



New Zealand
Antarctic
Research Institute

ANNUAL REPORT

2014 – 2015



Erebus Glacier ice cave entrance. Photo by Krystie Hedley ©Antarctica New Zealand Pictorial Collection
Cover: © Trey Ratcliff, StuckinCustoms.com

NZARI VISION & PURPOSE

The New Zealand Antarctic Research Institute (NZARI) partners with research agencies to develop a global understanding of Antarctica's impacts and vulnerability in a changing climate.

Our vision is to inform industry, government and community alike so that we can plan for impacts of change and, where possible, mitigate them.

Our focus is the Ross Sea region, where the Southern Ocean reaches its furthest south (85°S) beneath the Ross Ice Shelf.

Funding for NZARI is sought from organisations concerned with global scale connections to Antarctica and the consequences of its changing environment.

The grand scientific challenge for NZARI is to determine how Antarctica, its ice, oceans, climate and life will respond in a warming global climate and indirectly what those changes in Antarctica will mean for the rest of the world in terms of sea level, climate and ecosystems.



New Zealand
Antarctic
Research Institute



TRUSTEES' STATEMENT OF RESPONSIBILITY

The Board of Trustees of the New Zealand Antarctic Research Institute are pleased to present the annual report for the New Zealand Antarctic Research Institute for the year ended 30 June 2015.

The financial statements have been prepared in accordance with the statement of accounting policies on page 36 and comply with the charity's Trust Deed.

The Board of Trustees accept responsibility for:

- The preparation of the financial statements and for the judgements used in them; and
- Establishing and maintaining a system of internal controls designed to provide reasonable assurance as to the integrity and reliability of financial and non-financial reporting.

In the opinion of the Board of Trustees, the annual financial statements for the year ended 30 June 2015 fairly reflect the financial position, operations and cash flows of the New Zealand Antarctic Research Institute.

Rob Fenwick
CNZM
Chair
29 September 2015

Sir David Skegg
KNZM, OBE, FRSNZ
Trustee
29 September 2015



3	NZARI Vision and Purpose
4	Trustees' Statement of Responsibility
6	Chair's Report
7	Director's Report
8	NZARI's Structure, Governance and Management
8	Objectives
9	Board of Trustees
11	Staff
14	International Science Panel
16	NZARI's Partnerships for Antarctic Science
18	2014/2015 Achievements
19	2014/2015 Research Highlights
26	New Research Projects
30	Three-Year Science Review
31	Winter School
32	New Zealand - Republic of Korea Collaboration
34	Bibliography of Publications
35	Financial Statements and Statement of Accounting Policies
44	Independent Auditor's Report
46	Directory



Snow accumulation measurement on the southern McMurdo Ice Shelf using radar. © Michelle Ryan.

CHAIR'S REPORT

2014 was an exciting year for NZARI. It was marked by the strength of existing partnerships together with new opportunities, a strong, collaborative research programme and evaluation of our work by an International Science Panel.

A new partnership with National Geographic Society was announced. The focus of their output will be on the Ross Ice Shelf project. After overcoming a few challenges, a team of scientists are now set to deploy to Antarctica in November 2015, where they will traverse more than 350 kilometres across the ice shelf to investigate the ocean beneath. The National Geographic film crew will join them on this expedition as part of a TV series due to be released in mid-2016.

I am very pleased several researchers supported by NZARI during their first two grant rounds (2012/13 and 2013/14) received ongoing longer-term support from the Marsden Fund, Ministry for Primary Industries and the Ministry of Business, Innovation and Employment. Each of these new

projects were able to build on the support granted by earlier NZARI Type-A research awards.

NZARI is making excellent progress and the panel made particular note of this in relation to advancing its mission, vision and scientific goals. This was determined by a review led by the International Science Panel, under the Direction of Professor Chuck Kennicutt, of the science portfolio NZARI has been developing since its launch in 2012. The panel recognised new collaborative programmes with a greater level of intensity and collaboration proposed by the science community in the first three years of short-term projects supported by NZARI. While publications are only starting to emerge from the new research projects, the current status exceeds expectations.

Professor Craig Cary of the University of Waikato and Dr Vonda Cummings of the National Institute of Water and Atmospheric Research were appointed to the NZARI team as part-time (0.25 FTE) Deputy Directors. Both are well-known to the New Zealand and international Antarctic research communities and their appointment adds a greater breadth of disciplines to our work.

I would like to acknowledge Rob Fenwick who will return to the Chair in 2016 after a period of absence due to ill health. We are thrilled to commend Rob on receiving the Sir Peter Blake Trust Blake Medal earlier this year highlighting Rob's tireless efforts to conserve natural and human heritage in New Zealand and Antarctica.

We could not do what we do without the support of funding partners, The Aotearoa Foundation and Air New Zealand. We look forward to welcoming our new partner, the National Geographic Society as we embark on even more challenging expeditions.

Phillip Melchior
Acting Chair

DIRECTOR'S REPORT

In collaboration with Antarctica New Zealand, NZARI has hosted six events to Antarctica and the Southern Ocean this past research season. A seventh expedition, to the Auckland Islands aboard the University of Otago Research Vessel *Polaris II*, topped off the season's research efforts. Members of an eighth NZARI team joined researchers from the Korean polar programme aboard the RV *Araon*, the Korean ice breaker, an event which included a number of Australian scientists.

During the 2014/15 field season we were able to make a preliminary visit to Cape Adare to investigate the feasibility of a larger scale scientific programme. Based at Cape Hallett, and despite bad weather, we managed to get to Cape Adare on three separate occasions. During the short time on site, we were able to conduct ground surveys to assess camp-site location and establish a weather station and camera on the ridge overlooking the penguin rookery at Ridley Beach. Transmitting data since November 2014, the weather station has supported our research which informs our understanding on limitations relating to camp design and field operations.

We hosted the Governor General, Sir Jerry Mateparae, to the Auckland Islands to participate in the NZARI-funded research project which included site survey work for a potential future research station. NZARI hosted Hans Weise from National Geographic Society and Shelley Campbell from Sir Peter Blake Trust as part of its outreach and engagement programme to Antarctica.

NZARI received a three-year grant from the Ministry of Business, Innovation and Employment to build a partnership for Antarctic research with the Korea Polar Research Institute (KOPRI). Together with research partners at Canterbury, Waikato, Otago and Victoria Universities, GNS Science and NIWA, NZARI will develop a programme of research focusing on ice-ocean interactions and their importance in ocean and climate processes, a Southern Ocean paleoclimate programme and a programme of ecological research focusing on the Victoria Land coastal region.

We supported six new NZARI Type A projects in March, three of which will undertake research in Antarctica and three will use existing materials. The new projects include researchers from Victoria University, NIWA, Otago University, Auckland University of Technology and the University of Canterbury

with collaborators from Australia, Denmark, South Korea, the United Kingdom and the United States.

The inaugural NZARI Winter School was a highlight for the year. Supported by Antarctica New Zealand, NZARI hosted select media and key stakeholders for a long weekend to grow knowledge of 'What does it take to melt an ice sheet'. Participants travelled to Lake Ohau Lodge where a number of hands-on experiments melting ice and reconstructing ice history from ice core records were undertaken. Participants listened to influential Antarctic ice core researchers, and Nigel Latta presented his views of translating science to the public based on his experience in Antarctica during 2013.

To round out the year, the Antarctic Science Conference, held at the University of Canterbury, brought together some of the top science minds in the country, with more than 150 colleagues from across New Zealand and international participants from Australia, South Korea, China and the United Kingdom.

Gary Wilson
Director



Coring sea ice for measurement of optical properties at Cape Evans. © Ian Hawes

NZARI'S STRUCTURE, GOVERNANCE AND MANAGEMENT

Established as a charitable trust on 5 March 2012, NZARI is incorporated under the Charitable Trusts Act 1957 (NZ) and registered as a charitable entity under the Charities Act 2005 (NZ).

The Board of Trustees has appointed a Director whose role includes directing the implementation of research, ensuring delivery of science outputs and developing

partnerships with organisations to deliver outcomes and support and encourage new Antarctic scientists.

The Board of Trustees has also appointed an International Science Panel (ISP) whose role includes peer reviewing the NZARI science programme to ensure it meets international best practice, and carrying out triennial reviews of the effectiveness and outcomes of the NZARI science programme.

OBJECTIVES

The purpose of NZARI is to operate as a virtual, multi-disciplinary research institute dedicated to Antarctic and Southern Ocean research including, without limitation, through:

1. Delivering research on Antarctica's terrestrial and marine ecosystems;
2. Delivering research on Antarctica's cryosphere, atmosphere and lithosphere;
3. Providing new knowledge of the impact of global change on Antarctica and Antarctica's impact on global change;
4. Increasing understanding of Southern Ocean physical processes;

5. Facilitating applied environmental research that supports Antarctic environmental management outcomes;
6. Communicating effectively to the public and stakeholders on Antarctic and related environmental and climate science issues;
7. Attracting new, and supporting existing, capability in Antarctic research, and developing ongoing research and education on Antarctic-related matters; and
8. Enhancing international relationships and partnerships with research organisations and Antarctic programmes.



BOARD OF TRUSTEES



ROB FENWICK CNZM (Chair)

Rob Fenwick is the Chairman of Antarctica New Zealand. He is an experienced businessman and company director with interests closely aligned to promoting sustainable development. He has had a long association with Antarctica: for nine years until 2007 he was a Director and later Chairman of Landcare Research, one of several Crown Research Institutes involved in Antarctic research, and is a former Chairman of the Antarctic Heritage Trust. In 2005 the New Zealand Geographic Society named the Fenwick Ice Piedmont in the Ross Sea for his work in Antarctica.



PHILLIP MELCHIOR (Interim Chair, November 2014 – July 2015)

Phillip Melchior had an extensive career in journalism, both press and television, in New Zealand. He occupied senior management positions with Reuters in Asia before moving to London as Global Managing Director for Reuters Media from 1996 to 2001. Since his retirement in 2002, Mr Melchior held governance roles with a number of international media companies in addition to Chairman of Land Search and Rescue New Zealand (2007-2014) and Director of Antarctica New Zealand (2011 – present).



PROFESSOR MARY O'KANE

Professor Mary O'Kane is the New South Wales Chief Scientist and Engineer and also a company Director and Executive Chairman of Mary O'Kane & Associates Pty Ltd, a Sydney-based company that advises governments, universities and the private sector on innovation, research, education and development. She is also Chair of the Board of the Institute of Marine and Antarctic Studies at the University of Tasmania, Chair of the Development Gateway based in Washington and the Development Gateway International based in Brussels, Chair of the Co-operative Research Centre for Spatial Information, and a Director of Business Events Sydney, National ICT Australia Ltd, and the Capital Markets Cooperative research Centre. Mary was Vice-Chancellor of the University of Adelaide from 1996 to 2001.



PROFESSOR MAHLON CHUCK KENNICUTT II

Chuck Kennicutt is Professor Emeritus of Oceanography at Texas A&M University. He was a member of the U.S. Department of State delegation to the Antarctic Treaty from 2002 to 2007, U.S. Delegate to the Scientific Committee on Antarctic Research (SCAR) from 2003 to 2012 and ex officio member of the U.S. Polar Research Board from 1998 to 2014. He served as a Vice President (2004-2008) and President of SCAR (2008-2012) and led the first SCAR Antarctic and Southern Ocean Science Horizon Scan in 2014. Professor Kennicutt was named a National Associate of the U.S. National Academy of Sciences for life, awarded the Antarctic Service Medal of the U.S. Antarctic Program and a geographic feature was officially named Kennicutt Point in 2006.



SIR DAVID SKEGG KNZM, OBE, FRSNZ

Professor Sir David Skegg is one of New Zealand's most distinguished scientists and is recognised internationally for his work in epidemiology. He was knighted in 2009 for services to medicine. Sir David is the President of the Royal Society of New Zealand. After graduating from Otago and Oxford universities, he was a lecturer in epidemiology at the University of Oxford. In 1980, he returned to New Zealand to take up the Chair of Preventive and Social Medicine at Otago. From 2004 to 2011 he was the Vice-Chancellor of the University. Sir David is a former Chair of the Health Research Council, the Public Health Commission, and the Universities New Zealand Research Committee. He was the foundation Chair of the New Zealand Science Board, and currently chairs a research committee for the World Health Organisation in Geneva.



Panorama from Table Mountain with Ferrar Glacier © Bob Dagg

NZARI STAFF



DIRECTOR

PROFESSOR GARY WILSON

Gary Wilson is Professor of Marine Science at the University of Otago and also holds an adjunct position in the Geology Department. Before coming to Otago he lectured at the University of Oxford and held a research fellowship at Wolfson College. Gary has participated in and led more than 20 expeditions to the Antarctic and Subantarctic supported by the New Zealand and United States Antarctic Programmes. His collaborative research programmes have attracted more than \$20 million in research grants and resulted in more than 80 scientific papers in peer reviewed journals. He has held the Byrd Fellowship at The Ohio State University, the Blaustein Visiting Professorship at Stanford University and in 2006 he received a Sir Peter Blake Leadership award for his role in bringing together the multinational team for the ANDRILL project, which he chaired between 2004 and 2009.



DEPUTY DIRECTORS (Since May 2015)

PROFESSOR CRAIG CARY

Craig Cary is a microbial ecologist turned molecular geneticist and a professor in Biological Sciences at the University of Waikato. His research for more than 20 years has focused on studying microbial life in extreme environments. He has participated in 29 deep-sea expeditions to hydrothermal vents including many dives in research submersibles. His work includes 11 seasons in Antarctica to study microbial life in the Dry Valleys, thought to be the coldest, driest place on earth, and in the high temperature soils on the summit of Mt. Erebus, the most southern active volcano on the planet. Craig is the Principal Scientist leading the current government sponsored DryVER project, the Event Leader for the 2015/16 expedition to the Dry Valleys and the Theme Leader for the Human Impact Team that will be investigating the extent, and longevity of human impact on the Dry Valley ecosystem.





DR VONDA CUMMINGS

Vonda Cummings is a marine ecologist at the National Institute of Water and Atmospheric Research (NIWA) in Wellington. Throughout her career she has participated in and led a diverse range of projects focused on marine ecosystem structure and function both in New Zealand and Antarctica. She has been actively involved in Antarctic field research programmes since 2000. Most recently she led a team that implemented novel in situ experiments to understand how environmental change might affect coastal marine ecosystems. She is a principal investigator of two SCAR programmes, Antarctic Thresholds - Ecosystem Resilience and Adaptation (AnT-ERA) and Antarctic Nearshore and Terrestrial Observing Systems (ANTOS), and was part of the successful New Zealand-led Latitudinal Gradient Project (LGP). Vonda's research has so far resulted in over 80 research papers published in scientific journals. She is also currently a Research Associate at Victoria University of Wellington.

RESEARCH ADVISOR

DR NICOLE STAHLMANN



Nicole Stahlmann has extensive experience directing cross-disciplinary research programmes. Prior to joining NZARI in 2013, she spent five years as the Director of Fellowship Programs at the American Council of Learned Societies, where she oversaw a large portfolio of initiatives to support individual and collaborative research. Concurrently she held an adjunct professorship in the Department of Media, Culture, and Communication at New York University. Between 2001 and 2008, she directed the Fellowships Office at the Social Science Research Council in New York. Nicole received a Ph.D. from the Johannes Gutenberg University-Mainz (Germany), was a graduate scholar at Columbia University (U.S.) and an Erasmus scholar at the Rijksuniversiteit, Gent (Belgium).



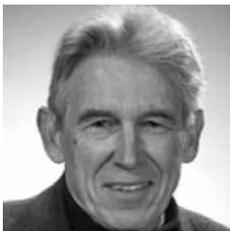
INTERNATIONAL SCIENCE PANEL



The International Science Panel (ISP) peer-reviews the science strategy and programme to ensure that it represents international best practice and advises on multi-disciplinary and international opportunities. The ISP also carried out a three-year review of the effectiveness and outcomes of the NZARI science programme.

PROFESSOR MAHLON CHUCK KENNICUTT II (CHAIR)

Chuck Kennicutt is a member of the NZARI Board of Trustees and chairs NZARI's International Science Panel. He is Professor Emeritus of Oceanography at Texas A&M University.



PROFESSOR PETER BARRETT

Professor Barrett is Professor Emeritus of Geology at Victoria University of Wellington where he is a founding member of the Climate Change Research Institute. He has received numerous awards in recognition of his Antarctic research including the Marsden Medal by the New Zealand Association of Scientists (2004), the SCAR President's Medal for Outstanding Achievement in Antarctic Science (2006) and the New Zealand Antarctic Medal (2010).



PROFESSOR STEVEN CHOWN

Professor Chown is the Head of the School of Biological Sciences at Monash University in Australia. He has worked on Antarctic terrestrial and marine ecosystems and their constituent species for the past 25 years. Much of his research has been taken up in conservation policy in the region. In 2009, Professor Chown was awarded the first Martha T. Muse Prize for Science and Policy in Antarctica, and in 2014 he received the SCAR Medal for Excellence in Antarctic Research.



PROFESSOR JANE FRANCIS

Professor Francis is the Director of the British Antarctic Survey. She was a Professor of Palaeoclimatology and Dean of the Faculty of Environment at the University of Leeds, UK. She is Chair of the UK National Committee for Antarctic Research and recipient of a UK Polar Medal. Her principal research interests include palaeoclimatology and palaeobotany. Professor Francis' work focused on understanding past climate change during both greenhouse and icehouse periods in the geological past, in both the Arctic and Antarctica.



DR YEADONG KIM

Dr Yeadong Kim is the President of the Korea Polar Research Institute (KOPRI) and was a Principal Research Scientist in geophysics at KOPRI. He was the Project Manager for the construction of the Korean Antarctic station, Jang Bogo, which opened in February 2014 at Terra Nova Bay. Dr. Kim was the President of the Korean Geophysical Society from 2004 to 2007 and is a current SCAR Vice President.



PROFESSOR W. BERRY LYONS

Professor Lyons is currently the Director of the School of Earth Sciences at the Ohio State University, and former Director of the Byrd Polar Research Center. He is a Fellow of the Geological Society of America, American Association for the Advancement of Science and American Geophysical Union. Professor Lyons was the lead investigator (and is still an active member) of the McMurdo Dry Valleys Long Term Ecological Research program funded by the National Science Foundation.



DR OLAV ORHEIM

Dr Orheim was Director of the Norwegian Polar Institute for more than a decade and subsequently Executive Secretary for the International Polar Year Secretariat. He was the Vice President of SCAR, chaired many meetings within the Antarctic Treaty system and was the first Chair of the Committee for Environmental Protection. He has more than 80 publications covering glacier mass balance and climate, ice dynamics, remote sensing, and politics of the polar regions. In 2007 he was knighted under the Royal Norwegian Order of St Olav.



DR STEVE RINTOUL

Dr Rintoul is a Commonwealth Scientific and Industrial Research Organisation (CSIRO) Fellow at the CSIRO Marine and Atmospheric Research facility in Hobart, and leader of the Oceans programme at the Antarctic Climate and Ecosystems Cooperative Research Centre. He is a recipient of the Australian Antarctic Medal and internationally recognised as a leading authority on the circulation of the Southern Ocean and how it affects global climate systems. Dr Rintoul was awarded the 2012 Martha T. Muse prize for Science and Policy in Antarctica and is a Fellow of the Australian Academy of Science.



PROFESSOR DIANA WALL

Professor Wall is the Director of the School of Global Environmental Sustainability, a University Distinguished Professor of Biology and Senior Scientist at the Natural Resource Ecology Laboratory at Colorado State University. She is the recipient of the 2012 SCAR President's Medal for Excellence in Antarctic Research and the 2013 Tyler Prize for Environmental Achievement. Her research interests include how soil biodiversity contributes to healthy, productive soils, and the consequences of human activities on soil sustainability.

NZARI'S PARTNERSHIPS FOR ANTARCTIC SCIENCE



The K081 team used a hot water ice cutter and the hydraulic arm of the Scott Base vehicle to make the access hole for the underwater vehicles © Ian Hawes

NZARI works with a range of researchers and research providers, funders and supporters and Antarctica New Zealand to develop the best partnerships to address the most challenging scientific questions.

Each year, NZARI calls for proposals for short-term research projects to address critical questions identified by the NZARI science strategy and science workshops. NZARI provides up to \$100,000 in funding for each project and seeks logistical support from Antarctica New Zealand for field observations and measurements. NZARI short-term projects have to be completed within two years.

As funding is available, NZARI also launches targeted longer-term multi-institution interdisciplinary programmes. Two such programmes are currently underway:

- Vulnerability of the Ross Ice Shelf in a warming globe;
- A pilot to investigate establishing a Long Term Ecological Research (LTER) and Monitoring programme at Cape Adare.

NZARI also provides support for scientists to participate in international research workshops.

NZARI leverages every dollar invested to support its researchers and research goals through institutional co-funding and logistics support through Antarctica New Zealand.



Sea algae © Ian Hawes

NZARI SCIENCE IS FUNDED BY THE FOLLOWING PARTNERSHIPS

	2013-14	2014-15
NZARI Grants	\$499,699	\$501,489
NZARI Workshops	-	\$30,892
Auckland University of Technology	-	-
Canterbury University	\$408,960	\$763,522
University of Otago	\$39,686	\$229,909
University of Waikato	\$247,766	\$25,483
Victoria University of Wellington	\$17,785	-
GNS Science	\$276,000	\$146,216
NIWA	-	-
Bodeker Scientific	\$45,000	\$7,650
Antarctica New Zealand logistics	\$1,135,333	\$1,042,800
Total	\$2,670,229	\$2,747,961

2014/2015 ACHIEVEMENTS

During its third year of operations, NZARI has:

- Funded a third tranche of six short-term research projects (selected from 30 proposals) to understand how Antarctica will respond in a changing climate. The projects were given national and international coverage through the *New Zealand Herald* and Air New Zealand's inflight *KiaOra* magazine;
- Entered into a new three year partnership with National Geographic Society to support the Ross Ice Shelf research programme and produce a series for National Geographic Channel to profile NZARI research;
- Awarded new funding from MBIE to develop a collaborative research programme with the Korea Polar Research Institute (KOPRI) to investigate the impacts of a warming globe on Antarctica;
- Conducted a site visit to Cape Adare including a ground survey to find a suitable long term camp-site and established a weather station and camera on Adare Ridge overlooking the penguin colony on Ridley Beach;
- Supported the three new action groups of the Scientific Committee on Antarctic Research - Antarctic Nearshore and Terrestrial Observing Systems, Integrated Science for the Subantarctic, and a geological mapping update of Antarctica;
- Organised the first NZARI Winter School at Lake Ohau Lodge to investigate the question of "What does it take to melt an ice sheet?" with a range of media and industry representatives;
- Hosted 120 delegates at the biennial New Zealand Antarctic Science Conference at the University of Canterbury. Two and half days of presentations (40 talks, 54 posters) and workshops focused on Antarctic science research and future challenges;
- Appointed two new Deputy Directors to support NZARI: Professor Craig Cary, an Antarctic terrestrial microbiologist from the University of Waikato, and Dr Vonda Cummings, an Antarctic marine ecologist from NIWA;
- Co-hosted the Governor General, His Excellency Lieutenant General The Right Honourable Sir Jerry Mateparae, to the Auckland Islands with the Sir Peter Blake Trust and the Department of Conservation.

2014/2015 RESEARCH HIGHLIGHTS

Impact of a warmer climate on Southern Ocean circulation and bioproductivity: The early Holocene

Dr Joe Prebble, GNS Science;
Dr Giuseppe Cortese, GNS Science;
Dr Helen Bostock, NIWA

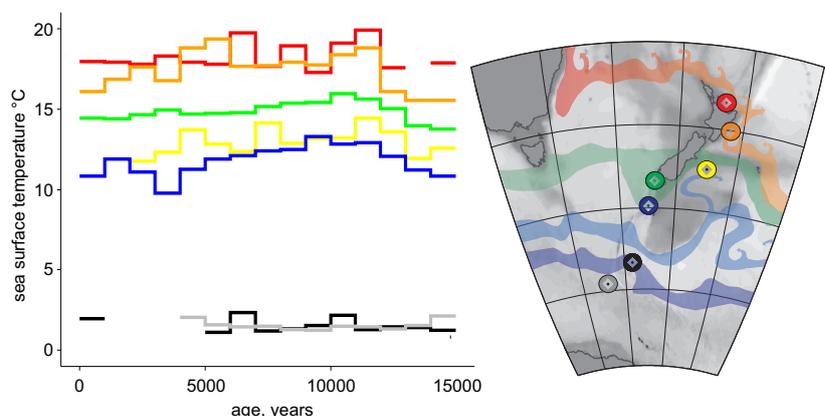
The goal of our project is to document the distribution of warmth and the circulation in the surface ocean, during the early Holocene (12,000-6,000 years ago) - the most recent time in the geological record when temperature was measurably higher than present in the waters around New Zealand and the Southern Ocean.

To do this, we have assembled a multi-disciplinary team, to examine samples from seven sediment cores that form a transect connecting the mid-latitudes east of New Zealand with Southern Ocean waters south of the Polar Front. Our team includes palaeontologists with specialist knowledge of foraminifera, diatoms, nannofossils, radiolaria, and dinoflagellates, geochemists who extract information on elemental and isotopic ratios and organic markers from calcareous shells and bulk sediment, and climate modellers who can help put the point data we generate from the sedimentary cores in a regional and global context.

The large climatic gradient covered by our sites means we have had to use a range of methods to produce robust estimates of sea surface temperatures for the early Holocene. These include statistical methods applied to species abundance from five groups of marine microfossils, and two geochemical methods. This multi-proxy approach allows us to achieve the best estimate possible of early Holocene conditions.

Initial results suggest the timing of maximum warmth during the early Holocene varied along our transect - with peak warmth occurring earlier at southern mid-latitude sites compared to sites north of the Subtropical Front, and generally low variability in the Southern Ocean.

Transect of sediment cores examined in this study, and multi-proxy maximum sea surface temperature estimates for the early Holocene generated for this project.





The underwater vehicles enjoying some sunshine on the surface at the end of the project. © Ian Hawes

Mesoscale variability in sea ice thickness, optical properties and algal biomass

Professor Ian Hawes, Gateway Antarctica, University of Canterbury

Sea ice is a defining characteristic of Antarctica, and its seasonal fluctuations affect global and regional climate, as well as energy fluxes in marine ecosystems. Despite its global significance, its opacity makes remote sensing of properties other than areal extent difficult. In October–November 2014 K081A deployed to Cape Evans to determine whether km-scale measurements of ice properties could be obtained by looking upwards from an Autonomous Underwater Vehicle (AUV). The AUV was equipped with upward-looking sonar and optical sensors and deployed along pre-programmed, under-ice transects. A particular goal of the research was to estimate the concentration of ice algae

over spatial scales larger than those normally attempted. These algae are the primary source of organic carbon during the polar spring, but are difficult to quantify. To accomplish this, the AUV measured ice transparency at six specific wavelengths, from blue to red. In parallel, the relationships between optical properties and algal biomass were determined by measuring transparency and biomass and species composition of the ice-algae at 60 calibration sites. Ongoing analysis of samples and data are showing that good algorithms can be developed to estimate ice thickness, snow cover and algal biomass from the AUV data.

Stratospheric transport, jets, and a better simulation of ozone's fingerprint on Antarctic climate

Dr Greg Bodeker, Bodeker Scientific

Our goal is to analyse location information from a constellation of balloons flying in the stratosphere to better understand the processes that control stirring and mixing of stratospheric air between Antarctica and southern mid-latitudes. In particular, we seek to diagnose how the Antarctic circumpolar vortex, a jet of strong westerly winds that forms in the stratosphere in the early winter of each year, isolates the Antarctic stratosphere from mid-latitudes. Constraints on exchange of air parcels across the vortex edge largely determines the distribution of radiatively active gases (e.g. ozone) in the stratosphere and hence their fingerprint on the climate system.

These processes are often not well simulated in global climate models. To date, we have obtained location information from 79 long-duration stratospheric balloons being flown by Google [X] Project Loon to provide internet access to remote locations. Analyses of Loon balloons locations, obtained every minute through their flights, have shown differences between true and modelled balloon trajectories that vary regionally over southern middle and high latitudes. Wind speeds derived from the Loon balloons show a strong diurnal cycle in east-west winds that are not well resolved in global meteorological data sets. Other discoveries are expected as the project continues.



An example of a Loon balloon trajectory, circling the Antarctic continent following its launch from Lake Tekapo airport. The inset shows the project PI standing in front of a Loon being filled prior to launch.

Meteorological change in the Ross Sea Region and its link to Antarctic Sea ice trends

Associate Professor Adrian McDonald, Department of Physics and Astronomy, University of Canterbury

This project examines the relationship between the intense southerly storms passing over the Ross Ice Shelf (RIS) and recent increases in sea ice extent. This will allow us to understand whether the observed changes in the southerly storms in the region are a driver of increasing sea ice extent in the Ross Sea. Towards that goal, we have examined one of the main drivers for the weather patterns, called the Amundsen Sea Low (ASL), over the Ross Sea and linked it to changes. In particular, we have published work on the impact of the position and strength of the ASL on the frequency and strength of weather patterns over the Ross Sea and RIS, which has

highlighted the important impacts of low pressure systems on sea ice. We have also begun to examine detailed observations made with the SNOW WEB wireless sensor network, a uniquely powerful network of weather monitoring instruments, in regions close to areas of major sea ice production. In this project, we placed 20 SNOW WEB stations, all communicating via wireless, to more than quadruple the number of observations near the RIS edge. These high resolution observations will allow us to understand the atmospheric processes which influence sea ice in significantly greater detail than previously possible.



Working on SNOW WEB © Ethan Dale

Postglacial changes in the location and intensity of the southern westerly winds, subantarctic Auckland Islands

Dr Chris Moy, Geology Department, University of Otago;
Dr Marcus Vandergoes, GNS Science;
Dr Matthew McGlone, Landcare Research

Fig. 1: Core on deck! Expedition scientists recover a three metre core from Norman Inlet in the Auckland Islands. Downcore changes in the organic and stable isotope geochemistry of fjord sediment cores will be used to reconstruct past changes in climate and ocean circulation related to the Southern Hemisphere westerly winds. © Edward Perkins

Fig. 2: Chris Moy (Otago University) and Marcus Vandergoes (GNS Science) recover a short gravity core from Lake Hinemoa in the Auckland Islands. This short core captures the sediment-water interface and will be used to calibrate the longer six metre long core recovered from this lake. © Chris Moy

The strength and latitudinal position of the Southern Hemisphere westerly winds play a fundamental role in influencing New Zealand's climate and carbon dioxide exchange between the Southern Ocean and the atmosphere. Today, southward-shifting and intensifying winds are thought to reduce the efficiency of the Southern Ocean carbon sink, with direct implications for the rate at which anthropogenic CO₂ accumulates in the atmosphere. However, the mechanisms and long-term impact of these short-term changes are poorly understood. The research team collected sediment cores from fjords, lakes, and peatlands in the Auckland Islands (New Zealand subantarctic) to reconstruct past changes in the wind field and to place recent observed changes in the winds within a longer perspective.

In February 2015, researchers conducted a three-week long expedition to the Auckland Islands using the University of Otago R/V *Polaris II* to collect sediment, water, and vegetation samples. The participants collected 32 piston and gravity cores from the fjords (Fig. 1), a six metre core from Lake Hinemoa (Fig. 2), and multiple peat cores from 100m high plateaus on the eastern margin of the main Auckland Island. Ongoing laboratory work is focused on constructing a chronology and obtaining paleoclimate information by applying a combination of geochemical and microfossil techniques to the cores. Together, this information will be used to evaluate the primary mechanisms that drive Southern Hemisphere westerly wind variability and influences on the Southern Ocean carbon cycle.



Fig. 1



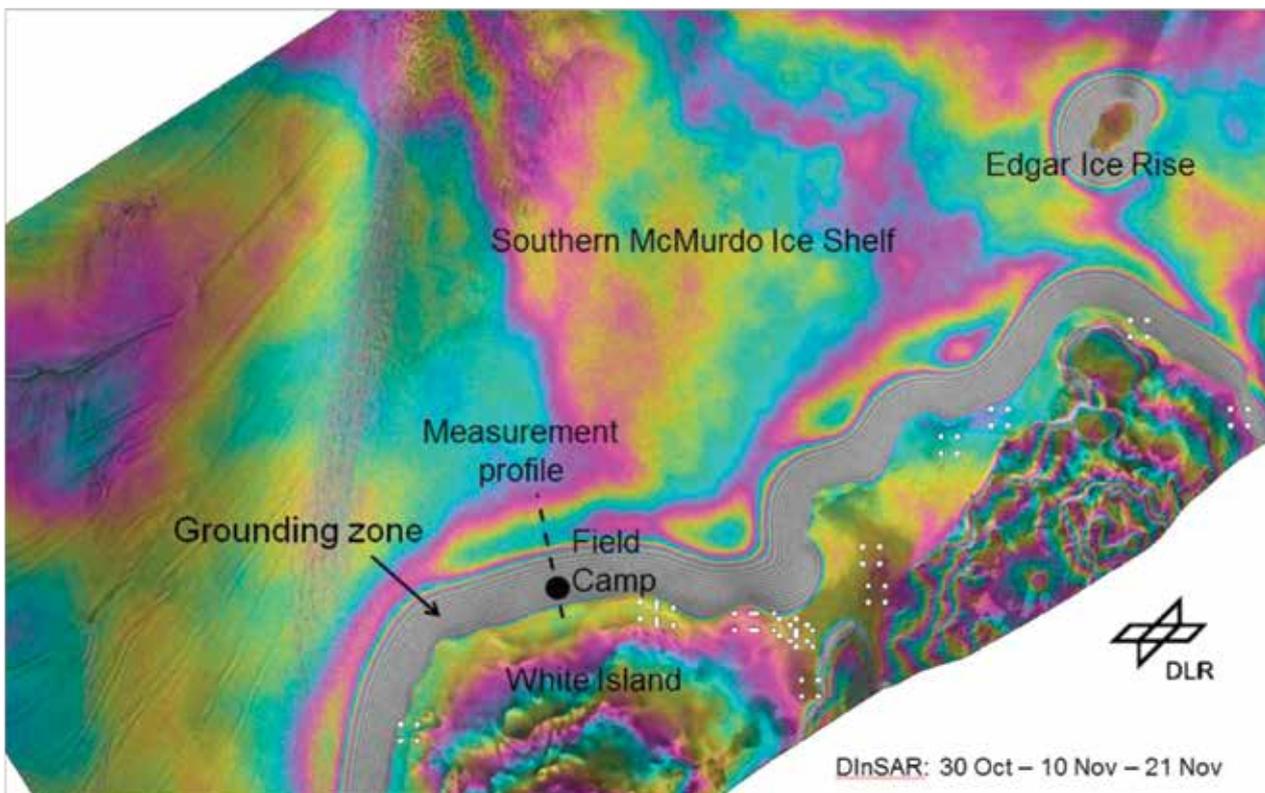
Fig. 2

Tidal flexure of ice shelves: the key to understanding Antarctic grounding zones

Dr Wolfgang Rack, Gateway Antarctica, University of Canterbury

Tides are constantly bending ice shelves in the grounding zone, where the Antarctic ice sheet starts floating on the ocean. We investigate the pattern of bending which depends on properties such as ice thickness and stiffness. Knowledge of these properties is required to understand ice sheet flow near grounding lines, critical for any prediction of future ice flow and sea level rise. In November 2014 a team of four researchers installed a series of tiltmeters and GPS stations in the grounding zone of the Southern McMurdo Ice Shelf, 50km south of Scott Base. Over two months the instruments precisely recorded vertical displacement and daily

changes in surface slope. At the same time, satellites acquired snapshots of the flexure pattern, using a technology called Radar interferometry. The field stations allow a continuous record of tidal bending over time along our measurement profile, whereas the satellite images reveal a complete spatial picture of bending at one moment in time. The glaciological work was complemented by ice thickness soundings, and measurements of accumulation and snow density. This field data is now being used to develop a model for correct interpretation of satellite measurements around the Antarctic coast line.



Differential SAR interferogram acquired by the German Terra SAR-X satellite showing the tidal flexure difference between 30 Oct/10 Nov and 10 Nov/21 Nov 2014.



Gomphiocephalus hodgsoni; actual size 1.3mm. © Barry O'Brien

Invertebrates on the edge: Assessing the Mackay Glacier as an ecotone for tracking biological responses to climate changes

*Professor Ian Hogg, School of
Science, University of Waikato*

“Ecotones” are transitions that naturally occur between one ecosystem type and another such as along shorelines (sea vs land) or between regions where different groups of species meet each other. Because of their transitory nature, ecotones are ideal for studying shifts in species distributions, particularly in response to climate changes. With support from NZARI, we focused on the fauna of exposed soil habitats in the vicinity of the Mackay Glacier. This region sits at the divide between northern and southern Victoria Land – both of which have unique species assemblages. Our research team included invertebrate specialists from the University of Waikato as well as microbial specialist Prof. Don Cowan (University of Pretoria) and nematode specialist Prof. Byron Adams (Brigham Young University and US Antarctic Program).

We examined the distribution and genetic diversity (DNA barcoding) for a range of invertebrates and microbes – the largest of these being the charismatic springtails, or Collembola, pictured above. From our base camp at Mt Sues, we visited a total of 49 sites

covering over 100km south to north. In addition to mapping the current distribution of invertebrate and microbial species, we also found evidence of strong genetic differences among populations of Collembola, some of which are likely to be previously unknown species. This suggests that populations have been isolated for several thousands of years and that dispersal is currently restricted by glaciers. Given these unique genetic differences, any future changes in species’ distributions can be easily tracked through the DNA barcoding of individuals. Using this information we can enhance our capacity to detect subtle biological responses resulting from gradual climate changes.

NEW RESEARCH PROJECTS

In its third round of funding, NZARI provided support for six new research projects to investigate how Antarctica's ice cover will change as the world warms.

The six projects were chosen from 30 applications through a rigorous peer-review process that involved 49 expert reviewers under the guidance of an International Science Panel. The new funding will support New Zealand research teams from across four New Zealand universities and two Crown Research Institutes enabling them to team up with international collaborators in Australia, Denmark, South Korea, the United Kingdom, and the United States of America. Three of the successful projects will involve fieldwork in Antarctica during the next two seasons (2015/16 and 2016/17) as part of New Zealand's Antarctic Programme. The logistics support for this research is provided by Antarctica New Zealand.

"An area which was once deemed one of the most stable parts of our planet is now showing real signs of change," says NZARI Director, Professor Gary Wilson. "Each proposal directly supports NZARI's goal of enabling high-quality, collaborative research

which seeks answers to some of the global challenges presented by a changing climate today."

The new projects, which are funded from support NZARI received from the Aotearoa Foundation and Air New Zealand, aim to understand if ocean warming is affecting the rate at which ice is melting and if the melting ice is in-turn refreezing the ocean. Researchers will also investigate the impact that changes to Antarctica's ice sheets will have on the planet. For New Zealand, this means better understanding the effect this has on sea levels and the climate. This is important as we may already be seeing changing patterns of rainfall and drought.

"New Zealand has a strong reputation of scientific leadership in Antarctica and NZARI is committed to tackling global challenges," says Professor Wilson. "NZARI research is not constrained by what scientists think they can achieve with existing resources, rather we are focussed on the future of our planet and what its ecosystems require."

Preliminary results from this research are expected towards the end of 2017.



University of Otago R/V *Polaris II* anchored in Waterfall Inlet, Auckland Islands. Flowering Rata (*Metrosideros umbellata*) can be seen at lower elevations on the hill in the background. © Chris Moy

ABSTRACTS OF NZARI-FUNDED PROJECTS

Antarctic influences on New Zealand climate during the Antarctic Cold Reversal

Associate Professor Andrew Mackintosh, Antarctic Research Centre, Victoria University of Wellington

Recent observations and modelling show that collapse of the West Antarctic Ice Sheet may be underway, with the potential to dramatically contribute meltwater to the oceans. During a previous period of global warming ~14,000 years ago, some geological records and computer model simulations suggest that a large Antarctic meltwater release caused a Southern Hemisphere climatic response known as the 'Antarctic Cold Reversal'. Using state-of-the-art glacier- and climate-modelling tools, we aim to identify the cause of this non-linear climatic response. This will allow us to assess whether future Antarctic melting could have similar, unexpected consequences for New Zealand climate.

Investigating Antarctic ice sheet response to past anomalous Southern Ocean warming

Dr Catherine Beltran, Department of Geology, University of Otago

"West Antarctic Glacier Loss Appears Unstoppable" (*NASA News* June 2014). Recent studies show that this melting, driven by ocean warming, has reached the point of no return. Because Antarctica can significantly increase global sea level, this faster-than-expected phenomenon is a real concern for the future. Our proposed work is to improve the understanding of the ice-ocean interactions during the last super-glacial (1 million years ago) when Antarctica partially melted due to ocean warming. Using organic geochemical proxies, we will identify the temperature threshold for melting ice-shelves and the magnitude of the phenomenon, aiming to provide crucial data to simulate future scenarios.

Interfacing human impact assessment and social valuation of climate sensitive landforms in the Ross Sea region

Dr Barbara Bollard Breen, Institute for Applied Ecology;

Professor Mark Orams, NZ Tourism Research Institute;

Professor Steve Pointing, Institute for Applied Ecology, Auckland University of Technology

Conservation outcomes in the Ross Sea region are limited by resources for monitoring past and cumulative effects of human impacts on vulnerable ecosystems and a lack of understanding of the relationships between visitor values and the environment. Our team are leaders in the development of novel 'zero-harm' remote survey tools for conservation solutions. This research will provide high resolution spatial maps of vulnerable habitats obtained from Unmanned Aerial Systems (UAS) and spatial analysis software developed specifically for use in harsh Antarctic environments. We will interface this data with site specific visitor values to understand human interactions with Antarctic sites, thus providing solution-focused outcomes to conserve Antarctic landforms at risk from climate change.

Supercooled ice shelf cavity water and the influence on sea ice growth

Associate Professor Craig Stevens, NIWA;

Associate Professor Patricia Langhorne, Department of Physics, University of Otago

The seasonal growth and decay in sea ice coverage is arguably the largest natural annual geophysical change on the planet, with the shrinking Arctic ice being one of the clearest manifestations of climate change. But why is this shrinking Arctic ice not paralleled in the Antarctic? We are researching the possibility that the answer lies in the production of supercooled seawater beneath the giant Antarctic ice shelves that make up 40% of Antarctica's coastline. This water is very cold but also slightly fresh. As it leaves the cavity and enters the polar ocean, it spreads out as a cold surface layer promoting sea ice growth far beyond the Antarctic coast. We will combine new approaches to turbulence and ice crystal measurement to aid in better computer predictions. The field campaign will also include an art-science-education thread to better engage young minds with aspects of Antarctic science less often encountered in the media.





Constraining Antarctica's contribution to past global sea level rise in Northern Victoria Land and the Western Ross Sea

Dr Kevin Norton, School of Geography, Environment and Earth Sciences, Victoria University of Wellington

Understanding past, non-linear changes in ice sheets is important for predicting their future response. Antarctica may have been a source of a dramatic sea-level rise ~14,600 years ago, when the Earth's climate transitioned from a glacial to warm climate. Outlet glaciers in Northern Victoria Land would have recorded the onset of this possible ice sheet collapse. We will use numerical models to understand the sensitivity of this sector of the ice sheet to environmental forcing and exposure dating techniques to precisely determine the timing and contribution of ice sheet loss from this region to sea level rise.

Reconstructing the history of the Ross Ice Shelf since the Last Glacial Maximum

Dr Christian Ohneiser, Department of Geology;

Dr Christina Riesselman, Department of Marine Science, University of Otago

Rising ocean temperatures may soon destabilise the West Antarctic Ice Sheet, which will result in sea-level rise and changes in oceanic and atmospheric circulation that will have a profound impact on New Zealand. The Ross Ice Shelf protects the West Antarctic Ice Sheet from the warming ocean. Because little is known about past Ross Ice Shelf behaviour, predictions of its future stability are challenging. We will reconstruct the Ross Ice Shelf history since the last ice age using seafloor sediment cores from the Ross Sea. Our reconstruction will test computer models of past change in order to improve forecast models.

THREE-YEAR SCIENCE REVIEW



In March and April, the NZARI International Science Panel undertook a review of the first three years of NZARI. Recognising that NZARI was established only three years ago, the review focused on preliminary performance of the programme and whether the programme was on track to achieve the original goals and objectives of the organisation.

The full review is available at <http://nzari.aq/about-nzari/publications> and the summary of findings from the report is reproduced below.

Abstract

The science portfolio of the New Zealand Antarctic Research Institute is reviewed in terms of the focus, depth, and mix of science projects, programs, and activities; contributions to Antarctic and global science; international partnerships and cooperation; position in New Zealand and international Antarctic science; galvanizing the New Zealand Antarctic community; and fidelity of actions to the organisation's vision, mission, and goals. Recognising that NZARI was established three years ago, the review focuses on preliminary performance assessments and future strategic directions.

Summary

In its first three years, NZARI has made very good progress toward addressing its mission, vision and scientific goals. Major milestones include securing five years of

core funding by the Aotearoa Foundation; establishment of NZARI as a Charity including a Trust Deed, a Board of Trustees and an International Science Panel of advisors; appointment of the inaugural Director; development of a robust and fair procedure for solicitation, peer review and selection of projects and programs based on international standards of excellence; co-location of offices with Antarctica New Zealand; appointment of a Research Advisor; award of 20 short-term projects and one longer-term program via four Requests for Proposals (RFPs); two major programs under development at Cape Adare and the Subantarctic Auckland Islands; a series of community building activities including workshops, symposia, quarterly newsletters and visits by the Director; several major NZARI-led initiatives including a National Science Challenge; and refinement and clarification of the relationship with Antarctica New Zealand. A diverse scientific portfolio of projects, programs and other activities has been assembled, building on New Zealand's strengths in Antarctic science, leveraging resources and assets through international partnerships and addressing current Antarctic scientific questions of high priority. It is too early to conclusively judge the quality and impact of NZARI's scientific outcomes. The current status of NZARI exceeds expectations in most instances and the trajectory of NZARI is promising.



NZARI Winter school attendees © Antarctica New Zealand Pictorial Collection

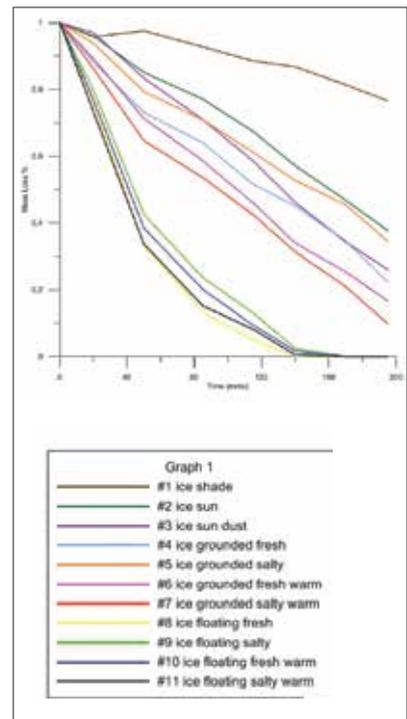
WINTER SCHOOL



Jamie Morton, Science Reporter at The New Zealand Herald and NZARI Director Gary Wilson reviewing an ice experiment. Photo by Krystie Hedley © Antarctica New Zealand Pictorial Collection

On the 16 and 17 May 2015, NZARI hosted its first Winter School under the theme of “What Does it Take to Melt an Ice Sheet?” at the scenic Lake Ohau Lodge. 17,000 years ago, Lake Ohau was a glacier, making this the perfect setting to understand how quickly ice can retreat and the influences that precipitated the retreat. The 25 participants represented stakeholders, media representatives, and policy advisors. Through a mix of presentations and hands-on science experiments, participants gained a deeper understanding of scientific discoveries and how to translate those insights for a broader non-specialist audience.

Right: Graph of the ice melt profiles from the Winter School experiments demonstrating that ice in contact with water melts at a much more rapid rate than ice on land. Additionally, floating ice melts more rapidly than grounded ice. Our conclusion is that floating ice shelves are very vulnerable to warming.



NEW ZEALAND – REPUBLIC OF KOREA COLLABORATION

In January 2015, together with its partners at the University of Canterbury, NIWA and GNS Science, NZARI was awarded a three-year international scientific collaboration grant through the New Zealand - Republic of Korea Strategic Research Partnership Fund. The New Zealand Government will provide \$450,000 over three years and the Korean Government will provide a matching three year grant to our research partners at the Korea Polar Research Institute (KOPRI).

The programme of collaborative research will investigate the impacts of a warming globe on Antarctica through three strands

of investigation: 1) Ecosystem monitoring in northern Victoria Land; 2) Ice-ocean interaction beneath floating ice shelves and tongues; and 3) Understanding ice sheet and Southern Ocean response to past global warming events.

In our first six months, we held a joint programme planning meeting with colleagues at KOPRI and the paleoclimate teams have already held their first core sampling workshop to investigate climate records from Ross Sea and Southern Ocean sediment cores. We are developing plans for several collaborative field programmes in the 2015/16 Antarctic field season.



Sling load © Jacob Anderson.

NZARI wishes to acknowledge the generous support of the Aotearoa Foundation, its foundation sponsor. The Aotearoa Foundation is a private foundation established by Julian H. Robertson Jr.

The Trust also acknowledges Air New Zealand for providing financial support under a sponsorship arrangement in conjunction with Antarctica New Zealand.



Snow accumulation measurement on the southern McMurdo Ice Shelf using radar. © Michelle Ryan.

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FINANCIAL
STATEMENTS
FOR THE YEAR ENDED
30 JUNE 2015

STATEMENT OF ACCOUNTING POLICIES

Reporting entity

The New Zealand Antarctic Research Institute (NZARI) was established as a charitable trust on 5 March 2012 for the purpose of operating as a virtual, multi-disciplinary research institute dedicated to Antarctic and Southern Ocean research. NZARI is incorporated under the Charitable Trusts Act 1957 and registered as a charitable entity under the Charities Act 2005.

Statement of compliance

The financial statements of NZARI have been prepared in accordance with New Zealand generally accepted accounting practice (NZ GAAP) and other applicable New Zealand Financial Reporting Standards as appropriate for charitable trusts that qualify for and apply differential reporting concessions.

NZARI qualifies for differential reporting on the basis that it does not have public accountability and is not large as defined in the framework for differential reporting. NZARI has taken advantage of all available differential reporting exemptions except for certain disclosure exemptions.

Basis of preparation

The financial statements have been prepared on a historical cost basis. The financial statements are presented in New Zealand dollars unless otherwise stated. The functional currency of NZARI is New Zealand dollars.

These financial statements are for the year from 1 July 2014 to 30 June 2015 and were approved by the Board of Trustees on 29 September 2015.

Interpretations issued that are not yet effective and have not yet been early adopted

Standards, amendments and interpretations issued that are not yet effective and have not been early adopted, and which are relevant to the New Zealand Antarctic Research Institute, include:

- The External Reporting Board has released XRB A1, Accounting Standards Framework (For-profit Entities plus Public Sector Public Benefit Entities plus Not-for-profit Entities Update). This Standard is effective for reporting periods beginning on or after 1 April 2015. The objectives of this Standard are to establish the accounting standards framework for those entities that have a statutory obligation to prepare general purpose financial reports. The New Zealand Antarctic Research Institute is likely to be classified as a Tier 3 entity under the new standards. The New Zealand Antarctic Research Institute has decided not to early adopt this standard and has not yet determined the impact of this transition on the preparation and presentation of the Trust's annual accounts.

Significant accounting policies

The following significant accounting policies have been adopted in preparation and presentation of the financial statements:

a) Revenue

Grants and donations

Grants and donations are the primary source of NZARI's

income and are restricted for the purposes of meeting its objectives as specified in the Trust Deed. Grants and donations are recognised as income in the statement of comprehensive income when they become receivable, unless NZARI has an obligation to repay the grant or donation if the requirements of the grant or donation are not fulfilled. A liability is recognised to the extent that such conditions are unfulfilled at the end of the period.

Interest income

Interest is recognised as income in the statement of comprehensive income as it accrues, using the effective interest rate method.

b) Donated goods and services

Where goods or services are acquired by NZARI for nil or nominal consideration, the fair value of the goods or services is recognised as income in the statement of comprehensive income.

Where the goods or services are utilised in the operations of NZARI, the fair value of the goods or services is recognised as expense in the statement of comprehensive income as if NZARI had paid for them directly.

Donated services are not recognised where they cannot be reliably measured.

c) Cash and cash equivalents

Cash and cash equivalents include deposits held at call with banks and other short term, highly liquid investments, with original maturities of three months or less.

STATEMENT OF ACCOUNTING POLICIES

d) Receivables

Receivables are recognised in the statement of financial position at their nominal value which is considered a reasonable approximation of their fair value due to their short term nature.

e) Accounts payable and accruals

Creditors and other payables are recognised in the statement of financial position at their nominal value which is considered a reasonable approximation of their fair value due to their short term nature.

f) Goods and services tax (GST)

NZARI is registered for GST purposes. All items in the financial statements are stated exclusive of GST except for receivables and payables, which are stated on a GST inclusive basis. Where GST is not recoverable as input tax then it is recognised as part of the related asset or expense.

The net amount of GST recoverable from, or payable to, the Inland Revenue Department (IRD) is included as part of receivables or payables in the statement of financial position.

The net GST paid to, or received from the IRD, including the GST relating to investing and financing activities, is classified as an operating cash flow in the statement of cash flows.

Commitments and contingencies are disclosed exclusive of GST.

g) Income Tax

NZARI is registered as a charitable entity and is exempt from income tax.

h) Financial assets and liabilities

NZARI is party to financial instruments as part of its normal operations. These financial instruments include bank accounts, interest receivable and accounts payable and are shown in the statement of financial position. Income and expenses arising from these financial instruments are recognised in the statement of comprehensive income. Bank account deposits are short term, highly liquid and held with high quality financial institutions. Receivables and payables are short term in nature.

i) Foreign currency

Foreign currency transactions are converted into local currency at the exchange rate on the date of transaction.

j) Judgements, estimates and assumptions

The preparation of financial statements in conformity with NZ GAAP requires judgements, estimates and assumptions that affect the application of policies and reported amounts of assets and liabilities, income and expenses. The estimates and associated assumptions are based on historical experience and various other factors that are believed to be reasonable in the circumstances. Actual results may differ from these estimates.

STATEMENT OF COMPREHENSIVE INCOME FOR THE YEAR ENDED 30 JUNE 2015

38

	Note	2015 NZ\$	2014 NZ\$
Revenue			
Interest income		23,513	21,135
Grants and donations		1,300,000	1,210,814
Donated goods and services	1	193,481	167,933
Total revenue		<u>1,516,994</u>	<u>1,399,882</u>
Expenditure			
Personnel costs		342,202	282,609
Operating expenses	2	837,208	1,217,249
Total expenditure		<u>1,179,410</u>	<u>1,499,858</u>
Net operating surplus/(deficit)		<u>337,584</u>	<u>(99,976)</u>
Other comprehensive income		—	—
Total comprehensive income		<u>337,584</u>	<u>(99,976)</u>

The accompanying notes form part of these financial statements.

STATEMENT OF CHANGES IN EQUITY FOR THE YEAR ENDED 30 JUNE 2015

	Note	2015 NZ\$	2014 NZ\$
Trustees' equity balance at beginning of year		544,355	644,331
Total comprehensive income		337,584	(99,976)
Trustees' equity balance at end of year		<u>881,939</u>	<u>544,355</u>

The accompanying notes form part of these financial statements.

STATEMENT OF FINANCIAL POSITION

AS AT 30 JUNE 2015

	Note	2015 NZ\$	2014 NZ\$
Trustees equity		<u>881,939</u>	<u>544,355</u>
Represented by:			
Current assets			
Cash and cash equivalents	3	820,273	1,087,886
Debtors and other receivables	4	686,464	25,653
Total assets		<u>1,506,737</u>	<u>1,113,539</u>
Current liabilities			
Creditors and other payables	5	624,798	569,184
Total liabilities		<u>624,798</u>	<u>569,184</u>
Net assets		<u>881,939</u>	<u>544,355</u>

The accompanying notes form part of these financial statements.

STATEMENT OF CASH FLOWS

AS AT 30 JUNE 2015

40

	Note	2015 NZ\$	2014 NZ\$
Cash flows from operating activities			
Cash was provided from:			
Grants from Aotearoa Foundation		500,000	1,000,000
Grants from Air New Zealand		150,000	200,000
Grants from Ministry of Business, Innovation & Employment		75,000	—
Other grants and donations		25,000	10,814
Interest received		27,600	23,036
Total receipts		<u>777,600</u>	<u>1,233,850</u>
Cash was applied to:			
Payments to grant recipients		(694,112)	(499,699)
Payments to suppliers		(153,248)	(135,758)
Payments to employees		(188,751)	(165,000)
Goods and services tax (net)		(9,102)	(2,885)
Total payments		<u>(1,045,213)</u>	<u>(803,342)</u>
Net cash from operating activities	6	<u>(267,613)</u>	<u>430,508</u>
Net increase/(decrease) in cash and cash equivalents		(267,613)	430,508
Cash and cash equivalents at the beginning of the year		1,087,886	657,378
Cash and cash equivalents at the end of the year	3	<u>820,273</u>	<u>1,087,886</u>

The accompanying notes form part of these financial statements.

NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS

FOR THE YEAR ENDED 30 JUNE 2015

1. Donated goods and services

Donated services totalling \$193,481 (2014 - \$167,933) have been provided by Antarctica New Zealand.

2. Operating expenses

	Note	2015 NZ\$	2014 NZ\$
Remuneration of auditor (audit fees)		3,475	3,380
Trustees' remuneration	9	34,125	36,000
Research grants		601,762	1,001,188
Science development functions		42,896	47,715
Director's travel		79,067	64,505
Trustees' travel		11,852	14,863
Other operating expenses		64,031	49,598
Total operating expenses		<u>837,208</u>	<u>1,217,249</u>

3. Cash and cash equivalents

	2015 NZ\$	2014 NZ\$
Cash at bank	520,273	587,886
Cash equivalents - term deposits	300,000	500,000
Total cash and cash equivalents	<u>820,273</u>	<u>1,087,886</u>

4. Debtors and other receivables

	2015 NZ\$	2014 NZ\$
Debtors and other receivables	685,928	21,030
Term deposit interest	536	4,623
Total debtors and other receivables	<u>686,464</u>	<u>25,653</u>

5. Creditors and other payables

	2015 NZ\$	2014 NZ\$
Creditors	374,596	67,195
Accrued expenses	250,202	501,989
Total creditors and other payables	<u>624,798</u>	<u>569,184</u>

NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS

FOR THE YEAR ENDED 30 JUNE 2015

42

6. Reconciliation of net surplus to net cash from operating activities

	2015 NZ\$	2014 NZ\$
Net operating surplus/(deficit)	337,584	(99,976)
Add/(less) non-cash items		
Donated goods and services - received	(193,481)	(167,933)
Donated goods and services - expended	<u>193,481</u>	<u>167,933</u>
Total non-cash items	—	—
Add/(less) movements in working capital		
Debtors and other receivables	(660,811)	(7,955)
Creditors and other payables	<u>55,614</u>	<u>538,439</u>
Net movements in working capital	(605,197)	530,484
Net cash from operating activities	<u>(267,613)</u>	<u>430,508</u>

7. Post balance date events

No post balance date events have come to the attention of NZARI that are of a material nature as to require adjustment of the amounts contained in the financial statements or separate note disclosure.

8. Related party transactions and key management personnel

There were no related party transactions between NZARI and its Trustees or any other party.

	2015 NZ\$	2014 NZ\$
Key management personnel compensation		
Trustees' fees	34,125	36,000
Director's salary	175,000	175,000
Total key management personnel compensation	<u>209,125</u>	<u>211,000</u>

Key management personnel are the Members of the Board of Trustees and the Director.

9. Trustees' remuneration

Members of the Board of Trustees earned the following fees during the year

	2015 NZ\$	2014 NZ\$
Mr Rob Fenwick (Chair)	8,000	12,000
Mr Phillip Melchior (Acting Chair)	8,000	—
Professor Mahlon Kennicutt II	6,000	6,000
Professor Mary O'Kane	6,125	6,000
Sir David Skegg	6,000	6,000
Mr Craig Heatley	—	6,000
Total Trustees' remuneration	<u>34,125</u>	<u>36,000</u>

No Trustees received compensation or other benefits in relation to cessation (2014 - nil).

NOTES TO AND FORMING PART OF THE FINANCIAL STATEMENTS

FOR THE YEAR ENDED 30 JUNE 2015

10. Contingent assets and liabilities and commitments

NZARI entered into a signed agreement with Aotearoa Foundation on 7 October 2011 in which the Foundation agreed to grant a total of \$5,180,000 to NZARI over five years to support NZARI's establishment and operation. The grant is subject to the achievement of agreed milestones and receipt of six-monthly reports. At 30 June 2015, \$2,500,000 (2013 - \$3,500,000) is yet to be received subject to achievement of these milestones.

There are no contingent liabilities, nor are there any commitments as at 30 June 2015 (2014 - nil).

Independent Auditor's Report

To the readers of the New Zealand Antarctic Research Institute's financial statements for the year ended 30 June 2015

The Auditor-General has agreed to be the auditor of the New Zealand Antarctic Research Institute (the Institute) pursuant to section 19 of the Public Audit Act 2001. The Auditor-General has appointed me, John Mackey, using the staff and resources of Audit New Zealand, to carry out the audit of the financial statements of the Institute on her behalf.

We have audited the financial statements of the Institute on pages 36 to 43, that comprise the statement of financial position as at 30 June 2015, the statement of comprehensive income, statement of changes in equity and statement of cash flows for the year ended on that date and the notes to the financial statements that include accounting policies and other explanatory information.

Opinion

In our opinion, the financial statements of the Trust on pages 36 to 43:

- comply with generally accepted accounting practice in New Zealand; and
- fairly reflect the Institute's:
 - financial position as at 30 June 2015; and
 - financial performance and cash flows for the year ended on that date.

Our audit was completed on 29 September 2015. This is the date at which our opinion is expressed.

The basis of our opinion is explained below. In addition, we outline the responsibilities of the Trustees and our responsibilities, and we explain our independence.

Basis of opinion

We carried out our audit in accordance with the Auditor-General's Auditing Standards, which incorporate the International Standards on Auditing (New Zealand). Those standards require that we comply with ethical requirements and plan and carry out our audit to obtain reasonable assurance about whether the financial statements are free from material misstatement.

Material misstatements are differences or omissions of amounts and disclosures that, in our judgement, are likely to influence readers' overall understanding of the financial statements. If we had found material misstatements that were not corrected, we would have referred to them in our opinion.

An audit involves carrying out procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on our judgement, including our assessment of risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, we consider internal control relevant to the preparation of the Institute's financial statements that fairly reflect the matters to which they relate. We consider internal control in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the Institute's internal control.

An audit also involves evaluating:

- the appropriateness of accounting policies used and whether they have been consistently applied;
- the reasonableness of the significant accounting estimates and judgements made by the Trustees;
- the adequacy of all disclosures in the financial statements; and
- the overall presentation of the financial statements.

We did not examine every transaction, nor do we guarantee complete accuracy of the financial statements. Also we did not evaluate the security and controls over the electronic publication of the financial statements.

We have obtained all the information and explanations we have required and we believe we have obtained sufficient and appropriate audit evidence to provide a basis for our audit opinion.

Responsibilities of the Trustees

The Trustees are responsible for preparing financial statements that:

- comply with generally accepted accounting practice in New Zealand; and
- fairly reflect the Institute's financial position, financial performance and cash flows.

The Trustees are also responsible for such internal control as they determine is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error. The Trustees are also responsible for the publication of the financial statements, whether in printed or electronic form.

The Trustees' responsibilities arise from clause 22 of the second schedule of the Trust Deed.

Responsibilities of the Auditor

The Auditor-General has agreed to be the auditor of the Institute pursuant to section 19 of the Public Audit Act 2001 and accordingly, under section 15 of that Act and clause 23 of the second schedule of the Trust Deed we are responsible for expressing an independent opinion on the financial statements and reporting that opinion to you based on our audit.

When carrying out the audit, we followed the Independence requirements of the Auditor-General, which incorporate the independence requirements of the External Reporting Board.

Other than the audit, we have no relationship with or interests in the Institute.



John Mackey
Audit New Zealand
On behalf of the Auditor-General Christchurch,
New Zealand

DIRECTORY

Trustees

Mr Rob Fenwick CNZM (Chair)

Phillip Melchior
(Interim Chair, November 2014- July 2015)

Professor Mahlon C Kennicutt II

Professor Mary O’Kane

Sir David Skegg KNZM, OBE, FRSNZ

Director

Professor Gary Wilson

Deputy Directors

Professor Craig Cary

Dr Vonda Cummings

Research Advisor

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Audit New Zealand

Solicitors

Chapman Tripp

Bankers

Westpac Banking Corporation

Website

www.nzari.aq

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NZARI Invited Visitors: Hans Weise *National Geographic Magazine*, NZARI Director Gary Wilson, Shelley Campbell Chief Executive The Sir Peter Blake Trust and Research Advisor Nicole Stahlmann in front of Shackleton's Nimrod Hut at Cape Royds © Mark Deaker.



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