	176.0	1,874
Research	9.8	7.4	5.4	22.6	281
Heritage	5.5	4.5	2.4	12.4	161
TOTALS	161.7	157.5	74.6	393.8	5,420

Source: AERU calculations.

This analysis suggests that in the current structure of the New Zealand economy, 2,307 jobs in Canterbury depend on Antarctic-related activities in the region and 5,420 jobs nationally are based on Antarctic-related activities.

4. Towards an Assets-Based Strategy for Development

Following the approach taken in Saunders *et al*. (2007), this final chapter offers some reflections on issues that were raised by participants in the study. The chapter is called "Towards an Assets-Based Strategy for Development" because more than 100 years of providing a gateway to Antarctica, and more than 50 years of active research in Antarctica, have provided New Zealand with important tangible and intangible assets that can contribute to further economic, social, environmental and cultural benefits for its citizens.

Not least among the intangible assets is the accumulated knowledge and reputation of Antarctica New Zealand. No one interviewed for this project expressed anything other than complete satisfaction in their dealings with the organisation. Three firms spoke very highly about their Antarctic work, in each case saying it was a small part of their revenue stream but a highly valued part of their business:[1]

> It is not a large part of our business in dollar terms, but the guys are right behind Scott Base. It offers a good profile for the business and is an attractor for staff knowing they can go down there. It is demanding, rigorous work and long hours, but it is not hard finding people who want to go.
>
> Antarctica New Zealand is one of our favourites for everyone who is involved. They are great people and what we do for them is a bit different. It creates a real buzz among the staff: "Were you just talking to someone at Scott Base?" There are lots of 'touch points' with this part of our work at senior management level.
>
> Our work in Antarctica is a flagship part of our business. It provides us with kudos and international recognition for a small boutique company. We feature in all sorts of wilderness magazines and had our picture taken with the Prime Minister. It's hard to quantify the impact this has.

It is also clear that the positive aspects reported from the interviews in 2007 have been justified by events over the last six years. Between 2007 and 2012, the National Antarctic Programmes continued to develop, tourism benefits increased, as did the Sub-Antarctic Ocean and Ross Sea fisheries, and the resources devoted to Antarctic research (including from philanthropists) grew.

Against that positive background, this chapter comments on three major themes that emerged from the interviews for further consideration by Antarctica New Zealand.

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[1] These three quotes are taken from three different interviews. They are paraphrased reports of what was said, based on handwritten notes made during each interview.

4.1 A whole-of-government response capability

Previous chapters have analysed Antarctic-related activities under separate headings while emphasising the strong connections among these headings. It is frequently said, for example, that the currency of Antarctic diplomacy is science. Facilities such as the International Antarctic Centre in Christchurch and Kelly Tarlton's Sea Life Aquarium in Auckland attract tourists and offer education programmes for school students. Firms involved in Southern Ocean fisheries and visitor cruises to the Sub-Antarctic Islands may face similar issues in their dealings with regulators (for example, on the Regional Coastal Plan for the Kermadec and the Subantarctic Islands). There can be important synergies among people interested in heritage conservation, environmental protection and scientific research in an Antarctic context.

Consequently, it was suggested that New Zealand might strengthen its capability to provide a whole-of-government response. Co-operation among Ministers is not new, of course. *The New Zealand Antarctic and Southern Ocean Science Directions and Priorities 2010-2020*, for example, was signed in 2011 by three Ministers (Hon Murray McCully, Minister of Foreign Affairs; Hon Dr Wayne Mapp, Minister of Science and Innovation; and Hon Phil Heatley, Minister of Fisheries and Aquaculture). There is a long-standing Officials Antarctic Committee (OAC), chaired by the Antarctic Policy Unit in the Ministry of Foreign Affairs and Trade (Brady, 2013, p. 151). The suggestion was that further development of this level of cooperation might be desirable, including the possibility of reviewing the OAC.

A possible model for strengthened collaboration is the Natural Resources Sector, whose primary purpose is "to ensure that, across government agencies, a strategic, integrated and aligned approach is taken to natural resources development and management" (see www.mfe.govt.nz/about/natural-resources-purpose-functions.html). The network is chaired by the Chief Executive of one of the major agencies (the Ministry for the Environment) but seven core agencies are involved, supported by the Treasury, the Department of the Prime Minister and Cabinet, and the State Services Commission. It might be feasible and add value to the Government's involvement in Antarctic-related partnerships if a similar Antarctic Sector based on the OAC is strengthened among the public service agencies.

4.2 Investment in multi-purpose infrastructure for the Gateway City

Christchurch City hosts some major assets for Antarctic-related activities, including the facilities at Christchurch International Airport, Lyttelton Port, the New Zealand base for the United States Antarctic Programme, the offices and logistics depot of Antarctica New Zealand, Gateway Antarctica at the University of Canterbury, the International Antarctic Centre and the Antarctic collection at Canterbury Museum.

Many of the organisations responsible for these assets are currently exploring options for further investment. The Christchurch International Airport has long-term plans to expand its terminals northwards, which would potentially affect the United States Antarctic Programme, Antarctica New Zealand and the International Antarctic Centre. Gateway Antarctica believes it can expand its scientific research and the number of its students. The Canterbury Museum is considering whether it can create a more interactive attraction for visitors to its Antarctic exhibits.

Against that background, a Working Group chaired by Margaret Austin, CNZM, has proposed that "the opportunity exists for a dedicated Antarctic Research Initiative at Christchurch International Airport as the keystone of a global centre of excellence to facilitate and enhance all aspects of Antarctic and Southern Ocean Research, Education, Logistics and Tourism". It has suggested the name Antarctic Endeavour Christchurch (AEC) for this initiative.

Some people interviewed for this project suggested that the AEC could involve purpose-built and multi-function facilities at a suitable site on Christchurch airport land (or nearby) that might include features such as:

- New warehousing and office areas for the National Science Programmes;
- Extreme environment training areas;
- Modern laboratories for Antarctic-themed scientific research;
- A major Antarctic attraction for tourists;
- Education resources on Antarctic themes; and
- A new inter-modal transport hub or inland port, linked to Lyttelton Port.

Other people were cautious about the viability of some of these facilities, while agreeing that there might be an opportunity for an integrated investment at Christchurch airport that would enhance the city's position as a gateway city to the Antarctic. The AERU has made no attempt to explore any aspect of the business case for this proposal; it is an example where a whole-of-government response might be required.

4.3 Contribution to the profile of New Zealand Inc.

A theme in several of the interviews is that New Zealand businesses and New Zealand scientists are doing some technologically very advanced work in Antarctica, where the extreme and isolated environment imposes rigorous demands on reliability and safety. There is a strong movement within New Zealand to promote the country as a place of innovation and scientific excellence (the most recent example is the book by Hendy and Callaghan, 2013). Christchurch itself has been recognised as a city containing a significant industry cluster of technology firms (www.cdc.org.nz/sector-profiles/technology-sector/).

Consequently, there were suggestions by some participants in the study that greater use could be made of Antarctic case studies to raise the profile of New Zealand business and science capabilities internationally. Individual businesses have taken advantage of this opportunity (see, for example, Meridian Energy's profiling of "the world's coolest wind farm" on its website at www.meridianenergy.co.nz/about-us/generating-energy/wind/ross-island/), but there is a suggestion that this could also be done by industry sectors and by the country nationally.

Closely related to this theme is the observation that New Zealand takes obligations to respect the Antarctic environment very seriously. This includes its "precautionary approach to protect the fragile Antarctic environment" (www.mfat.govt.nz/Foreign-Relations/Antarctica/3-New-Zealand-Procedures-for-Visitors-to-Antarctica/index.php) and its maritime patrols in Ross Sea to counter illegal, unreported and unregulated fishing. This respect might be used to support the "New Zealand 100% Pure" brand.

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Appendix 1:
Organisations Interviewed

Managers in the following organisations were interviewed for this report. The research team is grateful to everyone who agreed to participate in the study.

- Air New Zealand
- Antarctic Endeavour Christchurch Working Group
- Antarctica New Zealand
- Canterbury Development Corporation
- Canterbury Museum
- Christchurch City Council
- Christchurch International Airport
- Gateway Antarctica, University of Canterbury
- Gen-i
- Heritage Tours
- Information Leadership
- Intergen, Christchurch
- Lyttelton Port of Christchurch
- Ministry of Business, Innovation and Employment
- Ministry of Foreign Affairs and Trade
- National Institute of Water and Atmospheric Research (NIWA)
- New Zealand Antarctic Research Institute
- PAE (New Zealand)
- Setpoint
- Southern Lakes Helicopters

Appendix 2:
Semi-structured Interview Guide

Introduction and Thanks

The interview begins with Professors Saunders and Dalziel describing the project, explaining the confidentiality of the interview and thanking the participant for his or her involvement.

Four Questions

We are interested in collecting evidence for policymakers on four aspects of enterprises with a significant Antarctic-based component:

(i) How important has the Antarctic-based component been for the business? This might include an indication of proportion of turnover or proportion of employment. It might also include an indication of any significant amounts outside support for the American and New Zealand scientific programmes in Antarctica.

(ii) How important for the participant's own business, if at all, are connections with other businesses engaged in Antarctic-based activities? This might include businesses in Christchurch or other parts of the country.

(iii) What other factors or influences in the past few years – or in the present – have been either a help or a hindrance in developing the Antarctic-based component of the business?

(iv) How does the participant see the sector of Antarctic-based businesses developing in New Zealand and is there anything in particular that public policy agencies could do to encourage that development?

Other Feedback

(v) Is there anything else the participant would like to observe about doing Antarctic-based business in Christchurch or New Zealand?

Thanks

We are grateful for the participant's time and hope our report will help the development of the sector.