
NIWA
EXCELLENCE
AWARDS 2016
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NIWA 2017 EXCELLENCE AWARDS

Our annual NIWA Excellence Awards – announced during the NIWA Leaders' Forum each year – celebrate the achievements of staff who have made an extraordinary contribution. Staff are nominated by their peers, and finalists are then selected by a representative panel of staff, for ratification by the Executive Team.

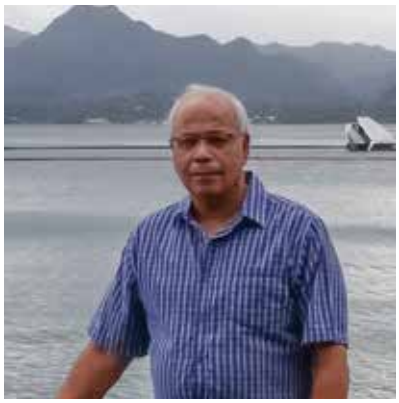
NIWA Excellence Awards 2016. Dave Allen

The NIWA Excellence Award

NIWA EXCELLENCE AWARDS WINNERS

Murray Hicks
Research Excellence

Murray is a world-renowned expert on braided rivers, and is recognised as New Zealand's leading fluvial geomorphologist. He has made an outstanding contribution to the advancement of knowledge in sediment transport and related geomorphic processes in river and coastal environments. With UK colleagues, he pioneered the use of aerial digital photogrammetry and LiDAR to capture channel topography and morphological change, which has transformed international understanding of dynamics in large gravel-bed rivers. His text, 'Roughness Characteristics of New Zealand Rivers', is a fundamental reference globally.



Ude Shankar
Applied Science

Shankar has redefined the freshwater management landscape since the launch of his creation, a digital river network (DRN), which digitally represents all our creeks, streams and rivers and identifies the route that a drop of water falling anywhere in New Zealand will follow to the sea. The DRN is the basis of New Zealand's most important water management tools, and Shankar's work is enabling researchers throughout New Zealand to simulate and better understand flows, ecosystem health, fish habitat, and morphological changes, for example, which the DRN underpins.

Leigh Tait
Early Career Science

Leigh has demonstrated insight, innovation and achievement in research and consulting in marine ecology, ecophysiology, environmental monitoring and assessment, and biosecurity. His PhD thesis examined the dynamics of light use by marine habitat-forming algae, and he developed and built innovative photo-respirometry chambers that are now used worldwide in research on shallow-coast ecosystems. His work is at the cutting edge internationally in understanding fundamental mechanisms that determine responses of important biogenic habitat to the changing quantity and quality of light in coastal waters.

Sylvia Nichol
Science Communication

Sylvia has engaged scientists and the public for more than 40 years, promoting meteorology, atmospheric science and science in general at all ages and levels. She facilitates communication of atmospheric science through NIWA's Climate and Atmosphere National Centres, the Meteorological Society of New Zealand and the TROPAC group. She has been the NIWA representative of the organising committee for the Wellington Regional Science Fair for the past 19 years and contributed substantially to the fair's continued success.

Julian Orange
Leadership

Julian has successfully delivered Office 365 OneDrive to NIWA staff, launching NIWA's most significant service yet to be hosted in the cloud. At the same time, he succeeded in his first team management role, leading the formation of the new Knowledge Resource Management Group. He was pivotal in guiding the architecture of the SharePoint solution and took the lead in solving the numerous technical challenges presented. Most staff are now using a cloud-based Office 365 and OneDrive and benefiting from the increased productivity.

Kimberley Seaward
Project Delivery

Kimberley's consistent performance is integral to the successful delivery of numerous NIWA research and applied science projects. Her quiet strength of character, modesty, unflappable demeanour, consistent delivery of any task on time, to scope, within budget, and with her ever-present good humour, symbolise excellence in project delivery. Her performance provides the foundation for NIWA's marine biosecurity team's very positive relationship with its key customer, and has helped build its respect internationally.

Keith Michael
Customer Focus

Keith demonstrated exceptional customer focus while taking on several significant challenges. These included the second of two challenging inshore surveys of fish stocks in the United Arab Emirates, and urgent work to assess the infection of South Island oyster populations by the parasite *Bonamia ostreae*. He provided the science leadership MPI needed to monitor and help deal with responses to the outbreak, and fronted the first public meeting in Bluff after the infection was confirmed to outline the science behind the disease and potential responses.

Steve de Lima
Operational Innovation

Steve has developed and supported key software packages that have revolutionised our capabilities in hydroclimate and irrigation monitoring, including his 'Starlogger' programming software to programme data loggers, and applications that are essential for NIWA's multi-million dollar hydroclimate and irrigation business. He was instrumental in hydroclimate software solutions which have been deployed across New Zealand and the Pacific, and his software is key to NIWA's Internet of Things automated data collection.

Kim Goetz
Operational Innovation

Kim has been extremely effective in undertaking and expanding cetacean research at NIWA, demonstrating excellence in planning, execution and science communication. She has established passive acoustic monitoring of cetaceans as a new area of science for NIWA and New Zealand, and gained support for investment in research and equipment in this area. She has formed particularly effective working relationships with DOC, MPI, the oil and gas industry and the leading cetacean research groups in New Zealand.

Phil Fisher
Support Services

Phil provides outstanding leadership and support as Site Services Manager in Wellington. His solution-oriented approach, 'can do' attitude, and 24/7 response to site issues and remedial action define him as a cornerstone for the smooth operation and success of the Wellington region. He has managed a significant programme of capital works and regular maintenance, and responded magnificently to the November earthquake, taking considerable ownership of the site, its integrity and safety.

Crispin Middleton
Health and Safety Champion

As NIWA's National Dive Manager, Crispin worked closely with WorkSafe to ensure NIWA can meet all its obligations for training and safe diving work practices. He re-wrote the scientific diver training standards to enable NIWA and others in the sector to meet the Australia/New Zealand scientific diving standards. Crispin has developed an exceptional health and safety culture in the dive team, ensuring that we operate at the highest level of safety at all times.

Pacific Hydroclimate Team
Team Excellence

The hydroclimate instrumentation and deployment team has been a fundamental reason NIWA has had so much success in the Pacific region over the last decade. The team have been integral to the delivery of more than $4.0 million worth of contracts in the Pacific in the last year alone. This has been done under considerable pressure, with multiple conflicting deadlines, travel to demanding and remote locations, and frequent overseas travel with short turn-around time.

The team provides the foundations for all NIWA's substantial work programme on climate services and early warning in the Pacific region, resulting in NIWA being considered the primary partner in this area for Pacific Island Meteorological Services.

Andrew Harper

Barry Waugh

Jeremy Rutherford

Mark Crump

Marty Flanagan

Stuart Escott

NIWA Special Achievement Award Winners

Bob Newlands
Lifetime Achievement Award

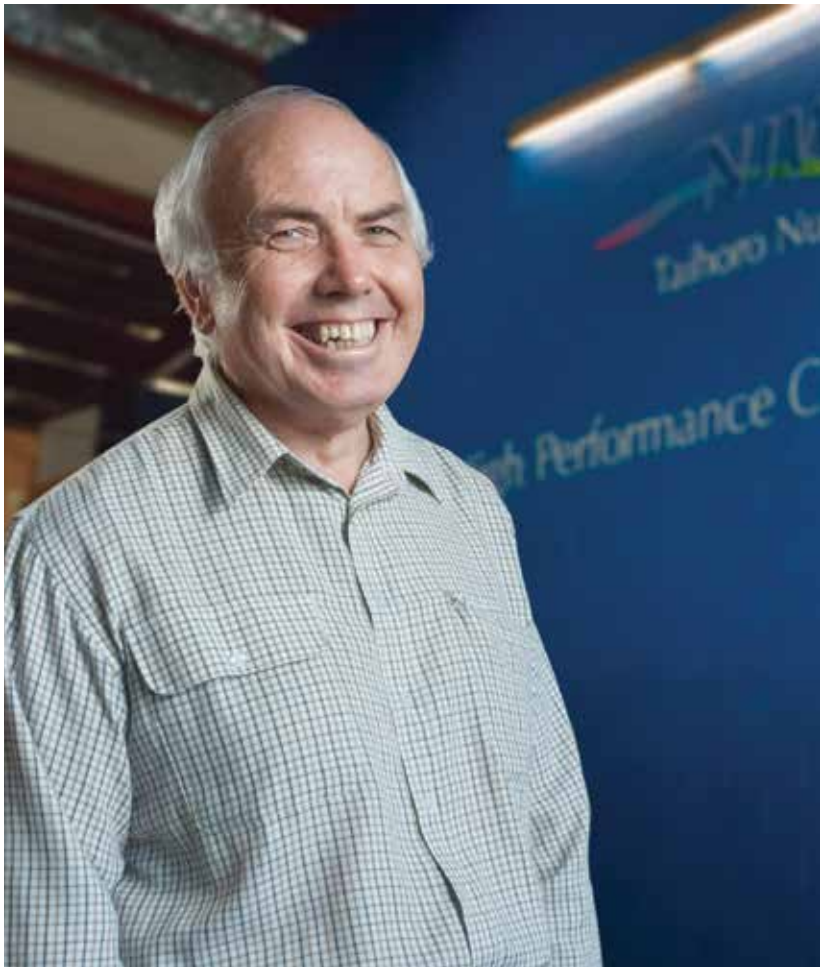
Bob is NIWA's pre-eminent specialist meteorological field technician, with more than 48 years of experience (with New Zealand Meteorological Service since January 1969 and NIWA from 1992) in the design, supply and maintenance of NIWA's meteorological station network. His work is nationwide and extends into the Pacific Islands.

Bob designs meteorological stations for specialist projects and data gathering, selects the optimal sites for data collection, installs the equipment and maintains it to ensure the data are of the highest standard and meet World Meteorological Organization protocols. The work involves management of other field team personnel, and he is a fine team leader.

His work entails forging close relationships with clients and landowners, NIWA and visiting scientists, government departments, local and regional councils and private companies, and he is well-respected by all his customers and collaborators.

Bryce Cooper
Extraordinary Achievement Award

NIWA science has been crucial in informing national and regional policy and debate on freshwater – and Bryce played the lead role in this. This has included the development of the technical report for the Prime Minister's Chief Science Advisor's Freshwater Report, with Sir Peter Gluckman acknowledging "the extraordinary amount of work done by Dr Bryce Cooper and his team", and the preparation of a technical background report to inform submitters on the Ministry for the Environment's Clean Water Swimmability Proposals for Rivers. He led NIWA's negotiations with the University of Waikato for the creation of *Te Waiora, Joint Institute for Freshwater Management,* and has continued work in relation to his former role as Chair of the Technical Leaders Group for the Waikato Regional Council's Healthy Rivers: Plan for Change/Wai Ora: He Rautaki Whakapaipai project.



Michael Uddstrom
Extraordinary Achievement Award

Michael has made an outstanding contribution and displayed impressive leadership in the procurement of NIWA's new high-performance computers. He led the entire procurement process from concept to contract, and his approach, clarity of thought and expression, leadership and attention to detail was exceptional throughout. He brought together the purchasing team made up from six organisations, and his pre-procurement planning was outstanding.

Michael identified every supplier in an exclusive international market and engaged with them individually to seek their interest and capability before drafting the RFP. He led the writing of the specification for the 130-page RFP, and responded to all supplier and stakeholder enquiries promptly, professionally and politely.

Michael worked tirelessly to develop the purchase contract, and succeeded in getting a $25 million contract over the line, on time and within budget to provide an extraordinary high-performance computing facility for the nation.

NIWA 2017 PHOTOGRAPHY AWARD WINNERS

This year's NIWA staff photographic competition was marked by a record number of entries from staff all over the country.

More than 300 stunning images were looked at by judges Gerry le Roux from Science Lens, Ross Giblin of Fairfax Media and NIWA photographer Dave Allen.

They admired the sense of scale, the detail and ability of entrants to capture New Zealand's stunning landscape through a variety of techniques.

For the first time this year the prize money for the People's Choice Award, voted via social media, will be donated to charity.

And now the competition is over for another year, many of the photographs entered, will feature on the NIWA website, our calendar, our magazine *Water & Atmosphere* and a wide range of other publications.

Freshwater

Jo Bind
Fox River, West Coast

A short road trip down the West Coast of the South Island provided the opportunity for what the judges said was "beautifully captured river movement".

Jo said it was hard not to think of Tolkein's Middle Earth in a landscape as primal as this. "To me this is a picture of contrasts – the softness created by the movement of the water contrasted against the sharp structure of the rocks. The intense colour of the water, contrasted against an almost monochrome scene; the vertical walls against the horizontal river bed."

Our Places

Hamish Sutton
Ivory Glacier, Westland

It was late afternoon during a tramping trip with colleague Pieter Havelaar when Hamish Sutton took this photograph. “Pieter had always wanted to go to Ivory Lake, which is notoriously difficult to access. It is at least three days from the road’s end, with three gorges to traverse and a difficult boulder-bashing section that sees many tramping parties turn back.”

He adds that the hut was built by the former Ministry of Works to conduct research on the glacier, and the walls are full of the names of past NIWA employees who worked there.

The judges loved the tones and muted colour of the shot, and said it gives a wonderful sense of place and character.

Our People

Jo Bind
Jules's Kayak, Banks Peninsula

Julian Sykes kayaked a good 20 kilometres on a tight schedule the day this photo was taken. He and Jo were surveying the estuary at Le Bons Bay, depth-sounding using kayaks because most of the area is too shallow for motorised boats.

"I really like this photograph as it is an unusual environmental portrait of someone I work with a lot in the field."

The judges agreed. They said there was great use of lighting and isolation of the subject, nice energy and movement and great use of the environment to anchor the subject.

People's Choice

Shannan Crow
Lindon stars and cars, Porters Pass

Shannan Crow spent a lot of time sitting and waiting to get his shot.

"I went out specifically to capture this shot. I needed a nice clear night when a new moon was happening, otherwise it would have been too bright to capture all the details in the sky."

Crow says the Milky Way was always going to be the main subject but he wanted something interesting in the foreground. "So I made a plan to get there early in the evening to capture some car lights and then I just sat and waited for the sky to get darker. It took quite a few attempts before I finally got this shot."

The judges loved the detail and the sense of scale, calling it "majestic".

Special Award

Crispin Middleton
Madonna Squid

The judges said this photo was a perfectly beautiful and simple looking image that they are sure was anything but simple to take. They loved the subtle, translucent detail and said the squid triptych looked like ballet dancers in formation.

Crispin took the shot while diving close to the Poor Knights Marine Reserve and says the squid was the ideal size for his macro lens.

"Despite the squid being only about 10–15mm long, my wife spotted it from the boat as we were driving along the coast of the Poor Knights. By the time we anchored I was sure it would have made a getaway but as soon as I backward rolled into the water, the little thing was right there in front of me posing for photographs. I wish more marine critters would behave like this!"

Our Work

Jennifer Beaumont
Brittlestar Anemone, Japan

It was the “beautiful detail” and the organism in the centre breaking the pattern that initially drew the judges to this image. They loved the repeating semi-circular pattern and said the limited colour palette of muted yellow, grey and black complemented the detail.

Jenny took the image while snorkelling on a reef at the Sesoko Marine Station at Okinawa in Japan. She says she loved the pattern made by the anemone’s tentacles. “I thought the brittle star hiding inside added interest and context.”

BOARD OF DIRECTORS

Prof. Keith Hunter

Keith was Pro-Vice-Chancellor of Sciences at the University of Otago between 2010 and 2016. Before that, he was Head of the Department of Chemistry. He retired at the beginning of 2017 and currently holds a part-time position in Chemistry. A graduate of the University of Auckland, Keith joined the department at Otago in August 1979 after five years of PhD and postdoctoral study in Britain and France. His research speciality is chemical oceanography and he is one of New Zealand's delegates to the UN's Scientific Committee on Oceanic Research.

Prof. Gillian Lewis

Gillian is a Professor of Microbiology and with the Faculty of Science at the University of Auckland. She was formerly Associate Dean of Research and Head of the School of Biological Sciences. She is University Proctor and has several leadership roles including with the Joint Graduate Schools between the Faculty of Science and CRIs or other research organisations. Gillian is a former President of the New Zealand Microbiological Society. She has a PhD in Microbiology from the University of Otago. Her research focuses on the interactions of complex microbial communities and their response to natural and anthropogenic impacts in freshwater environments.

Nick Main
Deputy Chairman

Nick is a Chartered Accountant and was CEO and later Chairman of Deloitte in New Zealand. More recently, he was Deloitte's Global Managing Partner of Sustainability and Climate Change Services and Global Chief Sustainability Officer, based in London. He has also served as Deloitte's Global Chief Ethics Officer. Nick currently chairs the Middlemore Foundation for Health Innovation, chairs the Westpac New Zealand Sustainable Business External Advisory Panel, is a member of the Westpac Australia Stakeholder Advisory Council and a trustee of the Sir Peter Blake Trust.

John Morgan
Chief Executive

John joined NIWA as CEO in April 2007. He has extensive senior executive and governance experience in public and private sector organisations covering a range of markets and activities including business, science, education and sport. His science sector roles have included Chairman of Science New Zealand, CEO of AgriQuality Ltd, Executive Director of Orica New Zealand Ltd, and Chairman of New Zealand Pharmaceuticals Ltd. John is passionate about the role science can play in transforming New Zealand's economy, environment, society and global reputation.

Inshore fishing vessel, Cook Strait.

Dave Allen

Sir Christopher Mace KNZM
Chairman

Sir Chris is an Auckland-based company director. He undertook establishment of the Crown Research Institute ESR in the early 1990s and continued as Chairman until 1999, and undertook establishment of Antarctica New Zealand in 1995, continuing as Chairman through until 2003. He remained as an independent trustee of the Antarctic Heritage Trust through until 2016. Sir Chris was a founding trustee and is a life member of the Sir Peter Blake Trust and is a Commissioner of the Tertiary Education Commission. In 2011 he was named Māori Business Leader of the Year and admitted to the New Zealand Business Hall of Fame in 2015.

Sir Chris was awarded a CNZM for services to Antarctica and the community and in June 2016 was honoured with a Knight Companion of the New Zealand Order of Merit for services to science and education. He was appointed Chairman of NIWA in July 2009.

Dr Helen Anderson

Helen chairs the BRANZ board and is an independent director of DairyNZ, Antarctica NZ and Lincoln Hub Ltd. She is Pro-Chancellor of Massey University and is a member of the National Council of the Institute of Directors. She was Chief Executive of the Ministry of Research, Science and Technology for six years, preceded by six years as Chief Science Adviser. Helen chairs or is a member of advisory boards for DIA, MBIE, NZ Police and ClearPoint Ltd. She has a PhD in geophysics from Cambridge University and enjoys keeping up-to-date with the latest science developments.

Jason Shoebridge

Jason is CEO of Kantar Insight New Zealand, who operate the market research agencies Colmar Brunton and Kantar TNS New Zealand. He has led consulting assignments across a range of industries and disciplines in New Zealand and overseas. Before his consulting career, Jason held a number of senior commercial and financial management posts, both internationally and in New Zealand, in large corporates and with an international chartered accounting firm. Jason is also Deputy Chairperson of Sport New Zealand.

Mike Pohio

Mike is a Hamilton-based director. Mike currently holds directorships on the boards of Panuku Development Auckland, Kiwirail, OSPRI and Te Atiawa Iwi Holdings. He is also Chairman of BNZ Partners, Waikato Region. He was the CEO of Tainui Group Holdings from 2006 to 2015. Mike holds an MBA from IMD, Lausanne and an FCA from the Chartered Accountants Australia & New Zealand.

EXECUTIVE TEAM

John Morgan
Chief Executive

John joined NIWA as CEO in April 2007. He has extensive senior executive and governance experience in public and private sector organisations covering a range of markets and activities including business, science, education and sport. His science sector roles have included Chairman of Science New Zealand, CEO of AgriQuality Ltd, Executive Director of Orica New Zealand Ltd, and Chairman of New Zealand Pharmaceuticals Ltd. John is passionate about the role science can play in transforming New Zealand's economy, environment, society and global reputation.

Patrick Baker
Chief Financial Officer

MEng, Brunel University, London; BBus (Accounting and Management), GDip (Professional Accounting), Open Polytechnic of New Zealand; CA

Patrick is a Chartered Accountant. He began his career as an engineer with Ford Motor Company in the UK before moving into financial management. He served in senior country finance management positions in Europe and the Middle East before joining Ford New Zealand in 2004. After choosing to settle permanently in New Zealand in 2012, he was appointed CFO of The Network for Learning Limited, a Crown company established to deliver managed internet services to New Zealand's schools. He joined NIWA as CFO and Company Secretary in May 2014.

Dr Rob Murdoch
General Manager, Research

PhD (Marine Science), University of Otago

Rob has a specialist interest in oceanography and marine ecology, and has been a practising scientist on projects associated with the Southern Ocean, aquaculture, oil and gas exploration and marine conservation. He has overseen the planning and direction of NIWA's science and the operation of the research vessels since 1999, and helps manage NIWA's relationships with key stakeholders and collaborators.

Dr Mary-Anne Dehar
General Manager, Human Resources, Information Technology

PhD (Psychology), PGDipPsych (Comm), University of Waikato

Mary-Anne is a registered psychologist, specialising in industrial/organisational psychology. Before joining NIWA in 2008, she practised as a consultant psychologist for 15 years, both in private practice and for several large consulting firms. Prior to that she worked in evaluation research with a range of community, justice, public health and health promotion programmes. Mary-Anne has extensive experience in psychological assessment, learning and development, executive coaching, leadership development, and organisational change and performance improvement initiatives.

Geoff Baird
General Manager,
Communications & Marketing

BSc Hons (Ecology), Victoria University of Wellington

Geoff has extensive experience in science publishing and communication from working with the Ministry of Agriculture and Fisheries, MAF Fisheries and NIWA. He became NIWA's Communications Manager in 2003 and General Manager, Communications and Marketing in July 2007, with a focus on reinforcing the values underlying the NIWA brand, enhancing communication and uptake of NIWA's science, and demonstrating how NIWA enhances the benefits of New Zealand's natural resources.

Dr Barry Biggs
General Manager, Operations

BSc Hons (Botany and Geology), Victoria University of Wellington; PhD (Stream Ecology), University of Canterbury

Barry is an environmental scientist with 40 years' research and commercial science experience, having specialised in the assessment of the effects of changes in land use and flows on river ecosystems, particularly on algal periphyton and instream plant growth. He has been extensively involved with planning and running some of New Zealand's largest RMA consenting projects. He was NIWA's Christchurch Regional Manager for three-and-a-half years, Chief Scientist of Environmental Information and Pacific Rim for three years, and has been General Manager, Operations since July 2008.

Dr Bryce Cooper
General Manager, Strategy

PhD (Microbiology), University of Waikato

Bryce is a graduate of the London Business School Senior Executive Programme. He has held research leader and regional manager roles in NIWA, and currently oversees NIWA's strategy development, including initiatives to transfer research to end users and the building of partnerships with businesses and central and local government.

Antarctica.
Rob Murdoch

SCIENCE MANAGEMENT TEAM

Andrew Forsythe
Chief Scientist, Aquaculture

DVM, University of Prince Edward Island

Andrew joined NIWA in 2005, bringing with him more than 20 years' experience in the North American and European aquaculture industries. He has extensive expertise in the design and operation of recirculating aquaculture systems, has provided ambulatory veterinary services for commercial and enhancement aquaculture in western Canada, and has managed freshwater production for a major salmon farming company. Andrew took up his current role as NIWA's Chief Scientist, Aquaculture, in 2007.

Dr Sam Dean
Chief Scientist, Climate and Atmosphere, Natural Hazards

PhD (Physics), University of Canterbury

Sam began his research career with a postdoc in the Atmospheric, Oceanic and Planetary Physics Department at the University of Oxford (UK), before he joined NIWA in 2006. He is an expert on the use of climate models to understand the drivers of climate variability in New Zealand and Antarctica, and, in particular, human-induced climate change. His research has been able to identify the contribution of human-induced warming to intensifying New Zealand weather extremes, including droughts and floods. He is part of a team investigating the interactions between Antarctic sea ice, atmospheric circulation and the Southern Ocean. He commenced his current management role in 2015.

Dr Barb Hayden
Chief Scientist, Coasts and Oceans

PhD (Marine Biology), University of Otago

Barb has a research background in marine biosecurity and the environmental sustainability of aquaculture. Today she leads NIWA's coasts and oceans research, which focuses on ecosystem-based approaches to managing activities in New Zealand's marine estate, so that economic and social benefits are realised while vulnerable components of the ecosystem are protected.

Dr Jochen Schmidt
Chief Scientist, Environmental Information

PhD (Geography), University of Bonn

Jochen has a background in hydrology, geomorphology, soil science, geo-informatics, and hazards and risk assessment. He worked for Landcare Research from 2001 to 2003, where he was instrumental in developing the New Zealand Digital Soil Map ('SMAP'). He joined NIWA in 2003 and coordinates systems for collecting, managing and delivering environmental information – ensuring they are robust and meet best-practice standards. Jochen leads NIWA's engagement with the primary sector.

Dr Rosemary Hurst
Chief Scientist, Fisheries

PhD (Zoology), Victoria University of Wellington

Rosemary has worked in fisheries research in New Zealand since 1979. She is a specialist in middle-depth and inshore fisheries resource surveys and stock assessment and has also conducted research on fish communities, ocean climate effects on fisheries, and trawl catchability and selectivity. She was a regional manager at NIWA Wellington for eight years and has been in her current role since 2010.

Dr John Quinn
Chief Scientist, Freshwater and Estuaries

PhD (Biotechnology/River water quality), Massey University

John has worked in freshwater research and management in New Zealand since 1980. He is a river ecologist with expertise in land-water interactions, riparian management, water quality, and invertebrate ecology. He has led NIWA's research in aquatic restoration for over a decade and took up his current role in 2015.

Dr Scott Larned
Manager – Freshwater Research

PhD (Ecology and Evolution), University of Hawai'i

Scott has carried out environmental research in a wide range of settings, including rivers, temperate and tropical rainforests, coral reefs, estuaries, lakes and aquifers. He is a specialist in nutrient dynamics and algal ecology. At NIWA, Scott has led projects and programmes in water quality, environmental flows, invertebrate and periphyton ecology, and surface water-groundwater science. Scott has been a principal scientist at NIWA since 2008 and is a programme leader in the *Our Land and Water* National Science Challenge.

Dr Mark Bojesen-Trepka
Manager, Marketing and Industry Engagement

BSocSc, MBA, PhD (Marketing and Technology Management), University of Waikato

Mark is an industrial marketer, and has led the marketing, product development, technology-transfer and business-development effort for a number of firms in the plastics, steel and primary sectors. Past roles include National Marketing Manager for BHP Steel Building Products, National Marketing Manager for ICI Resins and Adhesives Division and General Manager for NorthFert.

Rob Christie
Manager, Marine Resources

BSc (Hons) (Environmental Science & Technology), Middlesex University, MCIWEM, CSI

Rob is a chartered scientist with more than 20 years' international experience. He has held senior management positions in environmental consultancy and science sectors in the UK, Australia and New Zealand. Rob joined NIWA in 2013 and manages NIWA's marine resources and the application of NIWA's marine science. He also oversees NIWA's maritime fleet.

Douglas Ramsay
Manager, Pacific Rim

BEng (Civil Engineering), University of Aberdeen; MSc (Water Engineering), University of Strathclyde; MBA, University of Southern Queensland; CEng; MICE; MCIWEM; FRGS

Doug is a chartered engineer. He joined NIWA in 2003, following roles with HR Wallingford in the UK and the Government of Kosrae in the Federated States of Micronesia. He specialises in coastal hazard management and coordinates NIWA's international commercial work, focusing on the Pacific and Asia regions.

Alan Grey
Manager, MBIE Research

MSc Hons I (Geology), University of Canterbury; PGDipSSER, Massey University

Alan has a background in ecology and earth sciences. He has extensive experience in research administration and science and technology programme evaluation. He oversees NIWA's obligations to government funding agencies, responsibilities for undertaking research for the benefit of all New Zealanders, and evaluation of the impact and value of NIWA's research.

Marino Tahi
Manager – Māori Strategy & Engagement

MBA – Massey University, BA; (Māori Resource Management) and BCA (Management and commercial law) – Victoria University of Wellington.

Marino leads the Te Kūwaha National Science Centre, and works across NIWA to maximise the transfer of natural resources and environmental science knowledge to Māori entities and communities. His tribal affiliation is Ngāi Tūhoe, and he comes from Ruatahuna, a small settlement in Te Urewera. He joined NIWA from Landcare Research, where he was the Māori Partnerships Manager – Business Development for nine years. He currently chairs Te Ara Putaiao (TAP), a collective of Māori managers and scientists from across the Crown Research Institutes, mandated by Science New Zealand.

Greg Foothead
General Manager, Vessel Operations

NZCE (Mechanical), Central Institute of Technology

Greg is a certified automotive engineer. Before joining NIWA Vessels as Engineering Manager in 2004, he managed a marine and industrial supply and repair company. He has also worked for Mitsubishi Motors, in various technical roles, in New Zealand, Australia and Europe. Greg has managed NIWA's research vessels *Tangaroa, Kaharoa* and *Ikatere* since December 2010.

Dr Clive Howard-Williams
Chief Science Advisor, Natural Resources

PhD (Ecology), University of London

Clive is an aquatic ecologist with more than 35 years' experience, specialising in freshwater and estuarine water quality and aquatic ecosystem processes. His expertise results from research in a number of countries, from the tropics to the polar regions. He is now focused on the role of science in addressing water management issues and water policy. He is a Fellow of the Royal Society of New Zealand, an Adjunct Professor at the University of Canterbury and holder of the New Zealand Antarctic Medal.

OPERATIONS MANAGEMENT TEAM

Ken Becker
Regional Manager, Auckland

BSc Hons (Marine Biology), University of Liverpool; PGDip (Professional Ethics), University of Auckland

Ken has 36 years' experience in marine science. Before joining NIWA as a regional manager in 2005, he worked for Auckland Regional Council on resource management regulation, planning and policy development in water quality, wastewater treatment, stormwater management and water resource allocation.

Dr Michael Bruce
Assistant Regional Manager, Auckland

PhD (Aquaculture), University of Stirling

Michael's background is in fish nutrition and he has over 25 years' experience in aquaculture research and working with industry. He joined NIWA in 1999 and was appointed Assistant Regional Manager for Auckland in 2011, with operational responsibility for the Northland Marine Research Centre at Bream Bay. As well as a broad range of operational management skills, Michael also leads the Aquaculture Production science programme.

Dr David Roper
Regional Manager, Hamilton

PhD (Marine Science), University of Otago

David has more than 35 years' experience as an environmental scientist working for NIWA and within the power industry. His specialist areas are marine and freshwater ecology, ecotoxicology, environmental impact assessment and resource management. David has been Regional Manager in Hamilton since 2002.

Dr Andrew Laing
Senior Regional Manager, Wellington including Lauder

PhD (Fluid Dynamics), University of Canterbury

Andrew is a marine meteorologist and physical oceanographer with more than 38 years' experience in science research and operational management. He has conducted research at the New Zealand Meteorological Service, in the UK, and at NIWA, and led a research group in NIWA before becoming a full-time regional manager in 2000 and then Senior Regional Manager in 2008. His focus for the last 17 years has been on staff and operations management. He has also represented New Zealand in intergovernmental forums.

Dr Julie Hall
Regional Manager, Wellington

PhD (Aquatic Toxicology), University of Manitoba

Julie is a marine and freshwater biologist who has spent over 20 years working for DSIR and then NIWA, specialising in phytoplankton, microbial food web and zooplankton studies in both marine and freshwater. She chaired an international research programme investigating the impact of global change on marine foodwebs and biogeochemistry. She was a group manager at NIWA in Hamilton before joining the Operations Management Team in Wellington in 2008, where her focus has been on staff, project and operations management. In 2015 Julie was appointed Director of the *Sustainable Seas* National Science Challenge and now divides her time between this position and her role as Regional Manager in Wellington.

Dr Alison MacDiarmid
Regional Manager, Wellington

PhD (Zoology), University of Auckland

Alison specialises in behavioural ecology, with broad interests in coastal reef ecology and management, marine ecosystem risk assessment, closed area management, and historical marine ecology. She leads NIWA's Marine Ecosystem Trophic Structure and Function Programme within the Coasts and Oceans Science Centre. Alison joined the Operations Management Team in 2015 where her focus is on staff, project, and operations management, with particular responsibility for health and safety. She also chairs NIWA's Emergency and Crisis Management Critical Risk Team.

Dr Helen Rouse
Regional Manager, Christchurch

PhD (Physical Geography), University of Hull

Helen trained as a coastal geomorphologist with a PhD from the University of Hull, UK. She has been in New Zealand for over 20 years and, in that time, has worked as a teaching and research fellow at Lincoln University, as Environmental Information Manager at the West Coast Regional Council, and as a national advisor for the Tertiary Education Commission. She joined NIWA in 2007, first as a resource management scientist specialising in the boundary between science and policy, then from 2014 as National Projects Manager. She has been Regional Manager of the Christchurch region since January 2016 and of the Nelson region since April 2017.

Dr Graham Fenwick
Assistant Regional Manager, Christchurch

Dip BA, PhD (Marine Biology), University of Canterbury

Graham has extensive experience in marine benthic ecology and crustacean biodiversity, having worked on diverse projects from sub-Arctic Canada to New Zealand's subantarctic region and Antarctica. Graham continues active work on groundwater biodiversity and ecology in New Zealand, presenting science aimed at enhancing the sustainable use of these very important ecosystems. He joined NIWA in 2002 and brought his blend of science, business and academic experience to the Operations Management Team in 2006.

Charles Pearson
National Manager, Environmental Information Operations

BSc Hons (Statistics), University of Canterbury; MSc Hons (Engineering Hydrology), National University of Ireland

Charles is a hydrologist specialising in the analysis of hydrological and other geophysical and climatological data for purposes such as estimating flood risks. He is also the World Meteorological Organization's Hydrological Adviser for New Zealand. Charles has extensive staff and operations management experience, becoming full-time Regional Manager to Christchurch in 2006. He was appointed to the new position of National Manager, Environmental Information Operations in January 2016.

Dr Helen Neil
National Projects Manager

PhD (Earth Sciences), University of Waikato

Helen is a marine geologist specialising in seabed mapping and the use of stable isotopes in identification of sediment and biological distributions. She has undertaken research in the subtropical and subantarctic oceans surrounding New Zealand and has led or participated in many research voyages. Her expertise has been applied to seabed surveys, telecommunication cables, marine infrastructure, and ocean exploration. Helen led the ocean sediments research group before joining the Operations Management Team in 2016 as the National Projects Manager.

672
NIWA STAFF

598
FULL-TIME EQUIVALENT STAFF

16
NIWA SITES

Cave Stream.
Dave Allen

STATEMENT OF CORE PURPOSE OUTCOMES

NIWA is New Zealand's leading natural resources and environmental science services provider.

Our purpose, set out in our Statement of Core Purpose, is to:

- enhance the economic value and sustainable management of New Zealand's aquatic resources and environments,
- provide understanding of climate and the atmosphere, and
- increase resilience to weather and climate hazards to improve the safety and wellbeing of New Zealanders.

We are expected to fulfil our purpose through the provision of research and transfer of technology and knowledge in partnership with key stakeholders, including industry, government and Māori, to achieve six key outcomes:

1. Increase economic growth through the sustainable management and use of aquatic resources.
2. Grow renewable energy production through developing a greater understanding of renewable aquatic and atmospheric energy resources.
3. Increase the resilience of New Zealand and southwest Pacific Islands to tsunami and weather and climate hazards, including drought, floods and sea-level change.
4. Enable New Zealand to adapt to the impacts and exploit the opportunities of climate variability and change and mitigate changes in atmospheric composition from greenhouse gases and air pollutants.
5. Enhance the stewardship of New Zealand's freshwater and marine ecosystems and biodiversity.
6. Increase understanding of the Antarctic and Southern Ocean climate, cryosphere, oceans and ecosystems and their longer-term impact on New Zealand.

The information in this section of the Annual Report demonstrates how NIWA is delivering on its expected outcomes.

NIWA's research and applied-science services are delivered through our science and sector-focused management units (see over page).

Each centre conducts a wide range of research aimed at enhancing the economic value and sustainable management of New Zealand's aquatic resources and environments, or improving our understanding of climate and the atmosphere and increasing our resilience to related hazards. Much of our work is directly applicable to a wide range of commercial operations.

NIWA'S NATIONAL SCIENCE CENTRES

National Centre for Climate and Atmosphere

Understanding the complex relationship between atmospheric composition and how our climate behaves, and is changing, has never been more important, as extreme weather events linked to climate change make their presence felt. NIWA has been designated by the Government as the lead CRI in research and services relating to the understanding of our climate and atmosphere.

Our work includes:

- quantifying the exchanges of greenhouse gases between atmosphere, ocean and biosphere
- quantifying the relationship between atmospheric composition and climate
- measuring agricultural greenhouse gas emissions
- observing, analysing and documenting the climate of New Zealand, the southwest Pacific, the Southern Ocean and Antarctica
- understanding climate processes and causes
- modelling future climate – from seasons to centuries ahead
- developing options for adapting to climate variability and change.

niwa.co.nz/our-science/climate niwa.co.nz/our-science/atmosphere

National Natural Hazards Centre

New Zealanders need little reminding of how destructive nature can be. NIWA has been designated by the Government as the lead CRI in climate and weather hazards. We work closely with a number of other research agencies through the Natural Hazards Research Platform.

Our work includes:

- determining the frequency and magnitude of natural hazards
- estimating risk
- forecasting hazards by using integrated tools and modelling
- assembling research outcomes into meaningful and helpful outputs for end users.

niwa.co.nz/our-science/natural-hazards

National Aquaculture Centre

NIWA has been designated by the Government as the lead Crown Research Institute (CRI) in aquaculture. We focus on supporting the industry's growth targets, particularly through the development of new high-value species which can be farmed with a low environmental footprint.

Our work includes:

- developing high-performance aquaculture
- assessing and modelling the environmental effects of marine farm operations
- providing advice on designing and managing marine farms, and providing associated training
- conducting research into fish health
- providing breeding services
- conducting feed trials.

niwa.co.nz/our-science/aquaculture

National Centre for Coasts and Oceans

NIWA has been designated by the Government as the lead CRI in aquatic resources and environments (including coastal environments), aquatic biodiversity and biosecurity, and oceans–to provide the knowledge needed to support the sound management of our marine environments and resources. This ensures the vast economic, social and environmental benefits of our extensive marine estate can be realised.

Our work includes:

- oceanography, ocean geology, marine ecology, primary production and microbial processes
- undertaking environmental impact assessments
- determining rates of coastal erosion, and climate change impacts on the coast
- investigating impacts of coastal outfall and discharges
- habitat mapping and swath bathymetry of coastal environments.

niwa.co.nz/our-science/coasts and-oceans

National Centre for Environmental Information

Data which are precise, reliable and consistently comparable are fundamental to every branch of NIWA's science, and vital to many other end users. The centre is recognised as leading environmental monitoring and observation, information management, and the delivery of high-quality, interoperable environmental data which can be used for many purposes.

Our work includes:

- monitoring the environment through our national observation services and networks
- managing the information we acquire
- delivering information in user-focused ways
- acquiring, storing and disseminating metadata – information about how, where, when and by whom environmental information has been collected.

niwa.co.nz/our-science/ei

The Remarkables.
Gregor Macara

National Fisheries Centre

Robust science is critical to the sustainable use of New Zealand's significant marine and freshwater fisheries. NIWA has been designated by the Government as the lead CRI in the delivery of research and services relating to freshwater and marine fisheries.

Our work includes:

- assessing fisheries resources within New Zealand's Exclusive Economic Zone
- monitoring and assessing international fisheries
- determining the environmental impact of fisheries.

niwa.co.nz/our-science/fisheries

National Centre for Freshwater and Estuaries

Meeting increasing and often competing demands for clean water is one of the biggest challenges facing the planet this century. NIWA has been designated by the Government as the lead CRI in aquatic resources and environments (with a focus on surface freshwaters), aquatic biodiversity and biosecurity, freshwater fisheries, and aquatic-based energy resources. We provide public information on river and lake conditions across New Zealand, including water quantity and quality. We also develop and distribute new water-related technology and management tools.

Our work includes:

- monitoring and providing advice on water quality
- catchment modelling
- assessing and managing flow
- advising on the management of freshwater species and habitats
- providing freshwater data online and specialist analytical services.

niwa.co.nz/our-science/freshwater

Te Kūwaha – National Centre for Māori Environmental Research

NIWA's goal is to share knowledge and empower Māori communities and businesses with leading-edge science. We undertake research and provide consultancy services across a number of core science areas, including aquaculture, freshwater, marine, natural hazards, climate and energy.

Our work includes:

- providing environmental research of benefit to Māori through the formation of strong and meaningful partnerships with iwi, hapū and Māori organisations
- collaborating with Māori, other research providers, and central and local government agencies to identify and respond to Māori research priorities
- developing a distinctive body of knowledge at the interface between indigenous knowledge and research, science and technology
- increasing our Māori research capacity and awareness within NIWA of tikanga and te reo Māori.

niwa.co.nz/our-science/te-kūwaha

Pacific Rim

NIWA has a long history of providing applied science and environmental consultancy services to support international development activities, with a particular focus on the Pacific and Asia regions.

Our expertise and capabilities cover a wide range of applied science-based assistance to support the sustainable management of marine and freshwater resources and environments, increasing community and economic resilience to natural hazards, and understanding and adapting to the impacts of climate extremes, variability and change.

niwa.co.nz/our-science/pacific-rim

Vessels

NIWA's vessels are world-class environmental monitoring and research platforms. They enable our marine scientists, specialists from partner research organisations and commercial clients to carry out work where the need for knowledge is greatest – no matter how remote or inhospitable the environment may be.

Tangaroa, our flagship deepwater research vessel, is ice-strengthened and New Zealand's only DP2-equipped vessel. DP2, an advanced dynamic positioning system, enables the vessel to remain stationary or follow a precise path even in strong winds and rough seas. *Tangaroa* is also equipped with a range of sophisticated equipment enabling us to explore from sea surface to seabed and expand our understanding of our unique marine environment and its resources. A wide range of inshore and coastal research is made possible by *Kaharoa, Ikatere* and *Pelorus* to assist in coastal resource management.

niwa.co.nz/our-science/vessels

Increase economic growth through the sustainable management and use of aquatic resources.

Outcome 1

Sustainable and profitable seafood

Seafood exports contribute $1.8 billion to New Zealand's economy each year, and NIWA's scientific expertise has enabled many of New Zealand's fish species to be certified as sustainable, year-on-year, by the global Marine Stewardship Council (MSC).

MSC is the gold standard in fishery certification labels. MSC-certified fisheries have the opportunity to supply markets where environmental credibility plays an important role in purchasing decisions.

New Zealand fisheries with MSC certification include deepwater fisheries for orange roughy, hoki, hake and ling, and the pelagic albacore fishery. Most recently, in December 2016, 60 per cent of the orange roughy catch was certified, across three fisheries – the Challenger Plateau and two on the Chatham Rise.

Quantitative data and science is fundamental to meeting MSC standards. NIWA has been involved in most of the Ministry for Primary Industries science supporting these deepwater fishery certifications – including population modelling, fish ageing and assessing environmental impacts such as trawl footprint, bottom habitat (for example, corals) and trends in fish bycatch species.

MSC certification means New Zealand gets better access to key markets in the US, the UK and Europe, where eco-labelling is essential.

Coupled with New Zealand's internationally recognised Quota Management System, MSC certification is additionally important because it validates New Zealand's management approach to fisheries sustainability and addresses adverse effects of fishing on the environment.

MSC certification sets high standards for fisheries. In every respect, the Marine Stewardship Council is looking for evidence-based fisheries information, assessment and evaluation. NIWA is one of the few organisations in New Zealand able to do that with authority.

Orange roughy.
Neil Bagley

Mussel farm, Marlborough Sounds.
Aquaculture New Zealand

Tool forecasts mussel productivity

NIWA science is enabling New Zealand mussel growers to look into the future and predict the yield from their farms. The Mussel Aquaculture Forecasting Service – a website tool which combines climate and ecology data to forecast mussel productivity – is being used in Pelorus Sound in Marlborough.

The tool provides mussel farmers with information about growing conditions – good, average or bad – improving their ability to plan farm activities and respond to changing conditions.

This includes being able to more accurately determine the best time to harvest, or better understand how climate affects their farm production.

The forecast is updated monthly with data from NIWA's National Climate Centre and predicts mussel yield up to five months into the future. The tool is based on collaborative research with Aquatic Environmental Services and Seafood Innovation Ltd and was developed after NIWA scientists studying mussel meat yield fluctuations observed a relationship between climate and the supply of food for mussels.

The discovery that climate is an important factor affecting production was made after examining a detailed Sealord data set on mussel meat yield in Pelorus Sound. Those data were compared with water quality data collected in a collaboration between industry consortium Marlborough Shellfish Quality Programme and NIWA.

The NIWA website tool started its forecasting service in spring 2016 and has been used by more than 30 mussel growers to date.

Modelling national land-use capacity

NIWA scientists and their collaborators have examined the question of whether it is possible to intensify land use while meeting national water quality standards.

The National Policy Statement for Freshwater Management (NPS-FM) contains some compulsory water quality 'attributes', for which objectives must be set. Two key features are 'national bottom lines' (minimum acceptable states), and a requirement that overall water quality must be maintained or improved.

Scientists looked at how much capacity or 'headroom' for land-use intensification is possible, and where this capacity is located. They took into account how the bottom lines and 'maintain or improve' requirements constrain further contaminant loss from the land, and the creation of headroom by improving current land-use practice.

The analysis considered the current state of lakes, rivers and streams in relation to bottom lines across the country, and the

Rural Canterbury.
Dave Allen

effects of changes in contaminant loading (from land-use change, intensification or mitigation) on water quality, both locally and downstream.

The study found that the (then current) *E. coli* guidelines for primary contact severely constrained capacity for development – current loads need to be reduced to meet the primary contact objectives, even after applying mitigation measures.

At the other extreme, the bottom lines for nitrate toxicity were not a constraint for intensification, except in a few isolated places. What limited the room for further development was the requirement to maintain or improve water quality, and headroom was only created by applying mitigation measures. Allowing water quality to deteriorate to the bottom of its current grading created significant capacity.

The study also looked at whether using an overall measurement taken from the outlets of rivers or streams, rather than individual readings from the various tributaries, would create room for further intensification, but it did not have a significant effect.

Since this 2016 study, the water quality grading for primary contact recreation has been altered, and more specific national targets aimed at improving swimmability have been set.

Grow renewable energy production through developing a greater understanding of renewable aquatic and atmospheric energy resources.

Outcome 2

Helping keep the lights on

NIWA's comprehensive hydrological monitoring network plays an important role in supplying hydro companies with the latest information on lake levels and river in-flows.

Hydroelectric power has been a part of New Zealand's energy landscape for more than 100 years – now providing about 60 per cent of the country's total electricity supply.

It is important for 'security of supply' reasons that generators have accurate information about lake levels and river in-flows. NIWA's comprehensive network of monitoring instruments within hydro-power catchments enables real-time data to be delivered to energy generators – using the very latest in sensing and internet technology.

Having accurate river and lake water information enables hydro companies to make informed, evidence-based decisions about when to do maintenance and when to generate electricity.

NIWA is contracted to provide significant amounts of information to major hydro companies – including Meridian, Contact, Genesis, Mercury and Trustpower. Under these contracts, data is collected remotely from rivers and lakes in hydro areas on the hour, every hour.

The latest lake level and inflow data is also made available to the New Zealand Stock Exchange so that the market – including investors in hydropower companies – is fully informed about the current hydropower situation.

The community benefits of NIWA's work in this area are clear. Knowing what the natural resource is doing (and forecast to do) helps keep the lights on in households and businesses up and down the country.

Ōhau C Hydro Station.
Chris Sisarich

Helping the economy maintain full power

Weather-related power disruptions can be an expensive burden on the economy. Productivity and sales losses are an immediate impact, while flow-on effects, such as lost or corrupted data and damaged hardware, can hamper businesses well after power has been restored.

Moreover, the cost to lines companies of repairing or replacing damaged transmission infrastructure can be extremely high.

NIWA is using its superior data-gathering and high-resolution weather modelling capabilities to help quantify weather-related risk across New Zealand's 12,000km-long transmission network. Outputs from several projects undertaken during the year, in partnership with the sector, will help future-proof supply and minimise infrastructure repair costs.

Transmission lines expand and 'sag' as temperature increases. NIWA is working with TransPower Ltd (TPL) to model sag under all conditions, to ensure lines always have sufficient clearance from their surroundings.

TPL undertakes helicopter laser surveys of sections of the national grid every two years. To support the survey completed early this year, NIWA meteorologists provided observed and modelled data for key weather parameters that affect line sag (sun, air temperature and wind speed) at the specific height of the transmission lines, and at the precise time of the survey. This simultaneous quantification of terrain and meteorological variables provided a crucial baseline for the conductor model.

Line engineers will use the model's outputs to identify locations where proactive earthworks or pylon repositioning may be needed to reduce the risk of supply disruption caused by sag, and avert the expense of replacing transmission lines.

NIWA meteorologists and hydrologists also assessed the risk of floods, high winds, high rainfall events, tsunamis, lightning, snow and ice at 10 key substations, and prepared extreme wind analyses for 180 high voltage lines (incorporating 35,000 pylons and associated mid-spans).

NIWA is working with industry partners to combine historical records of power outages and faults with historical weather data, to 'hind-cast' extreme weather events that have caused supply disruptions in the past. The goal is to identify the weather thresholds and environmental factors that lead to power outages at specific locations, to aid development of an automated early warning system.

Turning animal waste into electricity

From Southland to Waikato, farmers are generating their own electricity by capturing waste. Glenarlea Farm in Otautau, in Southland, is the latest to turn methane gas from its effluent pond into electricity, with help from NIWA.

By capturing methane emitted from the effluent pond, the system, which was completed in November 2016, also reduces greenhouse gases.

NIWA, in collaboration with industry partners, had already demonstrated that Covered Anaerobic Pond (CAP) systems for the collection and use of biogas from piggery waste could make good financial sense, and improve the environmental impact of livestock farming substantially.

In the absence of oxygen, anaerobic microorganisms break down wastewater solids (such as those contained in manure) to biogas – a mixture mainly consisting of methane and carbon dioxide. While most biogas projects rely on engineered, heated digesters, NIWA research had shown that ambient temperature CAPs can be equally efficient and effective for converting manure solids into biogas.

Dave Allen

NIWA provided the basic design for the methane recovery system at Glenarlea, which is similar to most modern dairy farm effluent systems, except for an additional covered pond where methane is produced and captured. This methane is then used to power a biogas generator, generating electricity. This electricity is then used to run the dairy farm, significantly reducing power costs. Performance has already exceeded forecasts, providing 30kW of electrical power and 60kW of hot water per hour, meeting most of the farm's energy needs – including running an electric farm bike – entirely from waste product.

NIWA researchers introduced the technology at a large-scale Taranaki piggery in 2009, and it was subsequently recognised with an Energy Efficiency & Conservation Authority award. The biogas system makes the piggery more than 50 per cent energy self-sufficient and allows it to remain operational during a power outage.

The long-term effectiveness – in terms of greenhouse gas reduction, power generated and levels of energy self-sufficiency – is being monitored collaboratively through the 2017/18 dairying season at Glenarlea Farm with DairyNZ, Venture Southland, NIWA and farmers.

Increase the resilience of New Zealand and southwest Pacific Islands to tsunami and weather and climate hazards, including drought, floods and sea-level change.

Outcome 3

Firefighting in the Port Hills.

Christchurch City Council

Enhancing the efficiency of rural firefighting

New Zealand spends close to $30 million each year battling wildfires. February's destructive Port Hills fires alone cost $7.9 million to subdue – without counting the cost of damage to property, infrastructure and the environment.

Personnel, vehicles and equipment account for a large proportion of firefighting costs. Rural fire authorities must constantly assess risk and, when fire breaks out, mobilise resources to control the situation as efficiently and effectively as possible.

NIWA delivers carefully tailored support for Fire and Emergency New Zealand's (FENZ) risk-management and operational goals and significantly enhanced these services during the year.

After a very successful trial, NIWA's Forecasting Services Team now provides a 24/7 on-call weather forecasting service to inform FENZ operational decisions. The team responded to more than 100 enquiries from FENZ during the 2016/17 financial year. The Port Hills event and its aftermath saw NIWA forecasters preparing twice-daily local-scale forecasts of wind, temperature, humidity and rainfall, for a period of a month, to aid the firefighting and ongoing risk-management.

In addition, NIWA collaborated with FENZ during the year to design and build a customised online fire-weather forecasting and analysis tool: fireweather.niwa.co.nz.

This interactive website, which is free to view by the public, enables firefighting authorities to access a range of weather observations, regional forecasts, information and fire-risk indices. The site's outputs can be filtered by vegetation type and by fire-risk environment (for example, the presence of productive forestry land, or proximity of power lines).

The site was built by NIWA's IT Systems Development Team according to specifications developed by the NIWA Forecasting Operations Team. It is designed to work on a desktop or mobile device – ensuring versatility and ease of access.

The partnership between NIWA and FENZ continues to develop, and is likely to result in the development of further tools and services aimed at enhancing the efficiency and minimising the cost of rural firefighting in New Zealand.

Tsunami hazards for the Chatham Islands

NIWA scientists have completed complex modelling of the tsunami hazard in four of the Chatham Islands' largest settlements – Waitangi, Owenga, Kaingaroa and Port Hutt.

The work was commissioned by the Chatham Islands Council to understand what is likely to happen under two scenarios – a regional scenario of a megathrust earthquake on the Hikurangi Trench just offshore of the North Island, and a distant scenario of a megathrust earthquake near Peru.

Each scenario was modelled with the tsunami arrival coinciding with Mean High Water Spring tide.

The regional scenario modelled a magnitude 9.1 earthquake and represented a worst-case scenario. Such an earthquake would be similar in magnitude to the 2011 Great East Japan Earthquake. Shaking would last several minutes and would be felt over much of New Zealand, including the Chatham Islands. At three of the four locations, the modelling scenario showed that the first wave would arrive about one hour, 45 minutes after the earthquake. However, later waves would be higher, and the tsunami would continue for about six hours.The distant scenario involved a magnitude 9.5 earthquake on the subduction zone off the coast of Peru. This earthquake would not be felt in New Zealand, so we would be relying on the Global Seismographic Network to alert us to the earthquake, and the Pacific Tsunami Warning Centre and the DART buoy network to confirm that it had caused a large tsunami. The Chatham Islands lie to the east of the rest of New Zealand, so they would be the first location in New Zealand reached by the tsunami. The first waves would arrive about 13 hours after the earthquake, and larger waves would arrive up to 17.5 hours later.

The NIWA report maps the maximum water elevations over the land inundated by the tsunamis, and the maximum water speeds, which gives information about the potential damage to infrastructure and erosion.

The main purpose of the report is to help inform evacuation and emergency management planning, but it will also help Chatham Island residents understand the risks tsunami pose. A Master's student and Chatham Islands local, Kristie-Lee Thomas, is studying the effect of tsunamis on the infrastructure and lifelines in the Chatham Islands and will use the inundation maps in her research.

Risky business in the Shaky Isles

The past year has been busy for the joint NIWA/GNS Science team involved in RiskScape – a powerful research and software tool that analyses and estimates potential economic or human impacts and losses from natural hazards.

New Zealand sits in the latitudes of the roaring forties where regular storms are a fact of life – leading to frequent floods, wind damage and coastal inundation. Add our location on a major plate boundary with earthquakes, volcanic eruptions and tsunami, and the country is a dynamic place to live in.

RiskScape helps decision-makers balance the cost of protection measures (such as flood defences, earthquake strengthening or insurance cover) against potential losses from natural hazards. It helps improve understanding of likely community impacts and informs land-use planning and emergency management, countrywide.

RiskScape was notably updated after the Edgecumbe flood in April. NIWA researchers went from door-to-door surveying damage done to buildings when a stop bank on the Rangitaiki River breached. Information gathered has been used to improve and expand RiskScape's flood impact estimating capabilities.

RiskScape was also used to support emergency responses after November's magnitude 7.8 Kaikōura earthquake, and it has been employed further afield to help benefit New Zealand's Pacific neighbours.

An MFAT-funded project called PARTneR is tailoring RiskScape to develop vulnerability models for the Pacific and support decision-making in Samoa and Vanuatu – island nations dealing with their own share of natural hazards. Significantly, RiskScape models were used to help the Samoan Government secure US$57 million from the United Nations' Green Climate Fund.

Kaikōura earthquake response

NIWA geologists led a major effort to reveal the impact of November's magnitude 7.8 Kaikōura earthquake on the seafloor. Six separate surveys using NIWA research vessels *Tangaroa* and *Ikatere* collected data which revealed some of the most dramatic seafloor change ever observed.

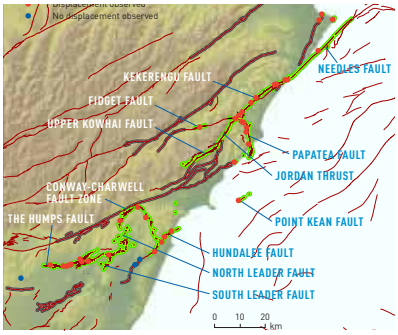
Mapping the fault ruptures on the seafloor showed that four major faults – including a new one off Kaikōura Peninsula – had ruptured. The Needles Fault in the north was mapped to confirm a 34km rupture in the offshore continuation of the Kekerengu Fault.

The earthquake triggered a massive landslide in the head of the Kaikōura Canyon. Remapping areas surveyed in 2013 and 2015 show that millions of cubic metres of mud and debris were dislodged from the shallow canyon rim. This material flowed down the canyon and substantially changed the canyon floor.

Video imaging of the seafloor in the Kaikōura Canyon showed that all seabed life had been wiped out after the earthquake. The deposit from the landslide generated a huge, rapidly moving turbidity current, or underwater river, in the Hikurangi Trough. It flowed at least 700km from the head of the Kaikōura Canyon, and would have been a cloud of water and sediment over 200m high.

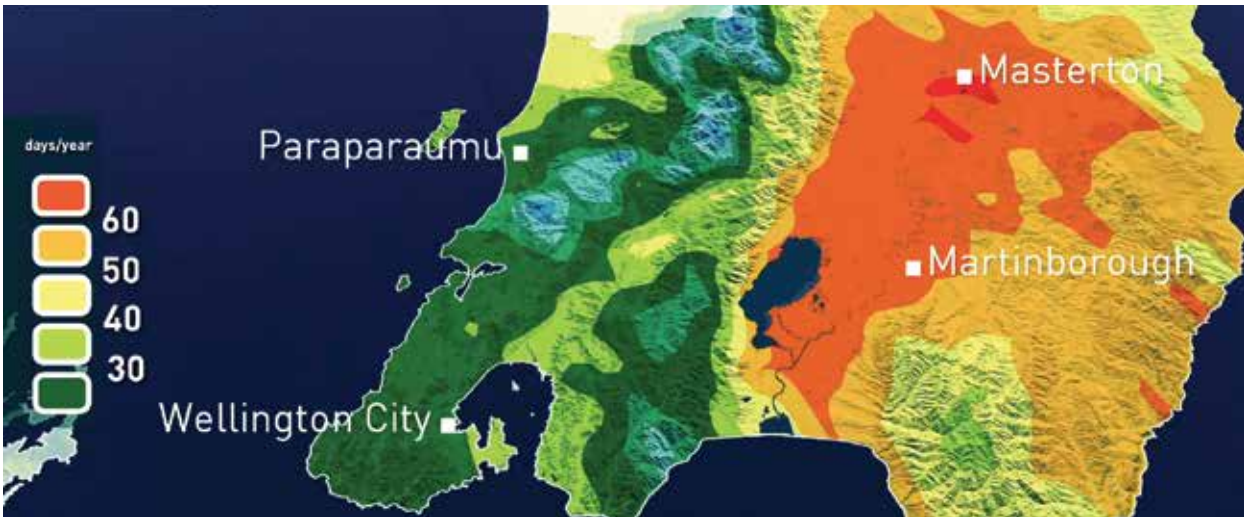
This is the first time an event of this scale has been documented in this way, which offers a unique opportunity to understand how global canyon-channel systems function. More surveys are being planned, and together the information will help improve understanding of New Zealand seismic hazard and stress changes in the earth's crust.

Fault lines mapped after the Kaikōura earthquake.
NIWA



Enable New Zealand to adapt to the impacts and exploit the opportunities of climate variability and change and mitigate changes in atmospheric composition from greenhouse gases and air pollutants.

Outcome 4



Preparing the regions for the impacts of climate change

The likely impacts of climate variability and change are high on the agenda of many regional councils and other territorial authorities nationwide. Planners and risk managers recognise the need to invest proactively in adaptation measures now, to avoid a potentially costly, difficult and disruptive response in the future.

In 2016 the Ministry for the Environment released the *Climate Change Projections for New Zealand* report, written by NIWA, which outlines the broad climate changes and impacts expected at the national scale. Since then, Tasman Regional Council, Northland Regional Council, Greater Wellington Regional Council, Horizons Regional Council and Ngāi Tahu have commissioned NIWA to prepare individual reports that provide high-level guidance for planning and risk mitigation at a region scale.

Each regional report provides projection maps for a range of climate variables (such as rainfall, temperature, frost and solar radiation) and two different carbon-emission scenarios. Projections are made for both the middle and end of the 21st century, and are provided as GIS layers for easy incorporation into council planning systems.

Other report details are tailored to each region, following consultation between NIWA and the regional authority about areas of specific concern. For example, the report to Greater Wellington Regional Council included projection maps for 21 climate variables, due to the wide variety of terrain, environments, land uses and economic activities undertaken across the region.

NIWA's science communication expertise and facilities helped Greater Wellington Regional Council convey the highlights of the report to a range of council stakeholders. The 180-page report was summarised in a short video, produced in NIWA's Auckland studio, which has been circulated widely and very positively received.

Auckland Council has now commissioned NIWA to prepare a tailored report for the Auckland region. Consultations have begun to determine the specific content of the report, which is expected to be completed during the 2017/18 financial year.

Projection map of the number of days when the temperature is expected to exceed 25°C in 2090.

NIWA

Vital role in the recovery of the Antarctic ozone hole

NIWA scientists celebrated a particularly successful milestone at its Lauder atmospheric research station in September – the 30th anniversary of the Montreal Protocol.

This international environmental protection treaty is often described as the most successful of its kind, and Lauder scientists have played vital roles in this achievement.

The Montreal Protocol is a global agreement to phase out the production and use of substances, such as chlorofluorocarbons (CFCs), that deplete the ozone layer.

Ozone is a naturally occurring gas in the stratosphere, 10–50km above the earth's surface, which acts as a shield around the earth, protecting humans from skin cancer-causing UV radiation.

The Montreal Protocol has successfully controlled and reduced CFCs in the atmosphere. NIWA's role began with staff who helped to negotiate it, and has continued with measurements in Antarctica and at Lauder of stratospheric ozone, the substances that deplete it, and other gases that affect it.

Astronauts capture the earth's atmospheric layers.
NASA/JSC

The Protocol was signed just two years after the discovery of the Antarctic ozone hole in 1985. In 2008, NIWA scientist Dr Olaf Morgenstern led a study which showed that the ozone hole would have been 40 per cent larger than it is now without the protocol. Several NIWA scientists have also been heavily involved in the three main assessment panels required by the protocol. The most recent contribution by the panels has been the decision in October 2016 to phase out use of hydrofluorocarbons under the Montreal Protocol, a decision known as the Kigali amendment.

In the past year ozone measurements, taken on several highly-specialised instruments, have continued to increase our knowledge. The longer the measurements are carried out, the more valuable they become because they enable scientists to measure tiny increments and trends over time that were not detectable even a decade ago.

In the past year NIWA has attended two international meetings for ozone researchers to discuss how NIWA's vital Lauder data is now helping to understand how ozone will be affected by a warming atmosphere. The threat to the ozone layer from human-induced warming is now a focus of Lauder research.

It is estimated that a clear recovery signal in the ozone layer may take about 30 years to become statistically significant, making ongoing measurements at Lauder and Antarctica a globally important undertaking.

Revolutionising air quality science and management

Environmental managers in regions prone to winter air quality degradation by wood smoke, such as Canterbury, face a difficult challenge making sense of the complex meteorological factors and human behaviours that affect particulate levels. Managers need comprehensive scientific evidence to ensure any emission limits and other management strategies they apply achieve the desired environmental and health benefits.

During the winter of 2017, NIWA undertook the third phase of an ongoing study in the Canterbury town of Rangiora, aimed at understanding the spatial variation of wood smoke and investigating the influence of weather on home-heating behaviour. NIWA is trialling a range of new low-cost technologies during the study, which could revolutionise air quality science and management throughout New Zealand and beyond.

During this year's phase, participating householders monitored their own woodburner using mail-order temperature sensors. Results were then integrated with observations from meteorological stations in and around the town.

In addition, NIWA's air quality scientists are using data from a growing network of outdoor air quality sensors known as ODINS, to model how external wood smoke levels vary across Rangiora under different meteorological conditions. Early results have been presented to Environment Canterbury (ECan) via a technical report and an animation utilising NIWA's sophisticated data-visualisation software.

NIWA has also developed an online data enquiry and analysis tool for ECan's air quality technical team.

Interest in this ground-breaking research has now spread offshore. Later in 2017, NIWA will partner with the University of Montana in the United States to begin a similar study in Idaho.

At the same time, development of the technology is continuing, and NIWA is collaborating with the University of Auckland to add networking capability to the ODIN sensors.

Enhance the stewardship of New Zealand's freshwater and marine ecosystems and biodiversity.

Outcome 5

NIWA joins forces with hapūon tuna research

NIWA are working with local hapū to find out more about the elver (juvenile freshwater eels) populations in streams connecting to the Wairua River in Te Tai Tokerau, Northland.

Ngā Kaitiaki O Ngā Wai Māori (NKoNWM) have long been concerned about the falling tuna (freshwater eel) populations in their rohe.

A feature of the Wairua River is Northpower's hydro dam. For six years, NKoNWM have been working with Northpower, NIWA, the Ministry for Primary Industries, the Department of Conservation and other agencies to move juvenile eels over the dam as they swim upstream as part of their life cycle.

To test the success of the trap and transfer programme NKoNWM and NIWA are looking at how the transferred elvers are surviving. The project involves catching tuna in streams connected to the Wairua River to assess their numbers, distribution and the habitats they are using.

Very little research has been undertaken in New Zealand to help explain what makes stream habitats suitable for elvers or tuna to thrive. The successful operation of the Wairua elver trap and transfer over the past six years provides NKoNWM and fisheries scientists with a unique opportunity to investigate how well elvers are surviving and growing in the different streams they have been transferred into.

The continued collaboration and dedicated involvement of these organisations and individuals will provide the platform to ensure that tuna populations are preserved in the Mangakāhia and Wairua River catchments for future generations.

This work is part of a research programme called Cultural Keystone Species, funded by the Ministry of Business, Innovation & Employment.

Members of hapū Ngā Kaitiaki O Ngā Wai Māori are working with NIWA to find out more about juvenile freshwater tuna.

Stuart Mackay

New Zealand sea lion threat management plan

The future survival of New Zealand sea lions is now a little more optimistic with this year's release of a threat management plan to ensure the long-term viability of the species.

NIWA scientists made a major contribution to the plan which describes the first five years of a 20-year programme to protect this rare and endemic species. New Zealand sea lions are classified as Nationally Critical. Between 1998 and 2009 the number of sea lion pups born annually at the Auckland Islands – by far the largest breeding site – declined by 50 per cent.

Ongoing work to determine the causes of the decline led to the development of the Threat Management Plan which aims to promote the recovery and ensure the long-term viability of New Zealand sea lions, with the ultimate goal of achieving Not Threatened status.

The plan is underpinned by a quantitative risk assessment carried out by NIWA scientists. The risk assessment focuses on the Auckland Islands breeding colony and the Otago Coast breeding location, and indicates that sea lions are exposed to different natural and man-made threats. It concludes that no single factor is solely responsible for the decline, and the plan has taken a holistic approach to mitigate the key threats and promote recovery of the sea lion population.

During the consultation phase of the plan's development, NIWA fisheries ecosystem modeller Dr Jim Roberts became concerned by misinformation about the cause of sea lion decline and the plan itself. In response, he wrote an article that was published in the New Zealand Herald explaining the results of scientific research undertaken to determine why the sea lion population had declined so dramatically, and challenging some of the myths proffered for that decline.

The plan is now being implemented under four workstreams: engagement, direct mitigation, targeted research and evaluation.

NZ sea lions.
Rob Murdoch

Mangroves near Whangamata.
Dave Allen

Managing mangroves

A new NIWA guide 'Managing Mangrove (Mānawa) Expansion' is supplying valuable information for councils and communities on this potentially divisive subject.

Mangroves grow on coastal mudflats in the northern half of New Zealand from Kawhia on the west coast and Ohiwa on the east coast. They have been expanding rapidly in recent decades as a result of increased sediment flows into estuaries, which have created ideal conditions for them to thrive.

Mangroves are often targeted for mass removal in attempts to return harbour seascapes to their previous state. Reasons for removal included improving recreation values and access to the ocean, improving views, returning habitats to firm sand flats, and improving drainage or flood protection.

Until recently, little was known about the effect of mass removal on the environment, or even if it worked.

The guide is the result of NIWA surveys of more than 40 areas where mangroves had been removed. The researchers found that the practice often did not result in a return to sand flats, and that many removals had detrimental effects on local ecosystems.

The guide explains that mangroves act as a buffer zone from waves and storms and protection from erosion of the coastline. They also store carbon and nutrients, and support a diversity of animal life that feeds off the plants' organic matter.

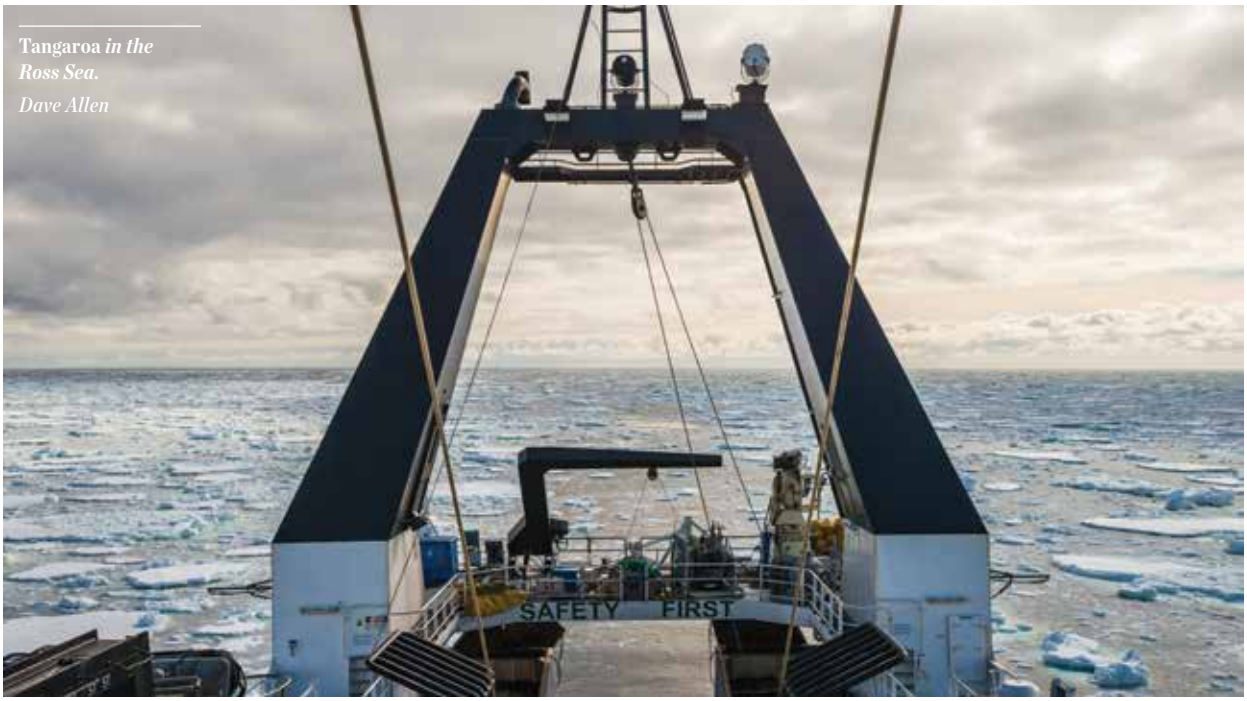
Areas where mangroves have been removed also need regular maintenance to prevent the seeds from re-establishing – an annual cost that can range from $1,000 to $5,000 per hectare for seedling removal and disposal, a cost that is often overlooked.

The guide discusses a range of management strategies that address mangrove expansion, and it advises on where removal is unlikely to achieve the desired outcome or could be very costly to maintain.

Launched at the *Manukau Harbour Forum Symposium* in May 2017, the guide has proved so popular it has already been reprinted.

Increase understanding of the Antarctic and Southern Ocean climate, cryosphere, oceans and ecosystems and their longer-term impact on New Zealand.

Outcome 6



Tangaroa *in the Ross Sea.*
Dave Allen

The world's largest Marine Protected Area

The world's largest Marine Protected Area (MPA) comes into force on 1 December 2017 after a six-year effort led by New Zealand and the United States. They first came together with a joint proposal for an MPA in 2012 and worked together to gain agreement from the other 23 members of the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), which is responsible for managing fishing activities in the Antarctic and only makes decisions by consensus.

NIWA science was critical in informing the creation of the Ross Sea region MPA, which covers 1.55 million square kilometres, of which 1.12 million square kilometres, 72 per cent, is fully protected – no fishing is permitted.

The MPA agreement balances marine protection and sustainable fishing while developing the science needed to ensure fishing is sustainable and the ecosystem is protected from changes due to fishing or climate change. These include important habitats and foraging areas for marine mammals, birds, fish, and invertebrates, including iconic species in the region, such as Weddell seals, killer whales and emperor penguins.

NIWA scientists developed and compiled biological and environmental data distribution maps for a wide range of key species and physical features which contributed to the development of "bio-regions" to describe the patterns of biological distributions and physical habitats of the area. They also provided other significant analysis, advice, and scientific rationale for the proposal.

This substantial achievement represents a major contribution to global marine protection, and it has led to the formation of a scientific and performance-based MPA which will stimulate collaborative science in the Ross Sea and support conservation efforts within CCAMLR.

Toothfish sustainability

On 1 December 2017, New Zealand will mark the official establishment of the Ross Sea region Marine Protected Area (MPA) – the world's largest MPA, which spans 1.55 million square kilometres of the Southern Ocean.

NIWA has been a key advisor of the MPA design and implementation by the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) – the international body responsible for fisheries management in the Southern Ocean. The agreement balances marine protection, sustainable fishing and science interests, and will stimulate further research into the ecology of the Antarctic toothfish.

NIWA scientists also carry out a wide range of research on the toothfish fishery which contributes to its sustainable management. This includes stock assessment, data analysis associated with the tagging programme, ageing toothfish, ecosystem modelling, collection of echosounder data, and survey work at sea.

Toothfish are found throughout the Ross Sea and may be important prey for top predators such as Weddell seals and killer whales. The MPA provides a mechanism for understanding how this polar ecosystem functions, and NIWA's toothfish research is crucial to learning more about how to conservatively manage the area.

NIWA research shows that toothfish living under the ice in coastal regions of the Ross Sea are large, slow growing, old fish that eat Antarctic silverfish, but do so at peril of being eaten by Weddell seals and killer whales. One focus of current research is understanding if these predators rely on toothfish at certain times of the year or whether they are an occasional snack.

Ongoing toothfish sustainability research will involve repeat trips by NIWA scientists to the sea ice to develop ecosystem indicators, and a monitoring plan to detect ecosystem changes due to climate change or the effects of fishing in areas outside the MPA.

The MPA supports these objectives by creating areas open and closed to fishing to measure the effects of fishing on the ecosystem, moving fishing activities away from areas used by top predators, and structuring fishing to ensure the continued integrity of the toothfish tagging programme, which informs the sustainable management of the fishery.

Toothfish eggs.
Darren Stevens

Antarctic ice crystal project

One of the outstanding challenges of climate modelling is a step closer to being resolved after a successful expedition to Antarctica last year, led by NIWA marine physicist Natalie Robinson.

Dr Robinson and her team set up camp 60km from Scott Base in late October to try to better understand why sea ice is expanding at Antarctica and how ice shelves will melt as the oceans warm.

The growth of sea ice in Antarctica is not always accurately represented in climate models, so the ultimate aim of this research was to provide new information that could be fed into climate models.

Under three metres of sea ice the team discovered a six-metre layer of ice crystals, known as platelet ice. The crystals form in water that is supercooled – colder than freezing – when it rises towards the surface. This supercooled water contributes to the thickening of sea ice, especially near the coast.

Part of Dr Robinson's Marsden-funded project involved testing how the crystals affect turbulence and heat transfer in the upper ocean as they grow and cluster together in this supercool water.

Other experiments involved looking at flow speeds around a grounded iceberg where platelets were about half a metre thick.

The team also set up moored instruments at three different sites on the sea ice, and 15 autonomous instruments were lowered into a hole drilled through the ice to collect data on temperature, salinity and currents down to a depth of 250m.

Good weather played its part and helped the team achieve more than it had expected from what was a particularly ambitious research plan that yielded an enormous amount of data.

Dr Robinson is returning to Antarctica later this year to continue the research.

Sea ice experiments, Antarctica.
Gabby O'Connor

NATIONAL SCIENCE CHALLENGES


Dave Allen

Deep South

The *Deep South* National Science Challenge is focused on helping New Zealanders to adapt, manage risk and thrive in a changing climate. To achieve this, the Challenge is using projections made by its NZ Earth System Model (NZESM) to inform research into the impacts of a changing climate on New Zealand.

The Challenge has the largest Māori-led climate research programme in New Zealand. These projects are a key vehicle for linking Māori knowledge with climate modelling and helping build a uniquely New Zealand understanding of the diverse impacts of climate change.

Initial testing of the NZESM is complete, and the first production runs are scheduled for early 2018. New observations in the Deep South region are supporting model development and providing insights into climate processes relevant to New Zealand. Global model outputs are being downscaled, so researchers can understand the impacts of climate change on New Zealand's snow and ice resources, hydrological systems, and future land-use suitability.

The Challenge is pioneering a dialogue process for climate research to co-develop research questions that directly respond to stakeholder needs and facilitate more effective adaptation to climate impacts. The Challenge team has substantially increased its focus on end-user engagement and is deepening relationships with climate-sensitive sectors to ensure it properly understands and respond to the real-world implications of climate change for New Zealanders.

Deep South is led by NIWA Principal Scientist Dr Mike Williams. NIWA researchers also lead 1 of the 5 research programmes and participate in 17 of the 38 projects. NIWA has also aligned 6 projects with the Challenge's objective.

Sustainable Seas

The vision of the *Sustainable Seas* National Science Challenge is healthy marine ecosystems providing value for every New Zealander. The Challenge will transform New Zealand's ability to enhance the marine economy, and improve decision-making and the health of our seas through ecosystem-based management.

EBM is a holistic and inclusive way to manage marine environments and the competing uses for them, the demands on them, and the ways we value them.

Sustainable Seas brings together scientists and experts from 37 organisations – including biophysical and social scientists, economists, lawyers, experts in mātauranga Māori – including 44 researchers from NIWA.

The Challenge is developing tools and knowledge needed to make such management practical. These will help marine resource managers, Māori, industry and communities assess the effect that developing an opportunity will have on the marine ecosystem, other marine activities, our values, and our cultural connection to the marine environment.

It is also investigating 'blue economy' initiatives – new, environmentally sustainable technologies and activities that will add value to our marine economy.

There is good and improving internal integration between disciplines, projects, and Western and Māori research approaches. Externally, the Challenge has excellent iwi engagement, and good relationships with people in key central and regional government agencies, NGOs and community groups, and some industry sectors.

Sustainable Seas is led by NIWA scientist Dr Julie Hall. NIWA researchers also lead two of the seven research programmes and 10 of 27 projects. NIWA has also aligned 19 projects with the Challenge's objective.

Researchers from the ecosystem connectivity project sampling algae, invertebrates and fish.

Steve Wing

BENEFITS OF MBIE STRATEGIC FUNDING

This section reports only on the MBIE Strategic Funding component of the Statement of Corporate Intent (SCI) programmes, all of which have associated research (e.g., Ministry of Business, Innovation & Employment contestable projects) and stakeholder-funded activities (e.g., co-funding).

The sector benefits column focuses on the elements of the programme supported by MBIE Strategic Funding. Detailed descriptions of three key innovations in each Statement of Core Purpose (SCP) outcome area are given in the Our Science section on pages 75–91.

The Statement of Core Purpose (SCP) Outcomes:

1. Increase economic growth through the sustainable management and use of aquatic resources
2. Grow renewable energy production through developing a greater understanding of renewable aquatic and atmospheric energy resources
3. Increase the resilience of New Zealand and South-West Pacific islands to tsunami and weather and climate hazards, including drought, floods and sea-level change
4. Enable New Zealand to adapt to the impacts and exploit the opportunities of climate variability and change and mitigate changes in atmospheric composition from greenhouse gases and air pollutants
5. Enhance the stewardship of New Zealand's freshwater and marine ecosystems and biodiversity
6. Increase understanding of the Antarctic and Southern Ocean climate, cryosphere, oceans and ecosystems and their longer-term impact on New Zealand.

Tangaroa *in Terra Nova Bay, Antarctica.*

Dave Allen

Aquaculture

MBIE priority area: Primary industry productivity and sustainability

SCI programme	Sector benefits	SCP outcome No.	MBIE Strategic Fund Investment ($) Budget 2017	MBIE Strategic Fund Investment ($) Actual 2017
Develop reliable and efficient techniques for commercial-scale production of established and emerging high-value aquaculture species	Production information and economic models that enable robust investment decisions to be made by commercial investors carrying out due diligence for aquaculture opportunities, as well as assisting national and regional government agencies supporting the commercialisation process. This includes existing species, such as chinook salmon and mussels, and new species on the point of commercialisation, such as kingfish and hāpuku. The programme also provides the background technical information that enables industry to optimise commercial operations by dealing with issues that affect profitability.	1	3,420,089	3,325,281
Develop the underpinning science, monitoring tools and farm management systems that quantify and minimise both the environmental effects and regulatory compliance costs of aquaculture while optimising production and minimising the risks to aquaculture from environmental stressors	Provision of services to central and local government, and industry, to facilitate decision-making on water-space allocation, marine farm siting, and monitoring protocols and guidelines. For example, tools, analyses and data are contributing to the Marlborough Aquaculture Planning Process, which is designed to streamline the reconsenting process for marine farms. The research also facilitates increased public engagement and understanding of the actual – and usually mild – environmental effects of aquaculture.	1, 5	1,319,911	1,263,642

Fisheries

MBIE priority area: Primary industry productivity and sustainability

SCI programme	Sector benefits	SCP outcome No.	MBIE Strategic Fund Investment ($) Budget 2017	MBIE Strategic Fund Investment ($) Actual 2017
Develop and apply stock monitoring and assessment methodologies for New Zealand's fisheries to enable monitoring and prediction of changes in fish population biology, fish stock biomass, and size and age composition	State-of-the-art tools that enable the improved monitoring of, and prediction of changes in, fish populations, biomass, and size and age composition. This gives stakeholders the information necessary to make robust decisions on fisheries management. New Zealand fisheries are recognised internationally as sustainably managed, which brings enhanced market opportunities, and this programme is an important contributor to that recognition.	1	660,000	660,000
Develop and apply standardised methodologies to monitor and assess international fisheries outside the New Zealand EEZ and determine the environmental effects of fishing	New Zealand demonstrates leadership in the effective management and sustainability of the toothfish fishery in the Ross Sea region. Scientific information and advice supports New Zealand and international organisations. Information on fisheries in the South Pacific area, including options designed for spatial management of bottom fisheries in the high seas, is a key contribution to processes for minimising adverse environmental impacts in sensitive ecosystems.	1	65,000	65,000

SCI programme	Sector benefits	SCP outcome No.	MBIE Strategic Fund Investment ($) Budget 2017	MBIE Strategic Fund Investment ($) Actual 2017
Determine the impact of fisheries on the aquatic environment to inform an ecosystem-based approach to fisheries management and contribute to broader ecosystem-based management approaches in conjunction with the Coasts & Oceans National Science Centre	Methods and tools that facilitate stakeholder engagement and collaboration, focused on actions that will enhance the economic benefits arising from New Zealand's natural marine resources. Examples include the development and implementation of strategic end-to-end ecosystem modelling frameworks, and spatially explicit risk assessment approaches. Developments to-date are forming the basis of work undertaken in parts of the Sustainable Seas National Science Challenge. Māori communities have an enhanced capability in monitoring and management of culturally important resources such as intertidal shellfish beds.	1, 5	725,000	725,000

Coasts and Oceans

MBIE priority areas: Marine resources and ecosystems; Mineral resources

SCI programme	Sector benefits	SCP outcome No.	MBIE Strategic Fund Investment ($) Budget 2017	MBIE Strategic Fund Investment ($) Actual 2017
Marine physical processes and resources: characterisation of the marine geological and oceanic energy resources in New Zealand, the Ross Sea region and the Southern Ocean and the physical processes and environmental factors that affect those resources	Improved knowledge of the shape and composition of the seabed, and improved access by industry and government agencies to seafloor data, which enables better management of the environment and utilisation of seabed resources. For example, data have been processed and interpreted for a wide variety of stakeholders, who have used them for infrastructure developments, environmental baseline monitoring, and hydrographic purposes. Research contributed to the government's decision to declare the Kermadec Ocean Sanctuary, and will in the future influence management plans for the sanctuary.	1, 5	1,809,040	1,809,040
Marine biological resources: delivery of fundamental knowledge about the diversity and distribution of the marine biota in New Zealand's territorial waters, EEZ and Southern Ocean, over a variety of space- and time-scales	A greater understanding of the biological resources in New Zealand's marine estate – their biodiversity, distribution in space and time, and biological functioning and interdependencies. The research covers a wide range of marine biota. The new taxa recognised, and new distributional and habitat information, all contribute to coast and ocean resource management and protection. The knowledge and developed tools (e.g., for species identification) are vital for many science programmes, and are an important component of decision making by central government agencies, commercial companies, regional government and others for enhanced stewardship of New Zealand's marine estate, particularly in relation to effective ecosystem and resource management, and improved biosecurity.	5, 6	2,161,131	2,184,131
Ocean flows and productivity: definition of the spatial and temporal variation in New Zealand's ocean current flows, primary and secondary production, and determination of how biogeochemical and physical oceanographic processes influence biotic variability	The influence of physical, chemical and biological processes on marine community structure, function and production, together with critical time series of coastal and deeper ocean waters, allows natural variability to be separated from anthropogenically induced changes. For example, one important coastal area in New Zealand has shown increased nitrogen enrichment from the catchment over the course of a decade, coupled with decreased denitrification rates. Understanding and predicting such impacts allows stakeholders to define the environmental and biological constraints and manage activities – such as aquaculture and fisheries – to maximise marine resource use.	5, 6	1,254,000	1,254,000

SCI programme	Sector benefits	SCP outcome No.	MBIE Strategic Fund Investment ($) Budget 2017	MBIE Strategic Fund Investment ($) Actual 2017
Ecosystem structure and function: determine the structure of marine ecosystems, the interactions amongst their components that affect ecosystem stability, and develop ecosystem models that can inform management of New Zealand's marine estate	Decision makers are able to consider multi-level interactions in marine food webs when managing human impacts such as fishing, habitat modification and pollution. For example, management tools and approaches for assessing ecological risk ('food-web' or 'second-order' effects) in the marine environment contributed to the development by central government of a new ecosystem indicator relevant to New Zealand deepwater fisheries at the national scale. Robust information on marine food-web dynamics is crucial to achieving the dual priorities of maximising economic growth while minimising risks to the long-term productivity of New Zealand's natural resources.	1, 5, 6	827,000	827,000
Managing marine ecosystems: determine the characteristics and vulnerability of marine communities, habitats and ecosystems by linking knowledge of how marine ecosystems work to how they are affected by human activity, and address limits to capacity, interactions between multiple stressors, the dynamics of cumulative effects and the underlying controlling factors of ecological recovery	Enhanced protection and restoration of marine biodiversity through the use of new techniques for measuring, understanding and monitoring marine systems. Methods for mapping and monitoring ecological functions in estuaries have been linked with work done by central agencies (e.g., to assess the ecosystem services of Marine Protected Areas), and then operationalised to allow both central and regional agencies to map ecosystem services, diversity and functional habitats within estuaries and MPAs. The programme provides the fundamental basis of an ecosystem-based approach to management of marine resources. It helps resource managers make decisions that balance resource use and the maintenance of biodiversity when there are multiple resource users with varying societal, economic and cultural values.	1, 5	1,412,690	1,412,690
Marine biosecurity: identifying and evaluating biosecurity threats to marine ecosystems from non-indigenous species, and developing tools and approaches to prevent entry, reduce establishment and mitigate impacts	A wide variety of novel tools and information that enable robust estimates of aquatic biosecurity risks, effective pest surveillance and monitoring, and the development and implementation of effective, socially and environmentally acceptable mitigation options. For example, in conjunction with central and regional government, the research contributes to policies for the management of vessels and other potential vectors that spread marine pests within New Zealand, and is contributing to the development of pathway management plans and vessel biofouling standards across New Zealand, and around the Kermadec and Sub-Antarctic islands. The programme supports interventions at different points in the biosecurity system; from prevention through to mitigation of impacts.	5	1,007,390	1,007,390

Freshwater and Estuaries

MBIE priority area: Land and freshwater resources

SCI programme	Sector benefits	SCP outcome No.	MBIE Strategic Fund Investment ($) Budget 2017	MBIE Strategic Fund Investment ($) Actual 2017
Water resources: understanding and predicting the hydrological cycle (how much water, where and when) to improve water management	Ensuring the wise use of New Zealand's freshwater and estuarine resources for economic benefit, with water quality and ecosystem health that meet community expectations. Better decisions on major water resource developments through the uptake and use of decision support and other tools by regional councils and a wide range of industry sectors. The merging of databases into one hydrological dataset will result in an increased ability to understand hydrological processes in New Zealand across natural and modified flow conditions, and improved access by stakeholders to relevant information and data.	1, 5	1,170,250	1,153,346
Sustainable water allocation: understanding and predicting effects of human use and modification of rivers and groundwater systems for sustainable allocation	Access to knowledge and tools that enable water use allocation plans and decisions that sustain stream/river environments and their ecosystems. Enhanced management tools and models are used to help identify the effects of complex water use, set appropriate flow levels, and quantify trade-offs between water allocated to instream values and out-of-stream uses. Facilitated assessments of cultural flow requirements and their consideration in water allocation decisions are being done for a range of rūnunga. Knowledge gaps and tools needed to implement the National Policy Statement for Freshwater Management (NPS-FM) are being filled, notably around setting and manging limits on water quantity in rivers.	1, 5	1,977,000	1,885,163
Causes and effects of water quality degradation: understanding and predicting the sources of contaminants, technologies to clean up the sources, and consequences of water quality degradation for aquatic ecosystems and human uses of waters	Support implementation of the NPS-FM and National Objectives Framework (NOF). For example, a decision-support framework for eutrophication assessment in New Zealand, designed in conjunction with end users, will enable structured access to key information and tools needed for nutrient limit-setting. The programme has informed the debate on the state of New Zealand's freshwaters, the trends in water quality and ecological health and the extent of human influences.	1, 5	2,732,800	3,206,060
Catchments to estuaries: understanding and predicting the functional connections between catchments and estuaries to improve diffuse-source contaminant management	Provision of the knowledge, methods, and tools needed to assist managers and policymakers to implement government policies that aim to maintain and improve environmental and cultural values in waterways impacted by sediment and other contaminants. There is direct support for the implementation of limits-based management of estuaries, and increased access to science-based tools for regional council managers. For example, the enhanced accessibility of CLUES Estuaries enables users to assess estuary susceptibility to eutrophication, and understand when the approach is applicable.	5	1,200,000	1,232,018

SCI programme	Sector benefits	SCP outcome No.	MBIE Strategic Fund Investment ($) Budget 2017	MBIE Strategic Fund Investment ($) Actual 2017
Freshwater biosecurity: identifying and evaluating threats from non-indigenous species, minimising risks of their establishment, and developing tools to mitigate their impacts	Reduced threat and spread from invasive aquatic plant species in major catchments and lakes by providing tools and strategies that control existing pest problems. For example, new aquatic weed incursions into New Zealand have been identified, risk assessments done, and programmes for eradication are now in place for several species. Research findings, advice and input to strategic management has led to enhanced ecosystem health and helped meet community expectations in a range of nationally and regionally important waterbodies.	5	710,000	715,747
Ensuring ecosystem health: developing techniques for biodiversity enhancement, rehabilitation and protection of freshwater values under future economic growth scenarios	Provision of techniques for protecting, enhancing and rehabilitating the biodiversity of freshwater ecosystems and the cultural values they provide. The development and implementation of riparian and wetland design methods enable contaminant transport hotspots in productive landscapes to be more effectively targeted for contaminant reduction, and adaptive management practices to meet specific water quality and instream habitat objectives. Support for restoration programmes and volunteer stream monitoring (e.g., improved equipment, protocols and resources) enable them to be optimally designed and well implemented.	5	1,898,160	1,506,285

Hazards

MBIE priority area: Hazards

SCI programme	Sector benefits	SCP outcome No.	MBIE Strategic Fund Investment ($) Budget 2017	MBIE Strategic Fund Investment ($) Actual 2017
Develop predictive models of weather-related hazards and incorporate them into an operational multi-hazard forecasting system	Increased resilience to extreme weather hazard events through a world-leading forecasting and information-delivery system that provides accurate, location-specific warning of anticipated events, leading to improved adaptive risk mitigation decisions. End users have direct access to information, forecasts and decision-enabling tools for use in a very wide range of sectors, including for issues not related to hazards (e.g., on-farm operational decisions on the deployment and management of assets and resources).	3	3,460,000	3,460,000
Evaluate the risk, impacts and potential losses due to weather-related hazards to inform planning for risk reduction and emergency response	Informed decision making in New Zealand and the Pacific Islands on managing or planning for the adverse effects of weather-related and marine geological natural hazards, based on quantitative natural hazard impact and loss modelling. Local government plans, regional policy statements, unitary plans and engineering and subdivision development standards are based on, and include, the programme's products, services and tools. For example, the research was used in Resource Management Act processes for hazard-risk planning, as input to a proposed district plan, and for assessing river flooding risk-reduction options. The research informs decisions around regulation of developments within floodplains and coastal areas.	3	1,180,000	1,180,000

Climate and Atmosphere

MBIE priority areas: Climate and atmosphere; Antarctica

SCI programme	Sector benefits	SCP outcome No.	MBIE Strategic Fund Investment ($) Budget 2017	MBIE Strategic Fund Investment ($) Actual 2017
Monitor atmospheric constituents relevant to climate change (including New Zealand's greenhouse gas emissions) to report the state of the atmosphere, improve national inventories, validate mitigation options, and improve models that make long-term predictions of global change	An informed international science community and national stakeholders about the state of the atmosphere in the New Zealand region. The long-term, high-quality measurements (in Wellington, Otago and Antarctica) are submitted to international databases, and used to detect composition variability and change, test climate models, and provide research products for a variety of applications. These are the most comprehensive set of internationally recognised, high-quality measurements in the Southern Hemisphere. Measurements made at the Lauder site (Otago) are of key international importance, including for validating satellite-based carbon measurements. There are strong linkages to the Deep South National Science Challenge, especially in linking model development with international partners.	4, 6	3,180,000	3,140,000
Determine the role of oceans in governing climatically important gases and aerosols, and thereby improve global models	The observation, documentation and analysis of oceanic parameters is critical for monitoring and understanding climate variations and changes in the southwest Pacific, to improve knowledge of ocean processes that contribute to the current climate variability. The programme provides baseline data for future analyses in the data-poor New Zealand region. Data on the variability of CO_2 uptake by the oceans in the region are used in regional carbon models and by the international carbon research community. National and international researchers and policymakers are informed on ocean acidification, particularly in the southwest Pacific region. The programme also supports the Deep South National Science Challenge.	4, 6	1,504,000	1,504,000
Observe and analyse the climate of the New Zealand region, including Antarctica, to determine how the dynamics of the climate system influence our region, and identify the causes of changes	Observations of the atmosphere and ocean are available, and their use is critical in other climate programmes (e.g., climate modelling, impact studies). The programme supports the quality control and analysis of the data to develop an understanding of the climate system around New Zealand, and to detect change. Key climatic indices and time series data are used in scenario-building exercises, and are critical for the provision of accurate and timely advice to national, regional and local government. Key government, business and community groups use the information to better manage lives and businesses, especially in relation to vulnerable sectors.	4, 6	1,030,000	1,030,000
Develop improved predictions of climate and climate extremes on all timescales through dynamical modelling and statistical techniques	Improved climate prediction and weather forecasting products (from weeks to a 50–100 year timescale) provide efficiencies and productivity gains for weather-sensitive sectors of the New Zealand economy, as well as central and local government risk assessment and planning. Operational seasonal climate outlooks are applied widely in hydrology and impact studies. Monthly seasonal climate outlooks for the southwest Pacific promote community awareness and better planning for climate hazards, particularly in regard to water resource availability.	3, 4	1,505,000	1,505,000

SCI programme	Sector benefits	SCP outcome No.	MBIE Strategic Fund Investment ($) Budget 2017	MBIE Strategic Fund Investment ($) Actual 2017
Determine present and future vulnerability, impacts and adaptation options to climate variability and changes in New Zealand, the southwest Pacific, Southern Oceans and Antarctica	Reduced community vulnerability to the risks of climate variability, extreme events and climate change, through the provision and use of better, more easily understood and more policy-relevant information by climate-sensitive end users. This climate information is used by a wide range of decision makers (in organisations such as local and regional councils, sectors such as dryland farming and health, winter season tourism, engineering consultancies, iwi/hāpu, central government, research institutes, media and the general public) to inform, manage and plan their activities. The use of future-focused, risk-based information is increasing, leading to wider-ranging benefits of the research.	4, 6	480,000	480,000
Determine the impacts of air pollutants on human health and evaluate mitigation options	Changing and improving the way air quality is monitored, assessed and managed, through the demonstration and adoption of new monitoring approaches and tools. For example, the distributed monitoring concepts within the CONA (Community Observation Networks for Air) initiative have been adopted in the US in a woodsmoke intervention programme. The establishment of an International Woodsmoke Researchers Network (Catalyst Funding) is giving the science in this programme greater international visibility.	4	1,016,000	1,016,000

Te Kūwaha

MBIE priority area: Land and freshwater resources

SCI programme	Sector benefits	SCP outcome No.	MBIE Strategic Fund Investment ($) Budget 2017	MBIE Strategic Fund Investment ($) Actual 2017
Develop tools for the management and restoration of aquatic taonga species	Enhanced participation of Māori in aquatic resource management, and benefits to the health and wellbeing of taonga species and Māori communities. This includes implementation of taonga/customary species management and restoration strategies, use of frameworks and tools to monitor the success of restoration initiatives, use of databases and decision-support tools for Māori, increased access to existing and new scientific knowledge and tools, and engagement with rangatahi (Māori youth).	1, 5	150,000	150,000
Develop knowledge and tools that support investment and returns from the Māori economy	Application of science expertise across various sectors and across the country to identify key opportunities and priorities for innovative Māori-specific products and Māori economic development. Māori will be able to assess changes in productivity (e.g., gross output, value added) due to science interventions in primary sectors.	1, 5	200,000	200,000

Environmental Information

MBIE priority area: Science collections and infrastructure

SCI programme	Sector benefits	SCP outcome No.	MBIE Strategic Fund Investment ($) Budget 2017	MBIE Strategic Fund Investment ($) Actual 2017
Environmental monitoring: develop innovative environmental monitoring technologies, demonstrate these through benchmark sites, and work with other agencies to ensure consistent and robust environmental monitoring across New Zealand	Access to high-quality data that are used in New Zealand science programmes, placed in international data repositories and used by industry, consultancies, and all levels of government. Ongoing developments are providing greater accessibility of metadata, and continuing investment in modern telemetry methods is enabling more timely information to be collected and disseminated, improving, for example, environmental hazard forecasting. Also supports nationally consistent approaches to environmental data collection (e.g., by contributing to NEMS activities).	1–5	5,400,000	5,132,500
Information management: implement and maintain robust information infrastructures to provide future-proof archives for New Zealand's climate, freshwater, marine and biological information	A robust information infrastructure enables NIWA's environmental data (e.g., freshwater hydrology, freshwater biology, climate) to be managed throughout the entire data life cycle, so it is discoverable, robust and reusable. It ensures the quality and integrity of New Zealand's environmental information for the benefit of all New Zealanders, such as through improvements in environmental state and trend reporting, resource use, business decisions, and responses to environmental hazards.	1–5	1,360,000	1,310,000
Information delivery: develop state-of-the-art, user-centric delivery services that enable information access and re-use for improved resource management and business decisions	Provision of internationally best-practice information delivery mechanisms (e.g., a standardised set of web-service protocols for information transfer, improvements in web delivery portals, a metadata catalogue, etc.) that result in improved discovery and delivery of available data for all stakeholders to use in internal decision making, planning and other processes such as for drought declarations. Standards developed under this programme are being adopted nationally and internationally, and tools are being redeployed and reused by government agencies.	1–5	240,000	240,000

Capability

MBIE priority area: Capability

SCI programme	Sector benefits	SCP outcome No.	MBIE Strategic Fund Investment ($) Budget 2017	MBIE Strategic Fund Investment ($) Actual 2017
National Science Centre operations and end-user engagement	NIWA's National Science Centres provide a communications, outreach and technology-transfer framework for NIWA research and services. Each centre acts as a focal point for effective engagement with key end users, and for the coordination of research in that area for the benefit of New Zealand.	1–5	1,911,094	1,779,997
Key activities to develop capability	Strengthened international collaboration, new skills and capabilities, transfer of international expertise to NIWA and contribution to core research.	1, 3–6	2,523,322	3,129,587

FINANCIAL STATEMENTS

NZ sea lion.
Rob Murdoch

NIWA Group – Statement of comprehensive income

For the year ended 30 June 2017

in thousands of New Zealand dollars	Notes	2017 Actual	2017 SCI Budget	2016 Actual
Revenue and other gains	1			
Revenue		142,617	133,130	130,308
Other gains		1	–	1
Total income		**142,618**	**133,130**	**130,309**
Operating expenses	2			
Employee benefits expense		(65,766)	(64,511)	(63,473)
Other expenses		(56,020)	(52,593)	(46,996)
		(121,786)	**(117,104)**	**(110,469)**
Profit before interest, income tax, depreciation, and amortisation		**20,832**	**16,026**	**19,840**
Depreciation and impairment	4	(14,775)	(14,886)	(14,006)
Amortisation	6	(978)	(908)	(813)
Profit before interest and income tax		**5,079**	**232**	**5,021**
Interest income		871	280	504
Finance expense		–	(6)	(33)
Net interest and other financing income		**871**	**274**	**471**
Profit before income tax		**5,950**	**506**	**5,492**
Income tax expense	9	(1,700)	(144)	(1,481)
Profit for the period		**4,250**	**362**	**4,011**
Other comprehensive income (loss)				
Foreign currency translation differences for foreign operations		(17)	–	(76)
Total comprehensive income for the period		**4,233**	**362**	**3,935**
Profit attributable to:				
Owners of the Parent		4,231	353	3,974
Non-controlling interest		19	9	37
Profit for the period		**4,250**	**362**	**4,011**
Total comprehensive income attributable to:				
Owners of the Parent		4,214	353	3,898
Non-controlling interest		19	9	37
Total comprehensive income for the period		**4,233**	**362**	**3,935**

The accompanying 'Notes to the financial statements' are an integral part of, and should be read in conjunction with, these financial statements.

NIWA Group – Statement of changes in equity

For the year ended 30 June 2017

in thousands of New Zealand dollars	Share capital	Retained earnings	Non-controlling interest	Foreign currency translation reserve	Total equity
Balance at 1 July 2015	**24,799**	**80,608**	**179**	**(184)**	**105,402**
Profit for the year	–	3,974	37	–	4,011
Other comprehensive income	–	–	–	(76)	(76)
Total comprehensive income	–	3,974	37	(76)	3,935
Balance at 30 June 2016	**24,799**	**84,582**	**216**	**(260)**	**109,337**
Balance at 1 July 2016	**24,799**	**84,582**	**216**	**(260)**	**109,337**
Profit for the year	–	4,231	19	–	4,250
Translation of foreign operations	–	–	–	(17)	(17)
Total comprehensive income	–	4,231	19	(17)	4,233
Balance at 30 June 2017	**24,799**	**88,813**	**235**	**(277)**	**113,570**

The accompanying 'Notes to the financial statements' are an integral part of, and should be read in conjunction with, these financial statements.

Share capital

The Group has issued and fully paid capital of 24,798,700 ordinary shares (2016: 24,798,700 ordinary shares). All shares carry equal voting and distribution rights and have no par value.

NIWA Group – Statement of financial position

As at 30 June 2017

in thousands of New Zealand dollars	Notes	2017 Actual	2017 SCI Budget	2016 Actual
EQUITY AND LIABILITIES				
Equity				
Share capital		24,799	24,799	24,799
Equity reserves		88,536	83,862	84,322
Shareholders' interest		**113,335**	**108,661**	**109,121**
Non-controlling interest		235	154	216
Total equity		**113,570**	**108,815**	**109,337**
Non-current liabilities				
Provision for employee entitlements	3	809	425	1,001
Deferred tax liability	10	7,244	7,668	7,050
Total non-current liabilities		**8,053**	**8,093**	**8,051**
Current liabilities				
Payables and accruals		11,375	10,112	11,210
Revenue in advance		14,561	10,554	10,453
Provision for employee entitlements	3	8,044	7,813	7,482
Taxation payable		350	–	545
Forward exchange derivatives		17	–	36
Total current liabilities		**34,347**	**28,479**	**29,726**
Total equity and liabilities		**155,970**	**145,387**	**147,114**
ASSETS				
Non-current assets				
Property, plant, and equipment	4	95,177	104,824	98,782
Identifiable intangibles	6	1,925	110	1,215
Deferred tax asset	10	160	–	–
Prepayments		5	–	38
Total non-current assets		**97,267**	**104,934**	**100,035**
Current assets				
Cash and cash equivalents	11	7,429	17,212	20,328
Other short-term investments	11	25,000	–	–
Receivables	7	13,967	12,262	17,771
Prepayments		2,231	2,863	1,900
Uninvoiced receivables		7,920	5,338	5,065
Taxation receivable		–	749	–
Inventory	8	2,156	2,029	2,015
Total current assets		**58,703**	**40,453**	**47,079**
Total assets		**155,970**	**145,387**	**147,114**

The accompanying 'Notes to the financial statements' are an integral part of, and should be read in conjunction with, these financial statements.

For and on behalf of the Board:

Sir Christopher Mace, KNZM
Chairman

Nicholas Main
Deputy Chairman

The financial statements were authorised for issue by the directors on 17 August 2017.

NIWA Group – Cash flow statement

For the year ended 30 June 2017

in thousands of New Zealand dollars	Notes	2017 Actual	2017 SCI Budget (unaudited)	2016 Actual
Cash flows from operating activities				
Cash was provided from:				
Receipts from customers		147,675	134,960	132,725
Dividends received		1	–	1
Interest received		871	280	504
Cash was disbursed to:				
Payments to employees and suppliers		(121,731)	(119,121)	(107,948)
Interest paid		–	(6)	(33)
Taxation paid		(1,860)	(601)	(2,188)
Net cash inflow from operating activities	11	**24,956**	**15,512**	**23,061**
Cash flows from investing activities				
Cash was provided from:				
Sale of property, plant, and equipment		146	–	64
Investments in other term deposits		22,000	–	–
Cash was applied to:				
Purchase of property, plant, and equipment		(11,311)	(19,742)	(11,835)
Purchase of intangible assets		(1,688)	(907)	(421)
Investments in other term deposits		(47,000)	–	–
Net cash (outflow) from investing activities		**(37,853)**	**(20,649)**	**(12,192)**
Net cash from financing activities		**–**	**–**	**–**
Increase in cash and cash equivalents		**(12,897)**	**(5,137)**	**10,869**
Effects of exchange rate changes on the balance of cash held in foreign currency		(2)	–	(404)
Opening balance of cash and cash equivalents		20,328	22,349	9,863
Closing cash and cash equivalents balance		**7,429**	**17,212**	**20,328**
Made up of:				
Cash at bank		799	17,212	637
Short-term deposits		6,630	–	19,691
Closing cash and cash equivalents balance		**7,429**	**17,212**	**20,328**

The accompanying 'Notes to the financial statements' are an integral part of, and should be read in conjunction with, these financial statements.

Notes to the financial statements for the year ended 30 June 2017

1. Revenue and other gains

Rendering of services

The Group uses the 'percentage-of-completion method' to determine the appropriate amount to recognise in a given period. The stage of completion is measured by reference to the contract costs incurred up to the end of the reporting period as a percentage of total estimated costs for each contract.

Goods sold

Revenue from the sale of goods is measured at the fair value of the consideration received or receivable, net of returns and allowances. Revenue is recognised when the significant risks and rewards of ownership have been transferred to the buyer, recovery of the consideration is probable, the associated costs and possible return of goods can be estimated reliably, and there is no continuing management involvement with the goods. The point at which the significant risks and rewards of ownership transfer to the buyer may vary and will depend on the terms of each individual sale contract.

Strategic funding

NIWA and the Crown are parties to a Strategic Science Investment Fund – Programmes Investment Contract (SSIF Contract) under which the Crown contracts NIWA to perform research activities that support NIWA's Statement of Core Purpose (SCP). Specific SCP outcomes, and their associated delivery programmes, are agreed annually with Shareholding Ministers and documented in NIWA's Statement of Corporate Intent. (Prior to 1 July 2016 this funding was known as Core Funding.)

For financial reporting purposes this Strategic Funding is treated as a Government Grant in terms of NZ IAS 20. Strategic Funding received and recognised during the year was $49.489 million exclusive of GST (2016: $42.854 million). All Strategic Funded projects were completed during the year.

Uninvoiced receivables and revenue in advance

The amount of revenue unbilled at balance date is represented by 'uninvoiced receivables', which are stated in proportion to the stage of completion of the transaction in the statement of financial position. Once this balance is invoiced it is transferred to trade debtors. Management believe there are no significant concentrations of risk relating to this balance.

Revenue received but not earned is recognised as 'revenue in advance'.

Judgement in applying accounting policies

As the Group recognises revenue from service contracts based on their stage of completion at balance date, where such contracts span more than one accounting period management must exercise its judgement over estimates of future contract costs and profitability. These revenues are also subject to ongoing reviews of underlying contracts to verify whether the latest estimates remain appropriate.

Revenue and other gains

in thousands of New Zealand dollars	2017	2016
Research		
Rendering of services	81,417	68,896
Applied Science		
Rendering of services	57,156	57,376
Sale of goods	4,044	4,036
Dividends	1	1
Total revenue and other gains	**142,618**	**130,309**

2. Operating expenses

Employee benefits

in thousands of New Zealand dollars	2017	2016
Defined contribution plans	2,822	2,725
Termination benefits	–	–
Other employee benefits	62,944	60,748
Employee benefit expense	**65,766**	**63,473**

Other Expenses

in thousands of New Zealand dollars	2017	2016
Materials and supplies	7,888	10,489
Research collaboration	20,916	14,671
Property occupancy costs	6,380	5,870
Information technology	5,288	4,860
Remuneration of directors	297	297
Foreign currency (gain) loss	(89)	(38)
Movement within doubtful debt provision	(17)	25
Bad debts written off	–	–
Change in the fair value of derivatives	(19)	(36)
Other expenses	15,197	10,678
Total other expenses	**55,841**	**46,816**

Auditor's remuneration

in thousands of New Zealand dollars	2017	2016
Auditor's remuneration comprises:		
Audit of the financial statements	173	177
Other assurance services (ACC audit)	6	3
Total auditor's remuneration	**179**	**180**

3. Employee entitlements

Liabilities for wages and salaries, including non-monetary benefits and annual leave, long service leave, retirement leave, and training leave are recognised when it is probable that settlement will be required and they are capable of being measured reliably. Provisions, in respect of employee benefits, are measured using the remuneration rate expected to apply at settlement. Employee benefits are separated into current and non-current liabilities. Current liabilities are those benefits that are expected to be settled within 12 months from balance date.

Provisions made in respect of employee benefits which are not expected to be settled within 12 months are measured at the present value of the estimated future cash outflows to be made by the Group in respect of services provided by employees up to the reporting date.

in thousands of New Zealand dollars	2017	2016
Remuneration		
Salary accrual	1,944	1,583
Annual leave	5,314	5,202
Training leave	238	252
Long service leave	876	1,028
Retirement leave	481	418
Total employee entitlements	**8,853**	**8,483**
Comprising:		
Current	8,044	7,482
Non-current	809	1,001

The provisions for long service leave, retirement leave, and training leave are dependent upon a number of factors that are determined by the expected employment period of employees, current remuneration, and the timing of employees' use of the benefits. Any changes in these assumptions will impact on the carrying amount of the liability. The employment period used to determine the appropriate long service leave liability is based upon historical average length of service. The training leave liability is based upon typical historical usage of the benefit.

4. Property, plant and equipment

Property, plant, and equipment is stated at cost less accumulated depreciation to date, less any impairment losses.

Expenditure incurred on property, plant, and equipment is capitalised where such expenditure will increase or enhance the future economic benefits provided by an asset's existing service potential. Expenditure incurred to maintain future economic benefits is classified as repairs and maintenance.

The gain or loss arising on the disposal or retirement of an item of property, plant, and equipment is determined as the difference between the sale proceeds and the carrying amount of the asset and is recognised in profit or loss.

Property, plant, and equipment items, except for freehold land and work in progress, are depreciated on a straight line basis at rates estimated to write off their cost over their estimated useful lives, which are as follows:

Category	Useful life
Buildings and leasehold improvements	5–40 years
Vessels	20–31 years
Plant and equipment	8–10 years
IT equipment	3–8 years
Office equipment	5 years
Furniture and fittings	10 years
Motor vehicles	6 years
Small boats	10 years

Assumptions underlying the estimated useful life of assets include timing of technological obsolescence and future utilisation plans.

Major source of uncertainty

The useful lives of items of property, plant, and equipment are key assumptions concerning the future that have a significant risk of resulting in a material adjustment to the carrying amounts of assets and liabilities within the next financial year.

The Group reviews the estimated useful lives of property, plant, and equipment items during each annual reporting period.

in thousands of New Zealand dollars	Land	Buildings & leasehold improvements	Vessels	Plant & equipment	IT equipment	Office equipment	Furniture & fittings	Motor vehicles	Small boats	Work in progress	Total
Cost											
Balance at 1 July 2016	15,635	50,766	41,532	84,613	21,260	6,348	1,255	4,321	3,157	2,248	231,135
Additions	91	665	255	5,815	1,831	535	129	557	11	1,476	11,365
Transfers	–	1,074	–	325	704	–	–	–	145	(2,248)	–
Disposals	–	(25)	(553)	(766)	(180)	(193)	(4)	(488)	(17)	–	(2,226)
Foreign currency	–	–	–	(3)	9	(7)	–	–	–	–	(1)
Balance at 30 June 2017	15,726	52,480	41,234	89,984	23,624	6,683	1,380	4,390	3,296	1,476	240,273
Accumulated depreciation and impairment losses											
Balance at 1 July 2016	–	27,616	20,542	55,803	17,088	5,210	1,062	3,140	1,892	–	132,353
Depreciation	–	2,360	2,450	6,464	2,481	433	50	407	130	–	14,775
Disposals	–	(20)	(553)	(616)	(167)	(191)	(2)	(487)	(11)	–	(2,047)
Foreign currency adjustment	–	–	–	12	4	(1)	–	–	–	–	15
Balance as at 30 June 2017	–	29,956	22,439	61,663	19,406	5,451	1,110	3,060	2,011	–	145,096
Net book value at 30 June 2017	**15,726**	**22,524**	**18,795**	**28,321**	**4,218**	**1,232**	**270**	**1,330**	**1,285**	**1,476**	**95,177**

in thousands of New Zealand dollars	Land	Buildings & leasehold improvements	Vessels	Plant & equipment	IT equipment	Office equipment	Furniture & fittings	Motor vehicles	Small boats	Work in progress	Total
Cost											
Balance at 1 July 2015	15,635	51,512	40,003	97,427	26,601	8,503	2,272	4,026	3,077	911	249,967
Additions	–	526	1,766	5,285	994	559	78	549	202	2,248	12,207
Transfers	–	–	–	911	–	–	–	–	–	(911)	–
Disposals	–	(1,272)	(237)	(19,007)	(6,323)	(2,712)	(1,091)	(251)	(122)	–	(31,015)
Foreign currency	–	–	–	(3)	(12)	(2)	(4)	(3)	–	–	(24)
Balance at 30 June 2016	15,635	50,766	41,532	84,613	21,260	6,348	1,255	4,321	3,157	2,248	231,135
Accumulated depreciation and impairment losses											
Balance at 1 July 2015	–	26,522	18,125	68,635	21,214	7,536	2,113	3,047	1,903	–	149,095
Depreciation	–	2,321	2,599	6,020	2,206	363	41	346	110	–	14,006
Disposals	–	(1,227)	(182)	(18,845)	(6,308)	(2,687)	(1,090)	(251)	(121)	–	(30,711)
Foreign currency adjustment	–	–	–	(7)	(24)	(2)	(2)	(2)	–	–	(37)
Balance as at 30 June 2016	–	27,616	20,542	55,803	17,088	5,210	1,062	3,140	1,892	–	132,353
Net book value at 30 June 2016	**15,635**	**23,150**	**20,990**	**28,810**	**4,172**	**1,138**	**193**	**1,181**	**1,265**	**2,248**	**98,782**

5. Heritage assets

NIWA has one collection and three databases that have been defined as heritage assets. Heritage collection assets are those assets held for the duration of their physical lives because of their unique scientific importance, and heritage databases are maintained as an incidental part of existing business operations.

NIWA has the following heritage assets:

Type	Description
Marine Benthic Biology Collection	A national reference collection of marine invertebrates.
National Climate Database	A national electronic database of high-quality climate information, including temperatures, rainfall, wind, and other climate elements.
Water Resources Archive Database	A national electronic database of river and lake locations throughout New Zealand, including levels, quality, and flows.
New Zealand Freshwater Fish Database	A national electronic database of the occurrence of fish in the fresh waters of New Zealand, including major offshore islands.

The nature of these heritage assets, and their significance to the science NIWA undertakes, makes it necessary to disclose them. In the directors' view the cost of these heritage assets cannot be assessed with any reliability, and accordingly these assets have not been recognised for reporting purposes.

6. Identifiable intangibles

Purchased identifiable intangible assets, comprising copyrights and software, are recorded at cost less amortisation and impairment. Amortisation is charged on a straight-line basis over the assets' estimated useful lives. The estimated useful life and amortisation method are reviewed each balance date.

Category	Useful life
Copyrights	5 years
Development costs	5 years
Software	3 years

Intangible assets which arise from development costs that meet the recognition criteria are recognised as an asset in the statement of financial position.

Capitalisation is limited to the amount which, taken together with any further related costs, is likely to be recovered from related future economic benefits. Any excess is recognised as an expense.

All other development and research costs are expensed as incurred.

Subsequent to initial recognition, internally generated intangible assets are reported at cost, less accumulated amortisation and accumulated impairment losses, on the same basis as purchased identifiable intangible assets.

in thousands of New Zealand dollars	Software	Copy-rights	Develop-ment costs	Total
Cost				
Balance as at 1 July 2016	7,256	215	35	7,506
Additions	1,688	–	–	1,688
Disposals	(252)	–	–	(252)
Balance as at 30 June 2017	8,692	215	35	8,942
Accumulated amortisation and impairment losses				
Balance as at 1 July 2016	6,068	215	8	6,291
Amortisation	971	–	7	978
Disposals	(252)	–	–	(252)
Balance as at 30 June 2017	6,787	215	15	7,017
Net book value at 30 June 2017	**1,905**	**–**	**20**	**1,925**

in thousands of New Zealand dollars	Software	Copy-rights	Devel-opment costs	Total
Cost				
Balance as at 1 July 2015	9,020	215	35	9,270
Additions	385	–	–	385
Disposals	(2,149)	–	–	(2,149)
Balance as at 30 June 2016	7,256	215	35	7,506
Accumulated amortisation and impairment losses				
Balance as at 1 July 2015	7,402	215	4	7,621
Amortisation	809	–	4	813
Disposals	(2,143)	–	–	(2,143)
Balance as at 30 June 2016	6,068	215	8	6,291
Net book value at 30 June 2016	**1,188**	**–**	**27**	**1,215**

7. Receivables

Receivables are stated at amortised cost using the effective interest rate, less any impairment.

Collectability of receivables is reviewed on an ongoing basis. A provision for doubtful debts is established when there is objective evidence that the Group will not be able to collect all amounts due according to the original terms of receivables. Changes in the carrying amount of the provision are recognised in profit or loss. Debts which are known to be uncollectable are written off against the provision, once approved by the Board of Directors.

in thousands of New Zealand dollars	2017	2016
Trade receivables	13,796	17,735
Sundry receivables	180	62
Provision for doubtful debts	(9)	(26)
Total	**13,967**	**17,771**
Classified as:		
Non-current	–	–
Current	13,967	17,771
Total	**13,967**	**17,771**

Included in the Group's trade receivables balance at the end of the year is one Crown debtor's balance which equates to 20% of the Group's total trade receivables balance (2016: 31%). 97% of that debtor's balance is less than 60 days over-due and is deemed to be low credit risk (2016: 98%).

The Group considers that a large proportion of its customers have a low credit risk associated with them. Before providing any service or goods to a new customer on credit terms, a check is undertaken when deemed appropriate to verify the credit-worthiness of the customer.

The Group reserves the right to charge interest at a rate of 2% per month, calculated daily, on all invoices remaining unpaid at the due date.

Included in the Group's trade receivable balance are debtors with a carrying amount of $138k (2016: $223k) which are past due at the reporting date for which the Group has not provided as the amounts are still considered recoverable. The Group does not hold any collateral over past due or impaired balances.

Included in the provision for doubtful debts are individually identified debts totalling $9k (2016: $26k) for the Group which are unlikely to be recoverable. The provision recognises the difference between the carrying amount of these trade receivables and the expected recoverable amount. The net carrying amount is considered to approximate their fair value.

8. Inventory

Inventory is stated at the lower of cost and net realisable value. The basis on which cost is calculated is first in first out (FIFO) for consumables, finished goods and work in progress; and weighted average for raw materials.

in thousands of New Zealand dollars	2017	2016
Consumables	403	370
Raw materials	309	296
Finished goods	1,444	1,349
Total	**2,156**	**2,015**

9. Income tax

The income tax expense for the period is the tax payable on the current period's taxable income, based on the income tax rate for each jurisdiction. This is then adjusted by changes in deferred tax assets and liabilities attributable to temporary differences between the tax bases of assets and liabilities and their carrying amounts in the financial statements, and changes in unused tax losses.

The income tax expense is determined as follows:

in thousands of New Zealand dollars	2017	2016
Income tax expense		
Current tax	1,666	2,084
Deferred tax relating to temporary differences	34	(603)
Income tax expense	**1,700**	**1,481**

Reconciliation of income tax expense

in thousands of New Zealand dollars	2017	2016
Profit before income tax	**5,950**	**5,492**
Tax at current rate of 28%	1,666	1,538
Adjustments to taxation:		
Other non-deductible expenses	56	48
R&D tax concession	(47)	(91)
(Over)/under provision in previous year	25	(14)
Income taxation expense	**1,700**	**1,481**

10. Deferred tax liability and assets

Deferred tax is accounted for using the balance sheet liability method in respect of temporary differences arising from the carrying amount of assets and liabilities in the financial statements and the corresponding tax base of those items. Deferred tax liabilities are generally recognised for all taxable temporary differences. Deferred tax assets are generally recognised for all deductible temporary differences to the extent that it is probable that sufficient taxable amount will be available against which those deductible temporary differences can be utilised.

Deferred tax liabilities are recognised for the taxable temporary differences arising on investment in subsidiaries, associates and joint

ventures, except where the consolidated entity is able to control the reversal of the temporary differences and it is probable that the temporary difference will not reverse in the foreseeable future. Deferred tax assets arising from deductible temporary difference from these investments are only recognised to the extent that it is probable there will be sufficient taxable profits against which to utilise the asset, and they are expected to reverse in the foreseeable future.

Such assets and liabilities are not recognised if the temporary difference arises from the initial recognition (other than in a business combination) of other assets and liabilities in a transaction that affects neither the taxable profit nor the accounting profit.

Deferred tax assets and liabilities are measured at the tax rates that are expected to apply to the period when the asset and liability giving rise to them are realised or settled, based on the tax laws that have been enacted or substantively enacted at balance date.

Current and deferred tax is recognised in profit or loss, except when it relates to items recognised in other comprehensive income or directly in equity, in which case the deferred or current tax is also recognised in other comprehensive income or directly in equity, or where it arises from the initial accounting for a business combination.

in thousands of New Zealand dollars **As at 30 June 2017**	**Opening balance**	**Credited/ (charged) to profit or loss**	**Closing balance**
Temporary differences			
Property, plant, and equipment	(7,647)	960	(6,687)
Library books	8	–	8
Uninvoiced receivables	(1,418)	(800)	(2,218)
Employee benefits	1,927	(180)	1,747
Doubtful debts	7	(4)	3
R&D Tax credit	73	(10)	63
Total	**(7,050)**	**(34)**	**(7,084)**

Of the net deferred tax balance of $7.084 million, $1.554 million is current.

in thousands of New Zealand dollars **As at 30 June 2016**	**Opening balance**	**Credited/ (charged) to profit or loss**	**Closing balance**
Temporary differences			
Property, plant, and equipment	(8,101)	454	(7,647)
Library books	8	–	8
Uninvoiced receivables	(1,377)	(41)	(1,418)
Employee benefits	1,780	147	1,927
Doubtful debts	–	7	7
R&D Tax Credit	37	36	73
Total	**(7,653)**	**603**	**(7,050)**

In accordance with the Income Tax Act 2007 the Group is not required to establish or maintain an imputation credit account by virtue of its classification as a Crown Research Institute.

11. Cash and cash flows

11a. Cash and cash equivalents and other short-term investments

Cash and cash equivalents includes cash on hand, deposits held at call with financial institutions, and other short-term, highly liquid investments with original maturities of three months or less that are readily convertible to known amounts of cash and which are subject to an insignificant risk of changes in value.

Other short-term investments consists of deposits with financial institutions with maturities over three months which are presented as a separate line item in the statement of financial position.

11b. Reconciliation of the profit for the period to net cash from operating activities

in thousands of New Zealand dollars	**2017**	**2016**
Profit for the period	**4,250**	**4,011**
Add/(less) items classified as investing activities		
Net loss/(gain) on disposal of property, plant and equipment	49	232
Depreciation and impairment	14,775	14,006
Amortisation of identifiable intangibles	978	813
Net foreign currency (gain)/loss	54	327
	15,856	**15,378**
Add/(less) movements in working capital items		
Increase/(decrease) in payables and accruals and revenue in advance	4,219	7,514
Increase/(decrease) in employee entitlements	371	814
Decrease/(Increase) in receivables and prepayments	3,506	(3,783)
Decrease/(Increase) in inventory and uninvoiced receivables	(2,997)	(217)
Decrease/(Increase) in taxation receivable	(230)	(705)
Increase/(decrease) in forward exchange derivatives	(19)	49
	4,850	**3,672**
Net cash flows from operating activities	**24,956**	**23,061**

12. Subsidiaries

The Group financial statements incorporate the financial statements of the Company and entities (including special purpose entities) controlled by the Company. Control is achieved where the Company has the power (including the ability to use the power) to govern the financial and operating policies of an entity so as to obtain benefits from its activities.

All intra-group transactions, balances, income, and expenses are eliminated in full on consolidation.

The subsidiaries of the Group and their activities are listed below:

Name	Country	Principal activities	Ownership
NIWA Vessel Management Ltd	New Zealand	Vessel charters for scientific research	100%
Unidata Pty Ltd	Australia	Supplier of environmental technology products	80%
EcoConnect Ltd	New Zealand	Non-trading company	100%
NIWA Australia Pty Ltd	Australia	Non-trading company	100%
NIWA Environmental Research Institute	USA	Non-trading company	100%
NIWA Natural Solutions Ltd	New Zealand	Non-trading company	100%

All subsidiaries have a balance date of 30 June.

No stake in any subsidiary was acquired or disposed of during the year.

13. Related party transactions

The Government of New Zealand (the Crown) is the ultimate shareholder of the NIWA Group. No transactions with other New Zealand Government-owned entities are considered related party transactions in terms of NZ IAS 24. No related party debts have been written off or forgiven during the year. Any business the NIWA Group has transacted in which a director or an employee has an interest has been carried out on a commercial basis. Any potential conflict is recorded in the minutes of Board meetings for directors and a separate interest register for employees. The interest register containing all relevant interests is updated on a regular and timely basis.

Key management personnel compensation:

in thousands of New Zealand dollars	2017	2016
Short-term benefits	7,342	7,159

The table above includes the remuneration of the Chief Executive and all key management positions.

14. Financial Instruments and Risk Management

The classification of financial assets and liabilities depends on the purpose for which the financial assets and liabilities were incurred. Management determines the classification of the Group's financial assets and liabilities at initial recognition.

Financial assets

Financial assets are classified on initial recognition into the following categories: at fair value through profit or loss and loans and receivables.

Financial assets and liabilities at fair value through profit or loss – Derivative financial instruments

The Group may use derivative financial instruments to hedge its exposure to foreign exchange and interest rate risks arising from operational, financing, and investing activities.

Derivative financial instruments such as forward exchange contracts are categorised as held for trading (unless they qualify for hedge accounting), and are initially recognised in the statement of financial position at fair value. Transaction costs are expensed immediately. Subsequent to initial recognition, derivative financial instruments are stated at fair value. The gain or loss on re-measurement to fair value is recognised immediately in profit or loss unless the derivative is designated and effective as a hedging instrument, in which event the timing of the recognition in profit or loss depends on the nature of the hedge relationship.

Loans and receivables

Loans and receivables are non-derivative financial assets with fixed or determinable payments and are not quoted in an active market. They arise when the Group provides money, goods, or services directly to a debtor with no intention of selling the receivable. They are included in current assets, except for those with maturities greater than 12 months after the statement of financial position date which are classified as a non-current asset. These are subsequently recorded at amortised cost using the effective interest method.

Impairment of financial assets

Financial assets, other than those at fair value through profit or loss, are assessed for indicators of impairment at each balance date. Financial assets are impaired where there is objective evidence that, as a result of one or more events that occurred after the initial recognition of the financial asset, the estimated future cash flows of the investment have been impacted.

For certain categories of financial assets, such as trade receivables, assets that are assessed not to be impaired individually are subsequently assessed for impairment on a collective basis. Objective evidence of impairment for a portfolio of receivables could include the Group's past experience of collecting payments, an increase in the number of delayed payments in the portfolio past the average credit period, as well as observable changes in national or local economic conditions that correlate with default on receivables.

The carrying amount of the financial asset is reduced by the impairment loss with the exception of trade receivables, where the carrying amount is reduced through the use of a provision. When a trade receivable is considered uncollectible, it is written off against the provision. Changes in the carrying amount of the provision are recognised in profit or loss.

Financial liabilities

Financial liabilities are classified as either financial liabilities at fair value through profit or loss or other financial liabilities. Financial liabilities are classified as fair value through profit or loss where the liability is either held for trading or it is designated as fair value. A financial liability is classified as held for trading if it meets similar criteria as financial assets held for trading.

Other financial liabilities are initially measured at fair value through profit or loss, net of transaction costs. Other financial liabilities are subsequently measured at amortised cost using the effective interest method, with interest expense recognised on an effective interest basis.

The Group derecognises financial liabilities when, and only when, the Group's obligations are discharged, cancelled, or they expire.

Capital management

The Group has the following requirements imposed upon it under the Crown Research Institutes Act 1992:

- to operate in a financially responsible manner so that sufficient operating funds are generated to maintain financial viability;
- to provide an adequate rate of return on shareholders' funds; and
- to operate as a going concern.

The Group's policy is to maintain a strong capital base so as to maintain investor and creditor confidence and to sustain future development of the business.

The Group's policies in respect of capital management and allocation are reviewed regularly by the Board of Directors.

The advance facility available from ANZ Bank (refer note 14 subsection financing facilities) is subject to two covenants:

1. That the value of the Group's net tangible assets is greater than $50 million; and
2. That ANZ reserves the right to review the facility in the event of a change in the shareholding structure.

Capital refers to the equity and borrowings of the Group.

There have been no material changes in the Group's management of capital during the period.

Fair value of financial instruments

The carrying value of all financial instruments is considered to approximate fair value.

All of the Group's financial instruments are classified as being within level 2 of the fair value hierarchy as defined by NZ IFRS 13 Fair Value Measurement. Their fair value is determined with reference to quoted rates for identical instruments on active markets.

Credit risk

Credit risk is the risk that a third party will default on its obligations to NIWA and the Group, causing a loss.

In the normal course of business, the Group incurs credit risk from trade receivables, uninvoiced receivables, and transactions with financial institutions (cash and short-term deposits and derivatives).

The Group has a credit policy that is used to manage this risk. As part of this policy, limits are placed on the amounts of credit extended to third parties, and care is taken to ensure the credit-worthiness of third parties dealt with. All credit risk exposures are monitored regularly.

The Group does not require any collateral or security to support financial instruments, because of the quality of financial institutions and counterparties it deals with. There are no significant concentrations of credit risk other than with the New Zealand Government which the Group does not consider to represent a material credit risk.

The exposure to the Group to credit risk as at 30 June 2017 was $54,316k (total exposure to credit risk, comprising cash and cash equivalents $7,429k, other short-term investments $25,000k, uninvoiced receivables $7,920k, and receivables net of provisions $13,967k) (2016: $43,164k).

Further analysis on the trade receivables balance can be found in note 7.

The Group has not renegotiated the terms of any financial assets which would result in the carrying amount no longer being past due or avoid a possible past due status.

The Group's maximum exposure to credit risk by geographic region is as follows:

in thousands of New Zealand dollars	2017	2016
New Zealand	50,600	41,156
Australia	958	971
USA	108	587
Other Asia Pacific countries	2,606	368
Other regions	53	108
Provision for doubtful debts	(9)	(26)
Total credit risk	**54,316**	**43,164**

Interest rate risk

Interest rate risk is the risk that cashflows will fluctuate because of changes in market interest rates. This could particularly affect the return on investments.

The interest rates on the Group investments as at 30 June:

	2017	2016
Cash (on call)	1.75%	2.25% – 3.0%
Other short-term investments	2.47% – 3.69%	–

The directors do not consider there is any significant exposure to interest rate risk.

Currency risk

The Group undertakes transactions in foreign currencies from time to time, and, resulting from these activities, exposures in foreign currency arise. It is the Group's policy to hedge foreign currency trading transaction risks economically as they arise. To manage these exposures, the Group may use financial instruments such as forward foreign exchange contracts. At balance date, the Group had forward foreign exchange arrangements in place with a New Zealand dollar (NZD) fair value of $17k (2016: $36k).

The Group's exposure to foreign currency denominated non-derivative financial instruments was as follows, based on notional amounts:

in thousands of New Zealand dollars **30 June 2017**	**AUD**	**EUR**	**USD**	**FJD**	**GBP**	**CAD**
Cash balances	394	7	34	–	3	14
Trade receivables	466	30	129	41	–	–
Trade payables	(219)	(66)	(91)	–	(66)	–
Statement of financial position exposure	641	(29)	72	41	(62)	14

in thousands of New Zealand dollars **30 June 2016**	**AUD**	**EUR**	**USD**	**FJD**	**GBP**	**CAD**
Cash balances	211	2	12	–	22	4
Trade receivables	709	14	429	–	–	–
Trade payables	(185)	(23)	(435)	–	(4)	(13)
Statement of financial position exposure	735	(7)	6	–	18	(9)

NIWA has a regularly reviewed treasury management policy in place which ensures the appropriate management of currency risk.

Liquidity risks

Liquidity risk represents the Group's ability to meet its contractual obligations. The Group evaluates its liquidity requirements on an ongoing basis. In general, the Group generates sufficient cash flows from its operating activities to meet its obligations arising from its financial liabilities and has credit lines in place to cover potential shortfalls.

Payables and accruals of $8.372 million (2016: $9.576 million) having a maturity of less than one year are the Group's contractual maturity. This is based upon the earliest date on which the Group can be required to pay.

Financing facilities

The Group has access to financing facilities made available by ANZ Bank with a total value of $10.5 million (2016: $10.5 million). This was undrawn at 30 June 2017 (2016: also undrawn). The total facility of $10.5 million relates to an overdraft facility of $0.5 million (on-call) and an overnight placement and short term advance facility of $10 million (2016: $10.5 million).

15. Leases

Leases are classified as finance leases whenever the terms of the lease transfer substantially all of the risks and rewards of ownership to the lessee. All other leases are classified as operating leases.

Operating lease payments are recognised on a systematic basis that is representative of the benefit to the Group (straight line).

in thousands of New Zealand dollars	**2017**	**2016**
Lease expense recognised in the year	2,256	2,213
Obligations payable after balance date on non-cancellable operating leases:		
Within 1 year	2,555	2,592
Between 1 and 2 years	1,885	1,912
Between 2 and 5 years	2,542	4,210
Over 5 years	2,852	2,819
Total obligations payable	**9,834**	**11,533**

Operating leases relate to office and laboratory facilities within New Zealand and Australia with lease terms between 1 and 11 years, with various options to extend.

16. Capital commitments

in thousands of New Zealand dollars	**2017**	**2016**
Commitments for future capital expenditure		
Contracted, but not provided for	20,200	590

On 8 June 2017 NIWA entered into a contract for the purchase of High-Performance Computing capability on behalf of itself as well as other collaborators within the National eScience Infrastructure (NeSI) arrangements. This contract included a commitment of $19.8 million for future capital expenditure of which $15.1 million is for equipment which will be owned by NIWA. The remaining balance of the capital expenditure commitment is in respect of equipment which will be owned and funded by the other NeSI collaborators.

17. Contingent liabilities

There are no material contingent liabilities at 30 June 2017 (2016: Nil).

18. Subsequent events

There are no material events occurring subsequent to 30 June 2017 which require adjustment or disclosure in the financial statements.

Preparation disclosures

Reporting entity

National Institute of Water and Atmospheric Research Limited ('NIWA' or 'the Company') and its subsidiaries form the consolidated Group ('the NIWA Group' or 'the Group'). NIWA is a profit-oriented company registered in New Zealand under the Companies Act 1993.

The financial statements for the NIWA Group are presented in accordance with the requirements of the Crown Research Institutes Act 1992, the Crown Entities Act 2004, the Public Finance Act 1989, the Companies Act 1993, and the Financial Reporting Act 2013.

Nature of activities

The NIWA Group conducts research and commercial science in water and atmospheric sciences in New Zealand and internationally.

Basis of preparation

The measurement basis adopted in the preparation of these financial statements is historical cost, except for financial instruments as identified in specific accounting policies above.

The presentation currency of the Group and functional currency used in the preparation of these financial statements is New Zealand dollars.

All amounts disclosed in the financial statements and notes have been rounded to the nearest thousand New Zealand dollars unless otherwise stated.

Accounting policies are selected and applied in a manner that ensures that the resulting financial information meets the concepts of relevance and reliability, ensuring that the substance of the underlying transaction or event is reported.

The accounting policies have been applied in preparing the financial statements for the year ended 30 June 2017 and the comparative information for the year ended 30 June 2016.

Statement of compliance

The financial statements have been prepared in accordance with New Zealand generally accepted accounting practice (NZ GAAP). They comply with New Zealand Equivalents to International Financial Reporting Standards (NZ IFRS) and other applicable financial reporting standards appropriate for profit-oriented entities.

The financial statements comply with International Financial Reporting Standards (IFRS).

Goods and services tax (GST)

These financial statements are prepared on a GST-exclusive basis, except for receivables and payables, which are stated GST-inclusive.

Foreign currencies

Transactions

Transactions in foreign currencies are converted to the functional currency of the Group, being New Zealand dollars, by applying the spot exchange rate between the functional currency and the foreign currency at the date of transaction. At the end of each reporting period, monetary assets and liabilities are translated to New Zealand dollars using the closing rate of exchange at balance date, and any exchange gains or losses are recognised in the statement of comprehensive income.

Translation of foreign operations

On consolidation, revenues and expenses of foreign operations are translated to New Zealand dollars at the average exchange rates for the period. Assets and liabilities are converted to New Zealand dollars at the rates of exchange ruling at balance date. Exchange rate differences arising from the translation of the foreign operations are recognised in other comprehensive income and accumulated as a separate component of equity in the Group's foreign currency translation reserve. Such exchange differences are reclassified from equity to profit or loss (as a reclassification adjustment) when the foreign operation is disposed of.

Adoption of new and revised standards

Certain new accounting standards and interpretations have been published that are not mandatory for 30 June 2017 reporting periods and have not been early adopted by the Group.

The key items applicable to the Group are:

NZ IFRS 9: Financial Instruments (effective for accounting periods beginning on or after 1 January 2018)

NZ IFRS 9 addresses the classification, measurement and recognition of financial assets and financial liabilities. It replaces the guidance in NZ IAS 39 that relates to the classification and measurement of financial instruments. Whilst there are some changes to classification, determination of impairment of financial assets and related hedge effectiveness requirements, given the nature of the Group's financial instruments, it is unlikely that there will be any significant impact from the adoption of this standard.

The Group intends to adopt NZ IFRS 9 on 1 July 2018.

NZ IFRS 15: Revenue from contracts with customers (effective for annual periods beginning on or after 1 January 2018)

NZ IFRS 15 deals with revenue recognition and establishes principles for reporting useful information to users of financial statements about the nature, amount, timing and uncertainty of revenue and cash flows arising from an entity's contracts with customers. Revenue is recognised when a customer obtains control of a good or service and thus has the ability to direct the use and obtain the benefits from the good or service. The standard replaces NZ IAS 18 'Revenue' and NZ IAS 11 'Construction contracts' and related interpretations. The standard is effective for annual periods beginning on or after 1 January 2018 and earlier application is permitted.

The Group intends to adopt NZ IFRS 15 on 1 July 2018. NIWA has commenced a detailed impact analysis. All contracts will be reviewed to consider whether there are multiple performance obligations, when revenue should be recognised, and principal/agency categorisation. There may be some changes to revenue recognition.

NZ IFRS 16: Leases (effective for annual periods beginning on or after 1 January 2019)

NZ IFRS 16 replaces the current guidance in NZ IAS 17. NZ IFRS 16 now requires a lessee to recognise a lease liability reflecting future lease payments and a 'right-of-use asset' for virtually all lease contracts. Included is an optional exemption for certain short-term leases and leases of low-value assets; however, this exemption can only be applied by lessees. The standard is effective for accounting periods beginning on or after 1 January 2019. Early adoption is permitted but only in conjunction with NZ IFRS 15, 'Revenue from Contracts with Customers.

The Group intends to adopt NZ IFRS 16 on 1 July 2019. The Group will recognise a right-to-use asset and a corresponding lease liability for the majority of leases currently treated as operating leases.

There are no other standards that are not yet effective and that would be expected to have a material impact on the Group.

Auditor's Report

Independent Auditor's Report

To the readers of National Institute of Water and Atmospheric Research Limited's Group Financial Statements for the year ended 30 June 2017

The Auditor-General is the auditor of National Institute of Water and Atmospheric Research Limited and its controlled entities (the Group). The Auditor-General has appointed me, Karen Shires, using the staff and resources of PricewaterhouseCoopers, to carry out the audit of the financial statements of the Group on his behalf.

Our opinion

We have audited the financial statements of the Group on pages 103 to 116, that comprise the statement of financial position as at 30 June 2017, the statement of comprehensive income, statement of changes in equity and cash flow statement for the year ended on that date and the notes to the financial statements that include accounting policies and other explanatory information.

In our opinion, the financial statements of the Group:

- present fairly, in all material respects, its financial position as at 30 June 2017 and its financial performance and cash flows for the year then ended; and
- comply with generally accepted accounting practice in New Zealand in accordance with New Zealand Equivalents to International Financial Reporting Standards (NZ IFRS).

Our audit was completed on 17 August 2017. This is the date at which our opinion is expressed.

The basis for our opinion is explained below. In addition, we outline the responsibilities of the Board of Directors and our responsibilities relating to the financial statements, we comment on other information, and we explain our independence.

Basis for our opinion

We carried out our audit in accordance with the Auditor-General's Auditing Standards, which incorporate the Professional and Ethical Standards and the International Standards on Auditing (New Zealand) issued by the New Zealand Auditing and Assurance Standards Board. Our responsibilities under those standards are further described in the Responsibilities of the auditor section of our report.

We have fulfilled our responsibilities in accordance with the Auditor-General's Auditing Standards.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

Responsibilities of the Board of Directors for the financial statements

The Board of Directors is responsible on behalf of the Group for preparing financial statements that are fairly presented and that comply with generally accepted accounting practice in New Zealand.

The Board of Directors is responsible for such internal control as it determines is necessary to enable it to prepare financial statements that are free from material misstatement, whether due to fraud or error.

In preparing the financial statements, the Board of Directors is responsible on behalf of the Group for assessing the Group's ability to continue as a going concern. The Board of Directors is also responsible for disclosing, as applicable, matters related to going concern and using the going concern basis of accounting, unless the Board of Directors has to cease operations, or has no realistic alternative but to do so.

The Board of Directors' responsibilities arise from the Crown Research Institutes Act 1992.

Responsibilities of the auditor for the audit of the financial statements

Our objectives are to obtain reasonable assurance about whether the financial statements, as a whole, are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion.

Reasonable assurance is a high level of assurance, but it is not a guarantee that an audit carried out in accordance with the Auditor-General's Auditing Standards will always detect a material misstatement when it exists. Misstatements are differences or omissions of amounts or disclosures and can arise from fraud or error. Misstatements are considered material if, individually or in the aggregate, they could reasonably be expected to influence the decisions of readers taken on the basis of these financial statements.

For the budget information reported in the financial statements, our procedures were limited to checking that the information agreed to the Group's Statement of Corporate Intent.

We did not evaluate the security and controls over the electronic publication of the financial statements.

As part of an audit in accordance with the Auditor-General's Auditing Standards, we exercise professional judgement and maintain professional scepticism throughout the audit. Also:

- We identify and assess the risks of material misstatement of the financial statements, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for our opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control.
- We obtain an understanding of internal control relevant to the audit 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 Group's internal control.
- We evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by the Board of Directors.
- We conclude on the appropriateness of the use of the going concern basis of accounting by the Board of Directors and, based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on the Group's ability to continue as a going concern. If we conclude that a material uncertainty exists, we are required to draw attention in our auditor's report to the related disclosures in the financial statements or, if such disclosures are inadequate, to modify our opinion. Our conclusions are based on the audit evidence obtained up to the date of our auditor's report. However, future events or conditions may cause the Group to cease to continue as a going concern.
- We evaluate the overall presentation, structure and content of the financial statements, including the disclosures and whether the financial statements represent the underlying transactions and events in a manner that achieves fair presentation.
- We obtain sufficient appropriate audit evidence regarding the financial statements of the entities or business activities within the Group to express an opinion on the consolidated financial statements. We are responsible for the direction, supervision and performance of the Group audit. We remain solely responsible for our audit opinion.

We communicate with the Board of Directors regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that we identify during our audit.

Our responsibilities arise from the Public Audit Act 2001.

Other information

The Board of Directors is responsible for the other information. The other information comprises the information included on pages 2-119 but does not include the financial statements, and our auditor's report thereon.

Our opinion on the financial statements does not cover the other information and we do not express any form of audit opinion or assurance conclusion thereon.

In connection with our audit of the financial statements, our responsibility is to read the other information. In doing so, we consider whether the other information is materially inconsistent with the financial statements or our knowledge obtained in the audit, or otherwise appears to be materially misstated. If, based on our work, we conclude that there is a material misstatement of this other information, we are required to report that fact. We have nothing to report in this regard.

Independence

We are independent of the Group in accordance with the independence requirements of the Auditor-General's Auditing Standards, which incorporate the independence requirements of Professional and Ethical Standard 1 (Revised): Code of Ethics for Assurance Practitioners issued by the New Zealand Auditing and Assurance Standards Board.

In addition to the audit, we have carried out an ACC Partnership Program assurance engagement, which is compatible with those independence requirements. Other than the audit and this engagement, we have no relationship with, or interests in, the Group.

Karen Shires
PricewaterhouseCoopers
On behalf of the Auditor-General
Auckland, New Zealand

Corporate governance and disclosures

Board and committee meeting attendance

The Board held 11 full meetings and one special meeting during the year. The Audit, Risk and Legislative Compliance Committee (ARLC Committee) held four meetings during the year. The table below shows director attendance at these Board meetings and committee member attendance at committee meetings. In addition, any director may attend any committee meeting.

Director	Board meetings	Special Board meetings	ARLC Committee
Sir Christopher Mace, KNZM (Chairman)	10	1	3*
Nicholas Main (Deputy Chairman)	11	1	4
Dr Helen Anderson	11	1	–
Prof Keith Hunter	10	1	–
Prof Gillian Lewis	11	1	–
Michael Pohio	10	1	3
Jason Shoebridge	11	1	4

* Sir Christopher Mace attends ARLC Committee meetings in an ex officio capacity.

Directors' remuneration

The total remuneration received or receivable by directors of NIWA during the year was:

in thousands of New Zealand dollars	2017	2016
Sir Christopher Mace, KNZM (Chairman)	72	72
Nicholas Main (Deputy Chairman)	45	45
Dr Helen Anderson	36	36
Prof Keith Hunter	36	36
Prof Gillian Lewis	36	36
Michael Pohio	36	36
Jason Shoebridge	36	36

Subsidiary company directors

The following people held office as directors of NIWA's subsidiary companies at 30 June 2017:

Subsidiary Company	Directors
NIWA Vessel Management Ltd	C Mace, N Main, H Anderson, K Hunter, G Lewis, M Pohio, J Shoebridge
Unidata Pty Ltd	B Cooper[1], B Biggs[1], D Saunders[2]
EcoConnect Ltd	J Morgan[1], P Baker[1]
NIWA Australia Pty Ltd	C Mace, N Main, H Anderson, K Hunter, G Lewis, M Pohio, J Shoebridge
NIWA Environmental Research Institute	C Mace, N Main, H Anderson, K Hunter, G Lewis, M Pohio, J Shoebridge
NIWA Natural Solutions Ltd	J Morgan[1], P Baker[1]

[1] Employee of the Group's parent company

[2] Appointed by the minority ownership interest in Unidata Pty Ltd

No fees were paid in respect of membership of subsidiary boards.

Insurance for directors and employees

The NIWA Group has arranged insurance policies for directors and employees which, with a deed of indemnity, ensure that they will generally incur no monetary loss as a result of lawful actions undertaken by them as directors or employees. These include, among others, directors and officers and professional indemnity policies. Certain risks are specifically excluded from the cover provided, including the imposition of penalties and fines in respect of breaches of the law.

Auditors

In accordance with Section 21(1) of the Crown Research Institutes Act 1992, the Group's auditor is the Auditor-General. The Auditor-General has appointed Karen Shires of PricewaterhouseCoopers to conduct the audit on his behalf. Their audit remuneration and fees paid for other services are detailed in note 2.

Interests register

The following are transaction types recorded in the interests register for the year.

Interested transactions

Any business the NIWA Group has transacted in which a director has an interest has been carried out on a commercial basis. Any potential conflict is recorded in the minutes of Board meetings. A register containing all relevant interests is updated on a monthly basis.

Directors' remuneration

Details of the directors' remuneration are provided in the 'Directors' remuneration' section above.

Use of company information by directors

Pursuant to section 145 of the Companies Act 1993 there were no recorded notices from directors requesting to use company information received in their capacity as directors that would not otherwise have been available to them.

Share dealings

During the year no director purchased, disposed of, or had recorded dealings of any equity securities of the NIWA Group.

Directors' loans

No loans by the NIWA Group to any director were made or were outstanding during the year.

Employees' remuneration

The number of employees (not including directors) whose remuneration exceeded $100,000 during the year, stated in brackets of $10,000, was:

	2017
100,000–109,999	49
110,000–119,999	47
120,000–129,999	36
130,000–139,999	23
140,000–149,999	9
150,000–159,999	10
160,000–169,999	9
170,000–179,999	10
180,000–189,999	3
190,000–199,999	7
210,000–219,999	3
250,000–259,999	2
300,000–309,999	1
330,000–339,999	1
340,000–349,999	1
390,000–399,999	1
610,000–619,999	1

The remuneration reflected in the above table comprises base salary and at-risk salary components.

In 2017, the Group did not make any payments for compensation or other benefits in respect of the cessation of employment of employees (2016: Nil).

Donations

Donations of $4,219 were made during the year (2016: $5,749).

Statement of responsibility

The following statement is made in accordance with section 155 of the Crown Entities Act 2004.

1. The Board of the Company is responsible for the preparation of these financial statements and the judgements used therein.
2. The Board of the Company is responsible for establishing and maintaining a system of internal controls designed to provide reasonable assurance as to the integrity and reliability of financial reporting.
3. In the opinion of the Board, these financial statements reflect a true and fair view of the financial position and operations of the Group for the year ended 30 June 2017

Sir Christopher Mace, KNZM
Chairman

Nicholas Main
Deputy Chairman

17 August 2017

DIRECTORY

National Institute of Water & Atmospheric Research Ltd

Directors

Sir Christopher Mace, KNZM
Chairman

Nicholas Main Deputy Chairman

Dr Helen Anderson

Prof. Keith Hunter

Prof. Gillian Lewis

Michael Pohio

Jason Shoebridge

Executive Team

John Morgan
Chief Executive

Geoff Baird
General Manager,
Communications and Marketing

Patrick Baker
Chief Financial Officer

Dr Barry Biggs
General Manager, Operations

Dr Bryce Cooper
General Manager, Strategy

Dr Mary-Anne Dehar
General Manager,
Human Resources,
Information Technology

Dr Rob Murdoch
General Manager, Research

Registered office and address for service

41 Market Place Auckland
Central 1010 New Zealand

Auditor

Karen Shires with the assistance of PricewaterhouseCoopers on behalf of the Auditor-General

Bankers

ANZ Bank of New Zealand Ltd

Solicitors

Meredith Connell

Atkins Holm Majurey

Insurance broker

Marsh Ltd

Head office

41 Market Place
Auckland Central 1010
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NIWA
Taihoro Nukurangi
Enhancing the benefits of New Zealand's natural resources