NIWA
Taihoro Nukurangi

Annual Report 2012

enhancing the benefits of New Zealand's natural resources

2012

Cover: *As New Zealand's leading environmental science provider, NIWA's role is to enhance the benefits of the nation's vast natural resources, in a sustainable way. We work across all environments to help people better manage their businesses and their lives.*

This page: *NIWA's Hauraki Gulf poster, published this year, reveals a coastline shaped by volcanism, tectonic upheaval and changing sea levels, and a seafloor with a signature of sedimentation with small areas of scour, reefs and rock pinnacles.*

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NIWA Annual Report for 2012

enhancing the economic value and sustainable management of New Zealand's aquatic resources

understanding climate and atmosphere

increasing resilience to weather and climate hazards

Courage and tenacity through times of change

Albert Einstein said "the measure of intelligence is the ability to change". It is also a measure of courage and tenacity. Faced with the unprecedented difficulties New Zealand has endured in recent times – including the ongoing impacts of the global financial crisis and the devastating Canterbury earthquakes – the need to adapt to change remains paramount.

In responding to this evolving economic environment, the Government has outlined three strategies to recover and grow the New Zealand economy – building a more productive and competitive economy, delivering better public services and rebuilding Christchurch. Those changes include the formation of two new Government Ministries closely linked to NIWA's work – the Ministry of Business, Innovation and Employment (MBIE) and the Ministry for Primary Industries.

Through the creation of both Ministries, and the announcement of a $385 million boost in funding for science, innovation and research in this year's budget, the Government has clearly signalled its intention to drive New Zealand's growth and international competitiveness by developing much closer connections between industry, business, science and innovation. At NIWA, we have long recognised the benefits of collaboration between science and the various sectors and industries we support. Our science is helping a wide range of organisations answer the important issues we face – such as water quality and water allocation, energy supply, resource management, the changing climate, impacts of natural hazards and extreme weather – but also helping them to make the most of new opportunities, particularly through the sustainable use of our natural resources. As New Zealand's leading natural resources and environmental science services provider, we look forward to working with the new Ministries to continue driving New Zealand's economic and environmental prosperity forward.

Over the last twenty years, since our inception in 1992, NIWA has changed considerably – continually refining how we do things to ensure that we are well placed to meet the demand for our expertise. This year has been no different. Recognising that the economic environment we are working in will continue to undergo significant shifts in the coming years, we too have implemented new strategies to ensure NIWA maintains the appropriate capabilities and assets to meet the country's science and innovation needs, whilst at the same time using our limited resources wisely. By adapting quickly and responsively, we have performed strongly this year.

NIWA has the scientific skills and expertise to answer some of the most serious and pressing issues facing New Zealand, and the world, so the demand for our services is higher than ever. To help support our science and technology transfer, we have also continued to invest in new technology,

> Our science is helping a wide range of organisations answer the important issues ... water quality and allocation, the changing climate ... but also helping them to make the most of new opportunities.

upgraded our facilities and made sure our support services are operating in the most efficient and effective way. With these continued areas of focus, the Board is confident we stand in good stead to meet our responsibilities, outlined in our Statement of Core Purpose, this coming year.

I want to personally thank my fellow Directors, John Morgan and his Executive Team, and all the other NIWA staff for their ongoing hard work and commitment, in what has been a challenging but rewarding year. I would also like to thank Dr Wendy Lawson for her contribution to NIWA's Board and wish her all the best for the future. Dr Lawson's position has been filled by Prof. Keith Hunter, Pro-Vice-Chancellor of Sciences at the University of Otago. We welcome Prof. Hunter to the NIWA team and know that he will provide very valuable input as a Director.

Finally, I would also like to acknowledge the untimely death of Sir Paul Callaghan earlier this year. Sir Paul was a not only a world-leading scientist, but an outstanding New Zealander who inspired and taught many. He will be particularly missed by his colleagues in the science sector.

NIWA is proud of its achievements this financial year and the contribution we have made to enhancing New Zealand's economic and environmental prosperity through the delivery of world-class environmental research and applied science services. We look forward to the challenges and opportunities in the year ahead.

Chris Mace
Chairman

Chief Executive John Morgan (left) and Chairman Chris Mace.

$121.4 MILLION	revenue from research and applied science services
$18.9 MILLION	EBITDA
$5.5 MILLION	profit after tax
$95.5 MILLION	capital investment over the last 5 years
$134.5 MILLION	total assets

A challenging year in which we have made excellent progress

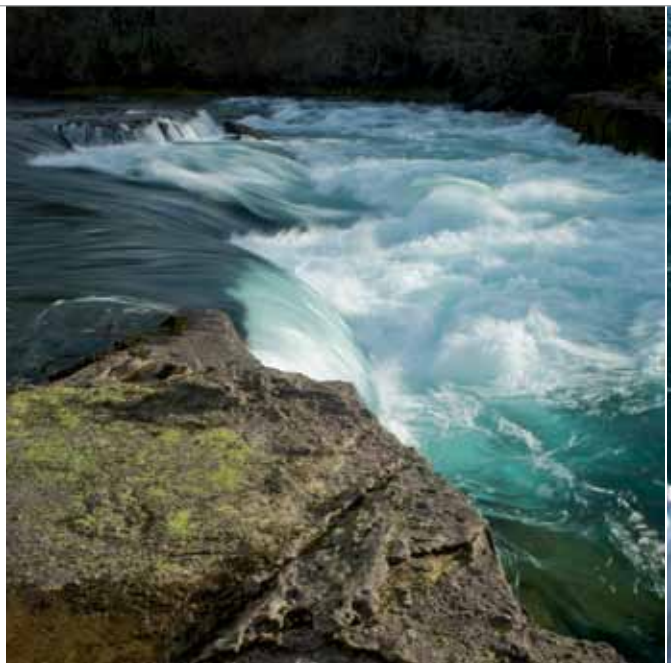
Over my five years as NIWA's Chief Executive, I have seen our country face some of its most challenging and difficult times, significantly changing both the economic and natural environment we work in. The natural resource and environmental opportunities and challenges we face – like water quality and allocation, marine resource use, natural hazards, biosecurity and climate change – are more prevalent than ever, and uncertainty in our economic environment requires all businesses to be more responsive and resilient. There are no quick fixes to either of these issues. Sound, long-term strategies will ensure we are well set up to face those challenges head on in the future.

Recognising this need, we have continued to change our structure and operations to ensure we maintain the appropriate capabilities and assets to meet the country's science and innovation needs, whilst still being prudent about increasing efficiencies and reducing waste.

Our response to the new environment we face has included streamlining many of our internal finance and administration systems so that our business operates more effectively and efficiently, continuing to carefully manage our costs but also making important investments in new technology and equipment to support our science staff, and reviewing our science capabilities and capacity to ensure we are well placed to meet New Zealand's environmental research and applied science service needs.

These reviews have resulted in changes to the way our national science centres are set up – by merging our coasts and oceans centres and changing our freshwater centre to the National Centre for Freshwater and Estuaries. Both changes are designed to ensure we have the right skills and expertise to focus our efforts on these vital areas of our natural environment as demand in these areas of science continues to grow.

To ensure our capabilities continue to meet demand, we have also established new advisory panels to help



The natural resource and environmental opportunities and challenges we face – like water quality and allocation, marine resource use, natural hazards, biosecurity and climate change – are more prevalent than ever ...

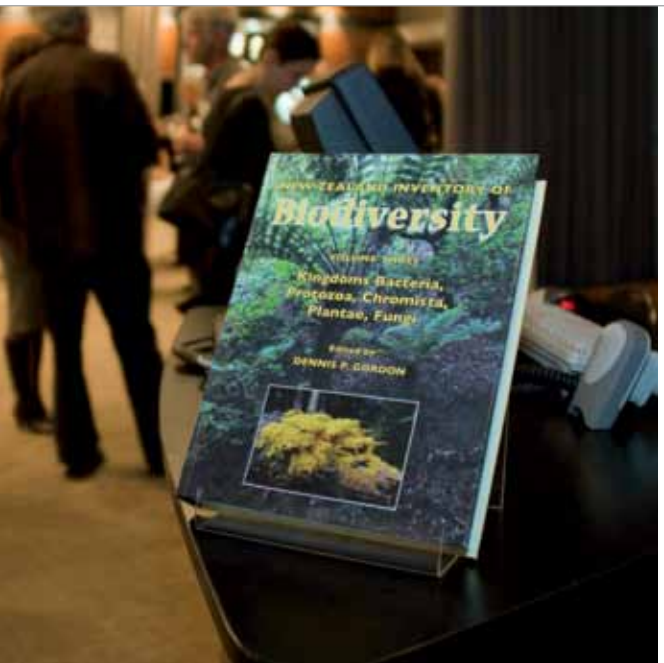
with our science planning process. These include a Strategic Advisory Panel that plays a key role in providing independent and forward-looking advice to the Board on research strategies, user relevance and knowledge transfer activities. We also have stakeholder panels who provide external advice to our national science centres on relevant research directions. We are grateful to these panel members for their extremely valuable input this year.

Through all these activities, and by showing a willingness to respond and adapt to the shifting environment we face, we had a strong year in 2011–12. Our final results show revenue of $121.4 million (2010–11: $117.9 million), with earnings before interest, tax, and depreciation (EBITDA) of $18.9 million ($16.3 million) and profit after tax of $5.5 million ($1.3 million). This is a pleasing achievement in a tough operating environment, and we can be rightly proud of these results.

Science that ensures our prosperity

New Zealand's environment is rich with natural resources. To ensure the nation's economic prosperity in the future, NIWA scientists are exploring ways to make greater use of those resources sustainably. This year that research has included Oceans Survey 20/20 voyages on board our deepwater research vessel *Tangaroa* to collect key seabed data that will help inform future development and management of potential oil and gas resources around coastal New Zealand (see page 19). Equipped with New Zealand's only DP2 (dynamic positioning) system, and ice-strengthened for work in Antarctica, *Tangaroa* is a New Zealand asset key to the continued enhancement of the country's marine resources, and it is set to make its tenth journey to Antarctica in 2013.

Our science staff continue to work closely with the aquaculture industry, helping the sector to meet its $1 billion target by 2025. For over 30 years, NIWA and its predecessors have worked closely with New Zealand's salmon industry to explore ways of adding value through applied research. The industry earns more than $60 million in exports each year and a similar amount from domestic markets. Results of our research have fed directly into the industry's breeding programmes, and as a result commercial production stocks are expected to improve significantly in future seasons, with direct financial benefits (see page 19). Working closely with the aquaculture industry, we are also continuing to progress the development of commercial farming of several high-value species, including kingfish and hāpuku.



From left to right: *Freshwater – one of our nation's fundamental competitive advantages. [Dave Allen]*

'Phred' – a great white shark being studied by NIWA, Department of Conservation (DOC), and University of Auckland scientists, takes offence to the underwater camera used for photo identification. [Chris Mace]

The New Zealand Inventory of Biodiversity, *edited by NIWA's Dr Dennis Gordon, is the only catalogue of a country's entire known living and fossil life in the world. [Dave Allen]*

Science that sustains our environment

How we look after our natural resources is also important. The Speech from the Throne, December 2011, emphasised that "balanced and sensible management of our resources will protect the environment while promoting stronger economic growth". NIWA's science makes a very important contribution to the sustainable management and development of our natural resources. For example, we collaborate with the fishing industry, the Ministry for Primary Industries and other research providers to survey abundance and analyse catch and age information on more than 100 commercial fish species. We have estimated sustainable harvest levels from complex population modeling of 20 key species, and we provide vital information to the international agency CCAMLR (Commission for the Conservation of Antarctic Marine Living Resources) on the sustainable management of Antarctic toothfish (see page 29).

On a lighter note, we were even able to deliver New Zealand's favourite emperor penguin, Happy Feet, home to his natural environment in the sub-Antarctic, courtesy of a fortuitously timetabled southern blue whiting survey earlier this year.

We are also learning more about the unique species that live in our environment. On a recent trip on *Tangaroa* to the north Chatham Rise, our scientists trawled deeper than ever before – down to 2730 metres, and found new-to-science fish close to the deep ocean seafloor. NIWA was also part of a team that discovered three new-to-science species down one of the world's deepest underwater caves near Nelson, brought home new footage of an undersea volcano from the Kermadecs, and discovered a 'supergiant' amphipod in the Kermadec Trench: discoveries that all contribute to our understanding of New Zealand's unique biodiversity, helping ensure we can sustain and protect it.

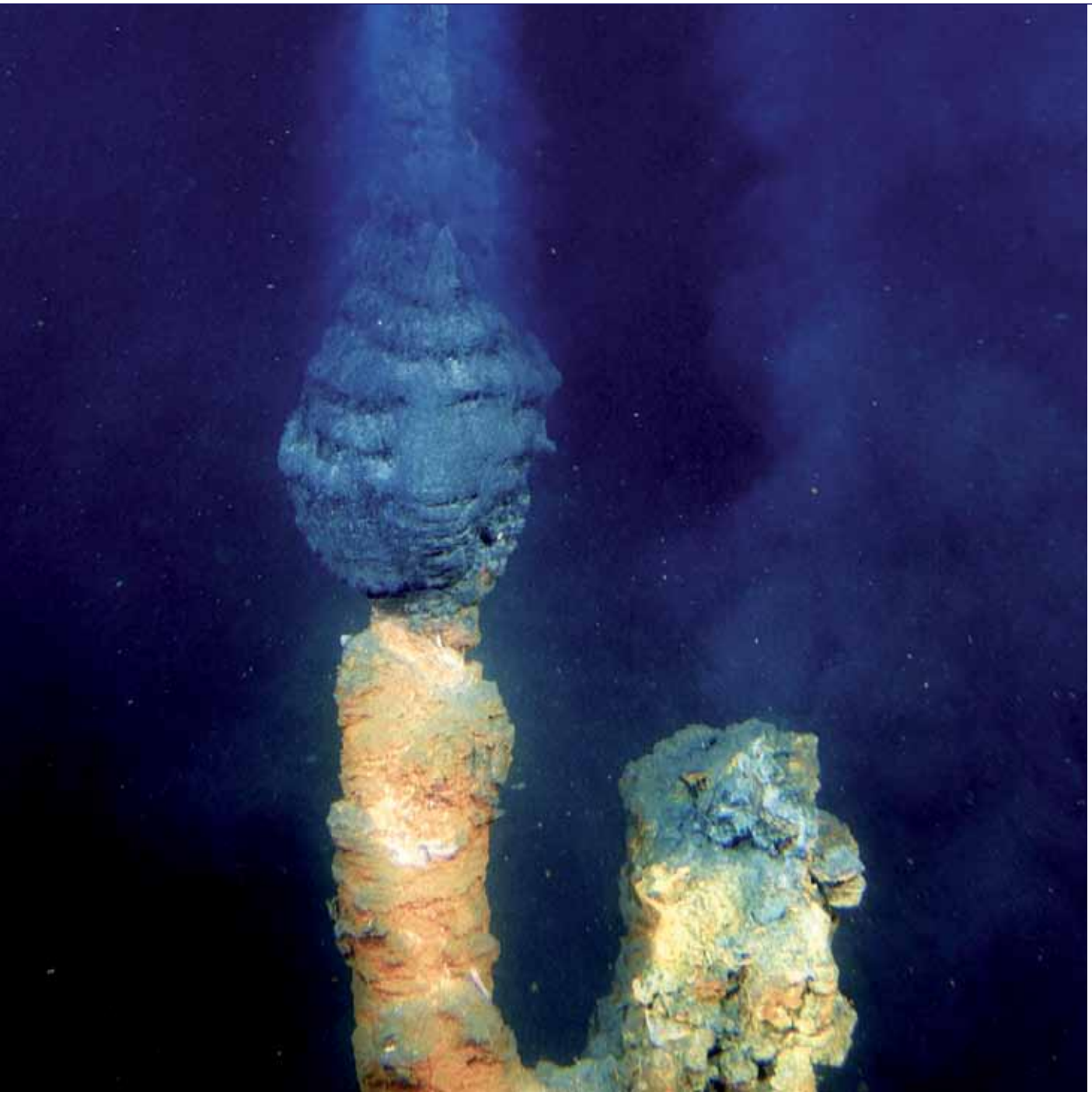
We are particularly proud of Dr Dennis Gordon, who helped New Zealand become the first country in the world to catalogue its entire known living and fossil life (see page 42).

Science that benefits all New Zealanders

One of Sir Paul Callaghan's legacies is the leading role he played in communicating science to the wider public. NIWA has a reputation for high quality science, but for this science investment to provide maximum value to New Zealand, it must be delivered to stakeholders and customers – be it government, businesses, councils, industry or individuals – in a way that encourages uptake and application. Recognising this, in April NIWA joined forces with the other Crown Research Institutes and several other science organisations, to hold the inaugural 'Science in the City' event in Auckland. During the one-day event – which included a public open day and lectures – more than 5000 people had the opportunity to get some hands-on experience of the amazing work going on in the science sector and how it directly impacts their lives. Because of its outstanding success, a similar event is planned for next year.

NIWA is also helping to transfer knowledge to our future New Zealand scientists by joining forces with the University of Auckland to open the Joint Graduate School for Marine and Coastal Sciences. Combining the complementary capabilities and resources of both organisations is intended to extend scientific leadership in coastal and marine science in New Zealand and deliver greater benefits to the management of New Zealand's coastal and marine environment.

Tools that NIWA creates also have direct application to the work councils, industry and iwi are doing. Examples developed this year include the 'Impacts of Climate Change on Urban Infrastructure and the Built Environment Toolbox' – a resource to help planners, engineers, asset managers and hazard analysts in New Zealand urban councils understand and evaluate the potential impacts of climate change on their city (see page 24), and the Ngā Waihotanga Iho estuarine monitoring toolkit for iwi, developed to equip iwi with tools to measure environmental changes in their estuaries (see page 27).



From left to right:

New Zealand's favourite emperor penguin Happy Feet returns home to his natural environment in the sub-Antarctic on board NIWA's research vessel Tangaroa. *[Richard O'Driscoll]*

NIWA fisheries scientist Dr James Williams shows the Prime Minister's Chief Science Advisor, Professor Sir Peter Gluckman (left), John Morgan and Chris Mace how to determine the age of fish by reading their otoliths (ear bones) at 'Science in the City'. [NIWA]

NIWA research is helping to quantify valuable mineral deposits from submarine volcanoes in the Kermadecs, while at the same time determining how to best protect the unique communities which thrive in the hot and chemically rich environment. [JAMSTEC/GNS Science/NIWA]

Science that protects us

New Zealand's location over an active plate boundary in a windswept ocean exposes us to earthquakes, storms, floods, tsunamis, landslides, damaging winds and waves, storm-surges and volcanic eruptions. The impact of these hazards on our society and the economy are enormous (the insurance bill from the Christchurch earthquakes has already topped $15 billion), and the hazard risk continues to increase as the population and infrastructure grows. NIWA, in collaboration with others in the Natural Hazards Research Platform, is providing information and tools, to reduce New Zealanders' exposure to hazards, and timely forecasts to minimise the impacts of extreme weather events.

Using our specialist environmental monitoring service, EcoConnect, we are providing port companies, regional councils, the fishing industry and energy companies with continually updated forecasts of weather-driven hazards such as flooding and storms, down to areas as small as 1.5 square kilometres. Through EcoConnect, forest owners, rural land management agencies and the public will also have earlier and better warnings about rural fire dangers, thanks to a joint project between NIWA and the National Rural Fire Authority.

The Hazards Forecasting System (HAFS), developed by NIWA, is another useful tool that can be directly employed by end users to mitigate risks of natural hazards. HAFS outputs are now being used in the horticulture sector to mitigate Psa-V infection risks, estimated to cost the kiwifruit industry more than $400 million over the next five years, and more than double that in the long term through lost development opportunities (see page 23).

One of our most innovative and powerful pieces of computer code – cylc – was developed by meteorologist Dr Hilary Oliver to run our forecasting system. Cylc has since been selected by the UK Met Office to run its operational forecasting and climate research, and is being used by other institutes, including the Max Planck Institute for Meteorology, the US Naval Research Laboratory, and the Department of Atmospheric and Oceanic Science.

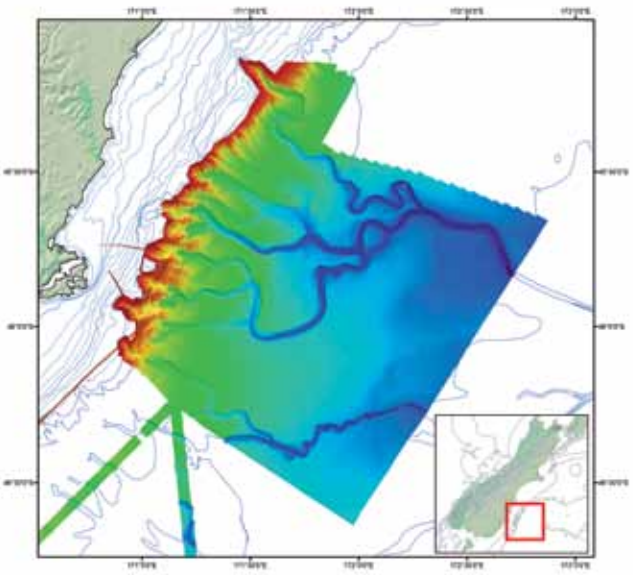
Our scientists have also been investigating the frequency and magnitude of historical earthquakes, in order to better understand the likelihood of large earthquakes occurring in active regions like Wellington and Poverty Bay. All of this information will help the Government and regional councils better understand, and prepare for, future seismic risk.

> The changes and strategies we have implemented have set us up well for the future.

Science that excels

This year, many of our people have been recognised for the significant contributions they have made to New Zealand, and international, science and research. In December, Dr Philip Boyd and other members of the Centre for Chemical and Physical Oceanography from NIWA and the University of Otago were awarded the top 2011 Prime Minister's Science Prize. The $500,000 award is one of New Zealand's most highly regarded science accolades, recognising a transformative science discovery or achievement which has led to an economic, health, social and/or environmental impact on New Zealand, or internationally (see page 39 for more details).

We also offer our sincere congratulations to NIWA's Chief Scientist, Climate, Dr David Wratt, who was awarded a Queen's Service Order (QSO) for services to science. Throughout his career, David has been a leading figure in



New Zealand climate science and is also a Bureau member of the International Panel for Climate Change (IPCC) (see page 38). For more examples of our team's achievements this year, see the Our People section of this report (page 36).

What lies ahead?

Five years on as Chief Executive of NIWA, I am not only heartened by the significant achievements we have made in recent years, but also reassured to know that the changes and strategies we have implemented have set us up well for the future. As New Zealand's leading environmental research and applied science service provider, demand for our services will continue to grow in the future. I am certain, with the profound level of expertise our people have and the assets we have to support them, and by continuing to work in a cost-effective and competitive way, we will meet that demand head on.

That said, we must remain agile and responsive, as business conditions shift and science priorities change. Our science, and the way we do it, has evolved enormously from what it was like 20 years ago. That evolution will continue. We cannot predict what might happen, but we can still be well prepared for it. With our new national science centres and a new and well-defined strategic focus for our work, I am confident we are.

I am proud of the NIWA team and the significant achievements we have made this year. Through strong commitment and hard work, we have had a very successful year. I also want to thank the NIWA Board and the Executive Team for their ongoing support and leadership. It has been a challenging year, but one in which we have made excellent progress.

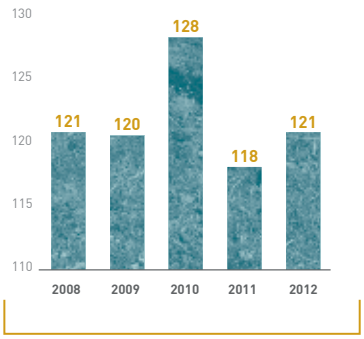
I look forward to the year ahead with NIWA contributing to advancing New Zealand's economic and environmental prosperity as the country's leading natural resources and environmental science services provider.

The following pages highlight just a few of our significant achievements this year.

John Morgan
Chief Executive

Left: *Recent seabed mapping off the Otago coast by NIWA's research vessel* Tangaroa *will help inform future development and management of potential oil and gas resources in the area.* **Centre:** *Supergiant amphipods discovered in the Kermadec Trench. [Oceanlab, University of Aberdeen]* **Right:** *Members of the NIWA and University of Otago Centre for Chemical and Physical Oceanography were awarded the top 2011 Prime Minister's Science Prize. [Chris Miller]*

A pleasing result



Total revenue ($ in millions)
(includes interest income)

HIGHLIGHTS

We are pleased with our 2011–12 results, in the face of what remained a challenging operating environment for most businesses. A substantial proportion of NIWA's revenue comes from central and local government agencies, and revenue from these sectors remained flat, as their spending was constrained or further reduced.

We continued to focus on operational efficiency and tight financial planning and management, to ensure our capabilities were closely aligned with the demands for our science-based services.

An increase in revenue and tight control of costs resulted in EBITDA at $18.9 million and a net profit after tax of $5.5 million (2010–11: $1.3 million) on revenue of $121.4 million ($117.9 million).

A five-year capital investment programme has focused on upgrading and future-proofing our deepwater research vessel *Tangaroa*, and upgrading our high performance computing facility, laboratory instrumentation, IT infrastructure and national environmental monitoring networks. That $95.5 million in capital expenditure over the last five years – a significant commitment to NIWA and New Zealand's science capability – ensures the quality of our assets now matches the skills of our people.

REVENUE

The 2011–12 budget was challenging, and it was pleasing to achieve revenue of $121.4 million (2010–11: $117.9 million) in such a constrained environment.

The value of NIWA's commercial consultancy to New Zealand remained stable at $31.0 million (2010–11: $31.0 million). International consultancy increased to $7.8 million (2010–11: $5.9 million), largely a result of an overseas *Tangaroa* survey.

EXPENDITURE

Personnel costs

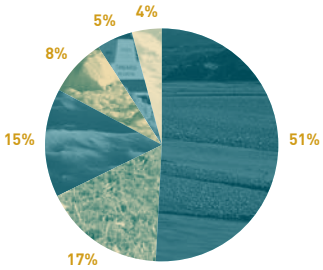
The ability of its people is key to NIWA's success, and that is reflected in the deliberate strategy to continue to raise average remuneration.

Although we had fewer staff in 2011–12 than in 2010–11, total payroll and benefits increased per staff member, despite the overall cost decreasing to $60.7 million (from $62.6 million in 2010–11), with average staff remuneration continuing to increase at a rate faster than New Zealand inflation.

Financial summary

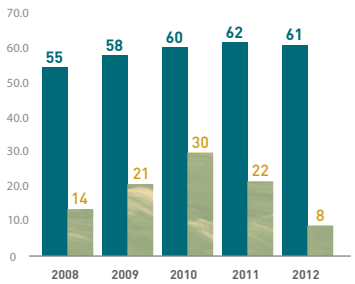
in thousands of New Zealand dollars	2012	2011	2010	2009	2008
Total revenue (includes interest income)	121,386	117,861	127,917	120,438	120,671
– Research	62,358	64,624	65,646	58,883	55,536
– Applied science	59,028	53,237	62,271	61,555	65,135
Net profit before tax	7,450	1,860	9,550	9,050	14,309
Net profit after tax	5,541	1,266	4,497	6,011	10,095
Capital expenditure	8,393	21,990	29,985	21,187	13,985
Adjusted return on average equity (%)	7.9	1.9	7.0	9.8	17.9
Return on average equity (%)	5.8	1.4	5.2	7.1	12.8

The 'adjusted return on average equity' uses a valuation basis comparable to other Crown Research Institutes. This valuation basis arose from the transition to New Zealand international financial reporting standards.

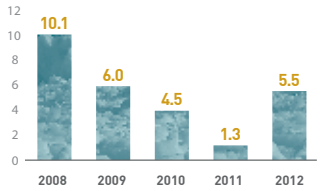


Revenue by source

Ministry of Science and Innovation	51%
Ministry for Primary Industries	17%
Other sales	15%
Central government	8%
Local government	5%
Private sector	4%



Payroll benefits and capital expenditure
($ in millions)



Net profit after tax
($ in millions)

The realignment of capabilities with the demands for our research and applied science services resulted in one-off termination expenses of $0.572 million.

Continual automation and streamlining of systems and processes increased efficiencies and improved customer engagement.

EARNINGS BEFORE INTEREST, DEPRECIATION, AND AMORTISATION (EBITDA)

EBITDA improved to $18.9 million (2010–11: $16.3 million).

Net profit after tax (NPAT)

NPAT was $5.5 million (2010–11: $1.3 million), against a budget of $3.0 million.

This result reflects the improvements in operating efficiencies and a one-off depreciation gain of $3.3 million after a review of the useful lives of five asset categories.

Adjusted return on equity (giving a comparative basis with other CRIs) was 7.9 per cent.

FINANCIAL POSITION AND CASH

Capital

NIWA's capital expenditure was $8.4 million during 2011–12; the major items being the second stage of a mass spectrometer upgrade ($1.0 million) and the final stages of the three-year *Tangaroa* upgrade ($0.9 million). Throughout the substantial five-year capital expenditure programme, NIWA's strong operating cashflows ensured that maximum debt did not exceed $19 million. Net debt has been managed down from $13.4 million to $4.7 million this year. In times of uncertainty we are pleased to have such an extensive revitalisation of the asset base and returned to such low debt levels.

Total asset base

Average shareholders' equity at 30 June 2012 was $93.0 million (2011: $89.7 million). NIWA's investment in capital expenditure is reflected in increased average total assets, which are now valued at $137.2 million (2011: $133.6 million).

Liquidity

NIWA continues to maintain healthy liquidity, and can meet all obligations as they fall due. The net debt balance declined steadily throughout the year, and stood at $4.7 million on 30 June 2012.

"Revenue of $121.4 million, EBITDA of $18.9 million, and a profit of $5.5 million – that's a pleasing achievement in a tough operating environment."

— **Kate Thomson,** *Chief Financial Officer*

our science

NIWA's research and applied science services are delivered by our national science centres.

Each centre conducts a wide range of research contributing to six high-level outcomes for New Zealand.

Delivering leading natural resources and environmental science services

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, however, are delivered through 10 national science centres, which are aligned to industry sectors and/or resources, and through NIWA Vessels.

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.

Previous pages: *View from Mt Olympus, Craigieburn Range. [Katja Riedel]*



NATIONAL AQUACULTURE CENTRE

NIWA has been designated by 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 species
- assessing and modelling the environmental effects of marine farm operations
- designing and managing marine farms, and providing associated training
- conducting research into fish health
- providing breeding services
- conducting feed trials.

www.niwa.co.nz/our-science/aquaculture-and-biotechnology

NATIONAL ATMOSPHERE CENTRE

Understanding the complex relationship between atmospheric composition and climate has never been more important, as extreme weather events linked to climate change make their presence felt. NIWA has been designated by 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.

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

NATIONAL CLIMATE CENTRE

Understanding how our climate behaves, and is changing, is of profound importance to all New Zealanders. NIWA has been designated by Government as the lead CRI in research and services relating to the understanding of our climate and atmosphere.

Our work includes:

- 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.

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

NATIONAL CENTRE FOR COASTS AND OCEANS

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

Our work includes:

- conducting research into physical 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.

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

NATIONAL CENTRE FOR ENVIRONMENTAL INFORMATION

Data that are precise, reliable, and consistently comparable are fundamental to every branch of NIWA's science, and vital to many other end users. Our National Centre for Environmental Information is recognised as leading environmental monitoring and observation, information management, and delivery of high-quality, interoperable environmental data that 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.

www.niwa.co.nz/our-science/ei

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 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
- enhancing fisheries value and market access.

www.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 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 water-related technology and management tools.

Our work includes:

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

www.niwa.co.nz/our-science/freshwater

NATIONAL NATURAL HAZARDS CENTRE

New Zealanders need little reminding of how destructive nature can be. NIWA has been designated by 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.

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

NATIONAL CENTRE FOR MĀORI ENVIRONMENTAL RESEARCH – TE KŪWAHA

NIWA's goal is to share knowledge and empower Māori communities and businesses with leading-edge science. We undertake research and provide applied science 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.

www.niwa.co.nz/our-science/te-kuwaha

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 research and 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.

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

The work of these national science centres is complemented and extended by NIWA vessels.

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.

RV *Tangaroa*, our flagship deepwater research vessel, is ice-strengthened and equipped with New Zealand's only DP2 – an advanced dynamic positioning system, which enables it 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. A wide range of inshore and coastal research is made possible by RV *Kaharoa*, RV *Ikatere* and RV *Pelorus*.

www.niwa.co.nz/our-science/vessels

The following pages provide an insight into our research and applied science services – which contribute to our six outcomes.

[Photo credits: page 15 – Sally Anderson, Alan Blacklock, Dave Allen; page 16 and 17 – Dave Allen.]

Growing the economy by sustainable use of aquatic resources

Above: *NIWA is leading research into the use of constructed wetlands to intercept pollutants in farm runoff before they reach natural waterways. (Dave Hansford)*

Top right: *NIWA's multibeam echosounder maps the seafloor using a fan of 135 acoustic beams.*

Bottom right: *Chinook salmon eggs and alevin. (Nelson Boustead)*

CLEANING UP OUR WATERWAYS – AND OUR INTERNATIONAL IMAGE

NIWA researchers have been working alongside AgResearch and other collaborators to evaluate the effectiveness of simple, voluntary, best management practices aimed at reducing the runoff of, particularly, nitrogen and phosphorus into our streams, rivers and lakes.
The work focuses on five dairy-dominated catchments in contrasting areas of the country.

Our findings contributed to the establishment of the Dairying and Clean Streams Accord in 2003, and have supported the widespread adoption of stream fencing, riparian management schemes, and improved effluent management on dairy farms.

Our science continues to contribute innovative solutions to the problem.

Extensive research and trials have led to the publication of guidelines for the use of constructed wetlands to treat farm runoff by 'processing out' certain nutrients before they reach natural waterways. See www.niwa.co.nz/news/wetlands-can-clean-our-water-but-location-is-key.

On Lake Rotorua, NIWA trials have proven the worth of an aeration system that uses a compressor to mimic the natural circulation of warm and cold water which occurs in summer, but slows in winter. This aids oxygenation, which prevents sediments from releasing phosphorus.

Our computer modelling expertise has led to the development of tools like ROTAN, a GIS-based model designed to predict water flows and nitrogen concentrations in streams. This helps lake and catchment managers understand the impacts of land use changes on nitrogen leaching rates, and implement mitigation measures accordingly. See www.niwa.co.nz/freshwater/management-tools/water-quality-modelling.

Together, these initiatives are having a positive impact. Clearer streams, rivers and lakes, and improved safety for swimming are evident in those dairy farming areas where actions have been taken. All our mitigation efforts are helping to prevent potential damage to New Zealand's '100% Pure' international image, which remains the mainstay of our export growth strategies.

Our computer modelling expertise has led to the development of tools like ROTAN, a GIS-based model designed to predict water flows and nitrogen concentrations in streams.

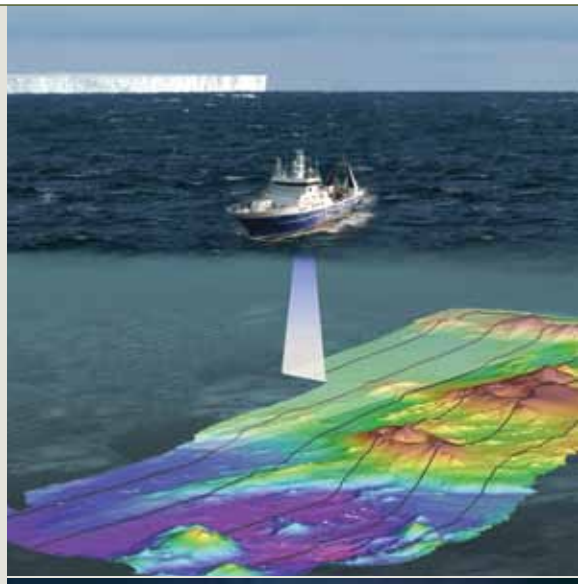
IMPROVING ACCESS TO VALUABLE INFORMATION ON OUR SEABED ENVIRONMENT

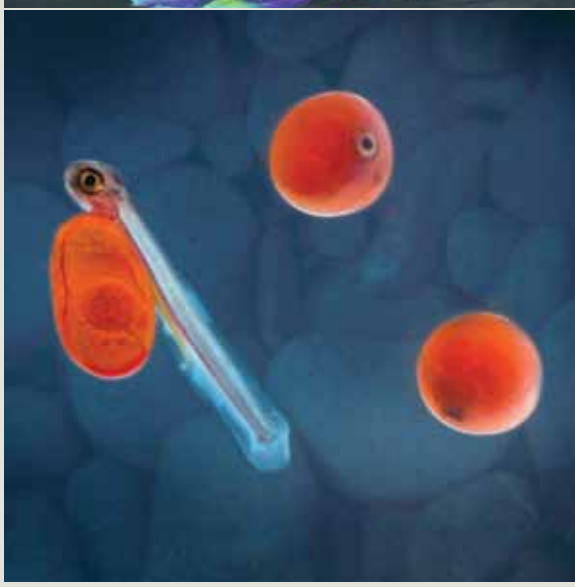
The Government has charged NIWA with leading Crown research that contributes to the sustainable management of New Zealand's marine resources and environment. Our theatre of marine research is vast – stretching across New Zealand's four million square kilometre Exclusive Economic Zone, and beyond. This area is home to extraordinary diversity, and significant commercial opportunity.

Using our world-class fleet of research vessels as a platform, we have made significant advances in our understanding of the shape and composition of the seabed. At the same time, we have greatly improved access to related databases and predictive habitat models, enabling a wide range of end users to employ our knowledge to aid economic and resource management planning. Many of our databases are now available online, using open source technology that enables access from anywhere, at any time, without the need for additional infrastructure.

Among the organisations that have benefited from the advances we have made are the various government agencies responsible for managing the demands placed on our marine environment. Other significant users include: the fishing industry; the energy sector (e.g., for planning power cable routes and tidal energy projects); iwi organisations (business and kaitiakitanga initiatives); the telecommunications sector (e.g., for planning seafloor cable routes); and the minerals exploration industry. We also share data with numerous oceanographic and earth science partners to further enhance understanding of our marine environment. Metadata on our seabed information is available through the newly launched New Zealand Petroleum and Minerals' (a group of the Ministry of Business, Innovation and Employment) Petroleum Basin Explorer, a new interactive web portal which provides easy access for petroleum exploration companies to New Zealand's petroleum geoscience information.

Online access to NIWA's geological, geophysical and ecological data (e.g., sub-bottom profiles, seabed sediment analyses and photographs) will continue to expand as information is captured in digital formats and added to our databases. For more information visit www.niwa.co.nz/our-services/databases.





ENHANCED EARNINGS FOR THE SALMON INDUSTRY

For over 30 years, NIWA and its predecessors have worked closely with New Zealand's salmon industry to add value through applied research. The industry earns over $60 million in export receipts each year, and a similar amount from domestic markets. Recent work with our key commercial partner has focused on optimising Feed Conversion Efficiency (FCE) – a measure of how well fish convert feed into weight. This is a high research priority for the company, and an important consideration in the aquaculture of any species.

Results of our research have fed directly into their breeding programme design, and have now been implemented. As a result, they expect the FCE of commercial production stocks to improve significantly in future seasons, with direct financial benefits. Typically, the earnings return on research investment of this nature is between 3:1 and 6:1.

Carefully targeted research in direct partnership with the industry is made possible by NIWA's world-class aquaculture facilities at Bream Bay in Northland, where full control over a range of environmental parameters is possible, and supported by specialist facilities at other NIWA sites. Research by our scientists at these centres has led to the successful commercial farming of several high-value species, including kingfish and hāpuku. See www.niwa.co.nz/our-science/aquaculture-and-biotechnology/aquaculture-species.

Growing renewable aquatic and atmospheric energy

MODELLING WATER AS A FUEL FOR THE ECONOMY

Water is – literally and metaphorically – the driving force behind many sectors of the New Zealand economy. Each day, New Zealanders use over 700 million litres of water. Nearly 60 per cent of our electricity is generated directly by its flow.

The continued availability of water is a crucial factor in the sustainable expansion of the New Zealand economy. Reliable information on the long-term and seasonal variability of our water resources is essential, to support sound investment and management decisions. Until recently, such information has been lacking for large areas of the country.

NIWA has developed two important tools that are advancing our knowledge of, and ability to predict future scenarios relating to, this critical resource.

Our TopNet hydrological model estimates stream flow in catchments where no measurement gauges are located. The model gives users the ability to investigate the impact of land use changes (such as cutting down or planting forests) and of climate variability and change on water availability – particularly as it relates to hydroelectricity generation.

TopNet integrates advancements made in the sciences of climatology and hydrology at NIWA. Continually improving precipitation forecasts by our climatologists enable increasingly accurate estimates of river flow. As well as having important practical applications, our work is contributing directly to worldwide advances in hydrology. Prediction of detailed stream flow time series in ungauged catchments is a key challenge facing the science worldwide. NIWA's work is leading edge. See www.niwa.co.nz/freshwater/update/no26-2008/how-much-water-is-available.

NIWA has also developed an extensive – and growing – snow and ice monitoring network in the Southern Alps. This is significantly improving our understanding of the relationship between snow and ice at high altitudes and river flow at lower altitudes. Climate variability and change may have a marked impact on the quantity and distribution of snow and ice in the mountains of the South Island. Our network will help us to model those changes accurately, determine their downstream effects and, ultimately, contribute to better-informed resource planning and business decision-making in the energy sector.

> The continued availability of water is a crucial factor in the sustainable expansion of the New Zealand economy.

Above: *NIWA's snow and ice network is significantly improving our understanding of the relationship between high-altitude snow and ice and low-altitude river flow. (Chris Appleby)*

Top right: *A covered anaerobic pond generates electricity for a Waikato dairy farm. (Dave Allen)*

Bottom right: *NIWA tide researchers deploy a current meter in Cook Strait. (NIWA)*

SWITCHING FARMERS ON TO RENEWABLE ENERGY

The Energy Efficiency Conservation Authority (EECA) estimates that an average dairy farm typically spends more than $21,000 each year on electricity. That represents a significant burden on the profitability of the business and, across all 12,000 dairy farms in New Zealand, a major use of the country's energy resources.

NIWA scientists are working alongside the dairy industry to demonstrate the potential of renewable energy sources to dramatically reduce – perhaps even eliminate – that cost. The model we have developed enables the integration of available renewable energy sources on the farm, including wind, solar and biogas, to place farmers on the path towards energy self-sufficiency.

Covered anaerobic pond technology, developed by a Hamilton-based NIWA research engineer, lies at the heart of our approach. Biodegradable matter, such as farm manure, is pumped into a covered holding pond where, in the absence of oxygen, it breaks down into biogas – a combination of methane, carbon dioxide and smaller amounts of hydrogen sulphide and ammonia. The main component, methane, is combustible, which means biogas can be used as a fuel for heating and electricity generation.

The first full-scale covered anaerobic pond on a dairy farm was constructed in Waikato early in 2012, and has been operating successfully since. The same technology has been applied to a pig farm in Taranaki, and is now supplying approximately half of the piggery's daily electricity needs. The farm owner expects to recoup all of his $120,000 investment in the technology ($30,000 came from an EECA grant) within three years. See www.niwa.co.nz/publications/wa/water-atmosphere-4-march-2012/pig-power.

This technology has also raised interest in Australia.

TIDE TURNING FOR ENERGY GENERATION PROSPECTS

Tidal flows around New Zealand's rugged coastline offer significant potential as a source of renewable energy for the country. However, the complex and highly variable nature of the strongest currents and the marine working environment in places like Cook Strait also present considerable risk: a large tidal power station is likely to require several hundred million dollars of investment, so placement of turbines for optimum productivity and durability is crucial.

NIWA has used a combination of direct observation and computer modelling to build knowledge of New Zealand's current patterns that will aid planning for marine tidal power generation schemes. We have produced maps showing the best tidal resources in the country and their variability, along with tools and examples that quantify metrics associated with deploying turbines in those areas.

Our work has involved close collaboration with the University of Otago and development projects aiming to harness the tidal energy. Stakeholders in the industry now have substantive research to support project planning, and their risk profile has been greatly reduced as a result. Individual companies have already modified their development plans in response to our findings.

The accuracy and resolution of NIWA's numerical environmental modelling and forecasting, to support research of this nature, has improved dramatically since the acquisition of our powerful IBM p575 POWER6 supercomputer. Industries that are weather- and climate-sensitive, or rely on an understanding of natural processes like tidal patterns, have benefited directly from our ability to make more accurate and specific forecasts. See www.niwa.co.nz/news/niwa-selects-ibm-provide-new-supercomputer-advance-environmental-forecasting.

Increasing resilience to weather and climate hazards, and tsunami

Top: *Sea wall construction at Paekakariki, north of Wellington. (Dave Allen)*

Centre: *NIWA is helping communities better prepare for natural hazard impacts. (Alan Blacklock)*

Bottom: *The harbour at Mangaia, Cook Islands — acutely vulnerable. (Doug Ramsay)*

MODELLING CURRENT AND FUTURE WAVE AND STORM SURGE RISKS

NIWA is helping New Zealand's coastal communities prepare for hazards now and in the climate-changed future, in several significant ways. We have prepared step-by-step planning guidelines for local authorities and others with a stake in coastal community infrastructure and environments (see 'Preparing for climate change impacts on the coast', page 25), and developed sophisticated integrated forecasting tools that predict the combined impacts of climate change-induced hazards on particular locations, including the coast (see 'Advanced hazard forecasting to mitigate risk', page 23).

WASP – the Wave And Storm-surge Projections project – is another forecasting model in NIWA's suite that is helping regional councils investigate future coastal inundation risks in their territory. WASP provides, over the internet, nationally consistent wave and storm-surge data at coastal nodes around the entire perimeter of New Zealand. It allows users to set up and run models for their region. Using validating data from the period 1960 to 2000, WASP can show present day likelihood, and indicate how that likelihood changes under the standard global climate change scenarios used in the Intergovernmental Panel on Climate Change assessment reports.

Under each scenario, WASP outputs:

- hourly/monthly time series of sea level, storm-surge, significant wave height, wave period and wave direction
- summary statistics for these modelled variables, including distribution plots such as histograms, probability and cumulative distribution functions
- extreme-value analyses and output for sea level, storm-surge and wave height; and joint-probability statistics for extreme sea level and waves, e.g., average recurrence interval or annual exceedance probability.

The information provides a firm basis for resource management and infrastructure planning decisions for the coastal margin, which adequately accounts for both sea-level rise impacts, and potential changes to waves and storm-surges and their impact on coastal hazards.

The ability to extract regional information helps create a more standardised approach by local government, infrastructure operators and coastal communities in their efforts to mitigate current hazard risk and adapt to climate change impacts.

Several regional and unitary authorities are already using WASP to aid planning and preparation for hazards associated with climate change. For additional information see www.niwa.co.nz/our-science/coasts/research-projects/wasp.

ADVANCED HAZARD FORECASTING TO MITIGATE RISK

New Zealanders need little reminding of their susceptibility to weather and weather-related hazards. In recent years, heavy rain, snow, hail, drought, severe winds and tornadoes have taken a direct and significant toll on infrastructure, livelihoods – and even lives. Weather-related hazards, such as avalanches, river flooding, landslides, storm-surges, damaging waves, rip currents and coastal erosion, add an extra layer of risk to the mix. In 2011 alone, weather-related damage cost the New Zealand insurance industry well over $50 million.

NIWA's Hazard Forecasting System (HAFS) is an integrated, multi-hazard tool that can be used to help mitigate risk. HAFS works by linking numerical forecast models for individual hazard components in a physically consistent way, to provide a forecast of the overall hazard likely to affect a particular location. For example, by linking a weather model with models for river catchments, sea level and ocean waves, HAFS can generate forecasts of flood levels in the rivers and at coastal towns, where tides and sea level play a significant role in the extent and timing of flooding. The system is based on state-of-the-art models and exploits the capabilities of NIWA's IBM supercomputer. Work developing and implementing the constituent models is complemented by efforts to validate the hazard forecasts using known hazard events.

HAFS outputs have wider applications when sector-specific downstream models are added. In the horticulture sector, for example, HAFS is being used to forecast the types of weather conditions in which the destructive Psa-V virus thrives and spreads. According to Lincoln University researchers, Psa-V could cost the industry as much as $885 million in the long term, so minimising the risk is vital.

For more information on our work to increase New Zealanders' resilience to weather-related hazards, visit www.niwa.co.nz/our-science/natural-hazards/hazards.

HELPING OUR PACIFIC ISLAND NEIGHBOURS ADAPT

Property and infrastructure located on coastal margins of the Cook Islands are acutely vulnerable to extreme wave and sea-level hazards caused by cyclones and large swell events. It is likely such hazards will be exacerbated by future climate change and sea-level rise.

NIWA has undertaken the crucial work of quantifying the changes in hazard occurrence and magnitude, and associated risks at island or community levels, which may occur as a result of future climate change scenarios. Our work in the Cook Islands took the form of a demonstration study, which is now informing community decision-making and planning, as well as the nature and design of coastal infrastructure. The study was undertaken in collaboration with the Secretariat of the Pacific Community Applied Science and Technology Division (SPC-SOPAC) and the Cook Island Ministry of Infrastructure and Planning, under the auspices of the Pacific Adaptation to Climate Change (PACC) project.

The demonstration study: *A Geospatial Framework for Climate Change Adaptation in the Coastal Zone of Mangaia, Cook Islands*, has:

- developed the baseline information necessary to support a risk-based approach to coastal hazard management and climate change adaptation in the coastal zone of Mangaia Island
- assessed how climate change and sea-level rise will impact on the frequency, magnitude and extent of inundation along the Oneroa village shoreline of Mangaia Island
- provided a sound, objective and evidence-based framework for developing climate change adaptation strategies for Oneroa village
- demonstrated an approach and tools that are scalable and can be transferred and applied to other coastal areas in the Cook Islands.

A key project outcome was the development of the Cook Islands Coastal Calculator, which is a Microsoft Excel-based engineering spreadsheet that provides information on extreme cyclone and swell wave and water levels at the shoreline, wave run-up, and overtopping, and how these may change under different climate change scenarios. This information, along with aspects of the study investigating cyclone frequency and intensity, has helped the Oneroa community to identify the facilities at greatest risk along the waterfront.

The study also helped community administrators identify a range of risk-reduction and adaption options, to be implemented in a structured manner over the next one to two generations, which will progressively reduce the effects that severe weather events and climate change may have on inundation risks.

The PACC project is funded by the Global Environment Facility (GEF). It is implemented by the United Nations Development Programme (UNDP) in partnership with the Secretariat of the Pacific Regional Environment Programme (SPREP).

Adapting to, mitigating and exploiting climate variability and change

Above: *The Impacts of Climate Change on Urban Infrastructure and Built Environment Toolbox helps local authorities evaluate the potential impacts of climate change on their town or city. (Dave Allen)*

Top right: *NIWA's science informs regional council policy on vehicle emissions. (Alan Blacklock)*

Bottom right: *The effects of climate change will be felt earliest and strongest on the coast. (Dave Allen)*

CLIMATE-PROOFING OUR TOWNS AND CITIES

New Zealand's urban environments are particularly vulnerable to extreme weather, including floods and coastal storm-surges. As a result, local authorities must consider a wide range of weather-related risks when they develop or upgrade infrastructure, such as roads, bridges, storm water systems and sea walls. Their goal is to create communities that are resilient to climate change and the hazards that come with it.

Getting it wrong can prove costly. In the 40 years before the Canterbury earthquakes, around 75 per cent of the $1.5 billion paid out in insurance claims for natural hazards was for weather-related damage. Climate change is introducing added uncertainty – and urgency – to the challenge.

NIWA is giving urban planners the vital support they need, via the Impacts of Climate Change on Urban Infrastructure and the Built Environment Toolbox. This is an online resource (www.niwa.co.nz/climate/urban-impacts-toolbox) that helps key personnel in New Zealand's urban councils understand and evaluate the potential impacts of climate change on their town or city. The toolbox comprises 57 downloadable reports, or 'tools', organised in a logically ordered framework based on the risk assessment process of: understanding the issues; assessing the likely hazards (or changes in hazards); identifying risks; evaluating options – and their comparative costs and benefits; and using the tools and improving practice.

Developing the toolbox (part of a Ministry of Science and Innovation-funded programme) involved extensive collaboration between NIWA, MWH (NZ) Ltd, the Building Research Association of New Zealand and GNS Science. Support was provided by a number of regional and city councils. Since its launch, the toolbox has received over 1500 visits to its main page and over 3500 visits to sub-pages.

The toolbox joins NIWA's growing suite of online tools aimed at increasing New Zealanders' resilience to potential climate change impacts. It complements HIRDS (http://hirds.niwa.co.nz), our High Intensity Rainfall Design System that estimates the frequency and scale of high-intensity rainfall events at any location in New Zealand – greatly assisting the design of infrastructure capable of coping with extreme events.

NIWA is giving urban planners the vital support they need, via the Impacts of Climate Change on Urban Infrastructure and the Built Environment Toolbox.

TAKING BETTER CARE OF THE AIR WE BREATHE

Regional councils are charged with maintaining the quality of air in New Zealand's urban areas within the National Environmental Standards for air quality, without compromising regional development. It is a difficult balancing act, requiring accurate emissions inventories and the removal of confounding factors, such as meteorological and natural background effects, to gauge the success of intervention strategies.

Before NIWA's Healthy Urban Atmospheres programme, most emissions factors used in New Zealand emissions inventories came from overseas research. However, accuracy is vital – so that regulators can plan interventions based on the receiving capacity of the specific 'airshed' in question. NIWA's research programme included a series of measurements of emissions factors specific to two key sources of pollution in New Zealand: woodburners and cars.

Results have been used by many councils, like Environment Canterbury and Auckland Council, to compile emissions inventories. These inventories are central to informing policy interventions, such as clean heat programmes and woodburner replacement schemes. Our measurements of actual traffic emissions revealed that 20 per cent of vehicles are responsible for 80 per cent of emissions. This knowledge has allowed councils, like Auckland, to prepare strategies for targeting the 'gross emitters'.

Over the past five years, NIWA has worked with councils in six urban areas to develop methods for removing the meteorological influence from measured concentrations of pollutants. The aim is to reveal underlying trends, so that the effectiveness of policy interventions can be gauged. Our work with Environment Canterbury has determined that, although the underlying trend in particulate matter <10μm (PM10) concentrations was downwards, further measures would need to be taken to meet National Environmental Standards by the required date. However, Nelson Council was able to determine that the underlying trend in PM10 concentrations was tracking according to plan – confirming the effectiveness of their policy interventions.

PREPARING FOR CLIMATE CHANGE IMPACTS ON THE COAST

New Zealanders are sea-loving people by nature. Nearly seven in ten of us choose to live within five kilometres of the coast; thirteen of our sixteen largest urban areas are located there. But the coast is where the effects of climate variability and change will have their earliest and strongest impacts. Storm-surge and wave damage are potentially destructive weather-related hazards that present unique challenges to coastal communities. There is a recognised need among local authorities for effective planning and strategies to help such communities adapt.

During the last four years, NIWA has led a Ministry of Science and Innovation-funded project aimed at supporting councils' efforts to prepare for climate change on the coast. The result is a comprehensive publication called *Pathways to Change* (see www.niwa.co.nz/our-science/coasts/research-projects/coastal-adaption-to-climate-change), which provides step-by-step guidance for planners, managers and others with a stake in coastal community infrastructure and environments.

Pathways to Change explains in detail the process of: raising awareness and gaining acceptance; assessing risks; planning adaptation responses; and implementing, monitoring and reviewing those responses. It offers a process for community leaders to follow to ensure they are adequately prepared for change.

Research underpinning the guidelines was conducted in the Coromandel area, and involved close collaboration with Waikato Regional Council, Thames-Coromandel District Council, AgResearch, Mercury Bay Area School, Department of Education, University of Waikato, and the Whitianga and Manaia communities. The NIWA-led work now serves as a blueprint for a community-based, participatory approach to climate change preparation.

The Whitianga community has now taken the first step on the pathway, with increased awareness of coastal climate change risks and management options. The Kāpiti Coast District Council is also an early adopter and is developing plans for consultation with the community.

Enhancing stewardship of freshwater and marine ecosystems and biodiversity

PREVENTING UNWANTED MARINE HITCHHIKERS

New Zealand's marine economy contributes billions of dollars to our gross domestic product. Shipping remains vital to the New Zealand economy, as the gateway for almost all our imports and exports, and vessels play an important role in our fishing and tourism industries.

But biofouling – the transport of marine organisms attached to the hulls of visiting vessels – is also a major pathway for the entry of unwanted or harmful marine organisms into New Zealand. Pests like the European green crab (*Carcinus maenas*) are a serious threat to the unique marine and estuarine ecosystems which sustain our marine economy.

NIWA's research has contributed to the development, by the Ministry for Primary Industries (MPI), of a new Import Health Standard (IHS) governing biofouling on vessels entering New Zealand waters. The IHS will be phased in over the next four years. Our work involved developing protocols for inspecting vessel hulls; taxonomic services to identify non-native species in biofouling; characterising and evaluating the risks associated with biofouling and in-water cleaning of fouled vessels; and identifying options for treating vessels which are not compliant with the proposed IHS. All of this work feeds into government and industry efforts to develop best practice measures to manage biofouling risks.

In addition, NIWA has helped the New Zealand and Australian governments revise the Australian and New Zealand Environment and Conservation Council Code of Practice for Anti-fouling and In-water Hull Cleaning and Maintenance (the ANZECC Code). We worked with Biofouling Solutions Ltd in Australia to redraft the code in consultation with a range of government and industry stakeholders in New Zealand and Australia.

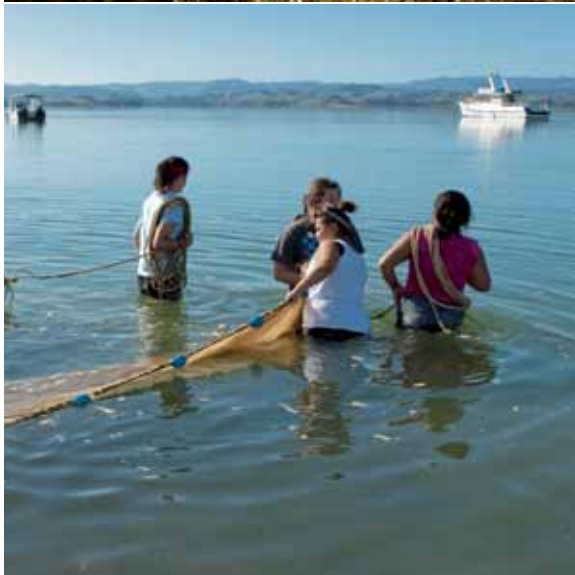
Ongoing surveillance for unwanted or harmful marine organisms is essential to ensure strategies like the new IHS are working. Earlier detection and better tracking of marine pest spread has been possible thanks to the implementation of risk-based survey design into the National Marine High Risk Site Surveillance Programme (funded by MPI) and consolidation of our national data on the recorded distribution of marine pests.

For more information see www.niwa.co.nz/publications/wa/water-atmosphere-4-march-2012/invaders-from-inner-space.

Top: *NIWA has developed protocols for inspecting vessel hulls for unwanted marine organisms. (Peter Marriot)*

Centre: *A floating wetland on Lake Rotorua – one of a number of NIWA-devised innovations aimed at removing lake pollutants such as phosphorus and nitrogen. (Dave Hansford)*

Bottom: *Students conduct a small fish survey with the help of NIWA's estuarine monitoring toolkit. (Alastair Jamieson)*



PUTTING A CAP ON LAKE POLLUTANTS

NIWA is leading a range of initiatives to help prevent eutrophication of our waterways by farm and urban runoff and to help restore polluted waterways (see 'Cleaning up our waterways', page 18). However, clean-up work is often complicated by the presence of phosphorus that, following past pollution events, has accumulated in lake bed sediments and is re-released into the water each summer.

To address this problem, we are working with Bay of Plenty Regional Council, University of Waikato, Scion and industry partners to develop a range of catchment and in-lake controls, and a decision support system to help users choose the most appropriate action in various contexts.

Among our most successful interventions is the application to the lake bed of a thin capping layer of natural zeolite clay, modified to chemically bind to aluminium, which permanently locks in the phosphorus. This technique has successfully improved the health of Lake Ōkaro, a small lake in the Rotorua area, and we are now developing the knowledge needed to apply capping agents to the beds of Lakes Rotoehu and Rotorua, whose size and currents present extra challenges.

Another of our most successful innovations is the use of slow-disaggregating prills (pellets), which can be applied by aircraft and which sink to just above the lake bed before dispersing and settling. Various phosphorus-binding substances have been compared for their cost-effectiveness and tested for potential undesirable ecological side-effects.

For more information on our mitigation efforts, see www.niwa.co.nz/publications/wa/water-atmosphere-4-march-2012/healing-waters-cleaning-up-the-rotorua-lakes.

Monitoring the impact of innovations like these on lake health is another important part of our work. NIWA researchers have developed a methodology called LakeSPI, which involves the regular counting and assessment of native and introduced submerged plant species growing within a defined area of a lake. The extent of submerged plants and the ratio of native to introduced species are good indicators of health. For more information see www.niwa.co.nz/our-science/freshwater/tools/lakespi.

ENHANCING MĀORI INVOLVEMENT IN ENVIRONMENTAL MANAGEMENT

River estuaries are highly valuable to Māori as sources of food, cultural identity, knowledge, recreation and commercial return. However, our estuarine environments are under increasing threat from urban and agricultural runoff, discharges, waterside developments and increased demand for resources.

For centuries, Māori have monitored the health of their natural resources and made environmental management decisions about how to use those assets accordingly. Now, mātauranga Māori (traditional knowledge) and kaitiakitanga are being integrated with NIWA science, to ensure that the issues and demands associated with modern environmental management and legislation can be addressed.

Ngā Waihotanga Iho is a mātauranga-based toolkit that NIWA, in partnership with Ngāti Whanaunga, Ngā Pūkenga in Manaia and Ngāti Hikairo in Kawhia, has developed to help hapū and iwi measure environmental changes in their estuaries.

The toolkit is based both on scientific principles and the knowledge and values of Māori to ensure that it addresses the issues important to kaitiaki living alongside estuaries. It provides easy-to-follow guidelines to help monitor and support a range of parameters associated with estuarine health, such as water quality, sediments, plants and fish stocks. The toolkit will be available in both te reo and English. NIWA has also partnered with Te Uri o Hau (northern Kaipara) to implement a marae-based programme using Ngā Waihotanga Iho.

The estuarine monitoring toolkit is one of a number of ways we are transferring environmental science knowledge to Māori communities. We are also providing scientific tools and expertise to complement mātauranga Māori and resource management components of the Te Uri o Hau Cultural Education Trail and Marae Biodiversity Project. This project will assist in the development of science skills by Te Uri o Hau kaitiaki and secondary school students. We have also developed resources and held workshops to help Māori better understand the life cycle, breeding and habitat of tuna (see http://www.niwa.co.nz/te-kuwaha/tuna-information-resource).

Kaitiaki Tools is a NIWA resource focused on mahinga kai and contains information about the environmental impacts of different land uses and industries on water quality and mahinga kai health. This tool also helps Māori and resource managers apply this information to the resource consent process. See www.niwa.co.nz/our-science/freshwater/tools/kaitiaki_tools for more information.

Above: *Scientists on board NIWA's RV* Tangaroa *collected over 37,000 biological specimens during the International Polar Year voyage to the Ross Sea. (Dave Bowden, IPY-CAML)*

Top and bottom right: *RV* Tangaroa *and crew at work in the frigid environs of the Ross Sea. (Glen Walker/Peter Marriot, IPY-CAML)*

Understanding the Antarctic and Southern Ocean environments

PROVIDING THE SCIENCE TO INFORM INTERNATIONAL DECISION-MAKING

Since 2005, the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) has been progressing plans to implement spatial management for purposes of marine conservation (i.e., networks of Marine Protected Areas or MPAs) around Antarctica. New Zealand has been an active contributor to the CCAMLR spatial management planning process and has focused on supporting the New Zealand Ministry of Foreign Affairs and Trade (MFAT) in developing a proposal for an MPA in the Ross Sea region. NIWA marine and fisheries scientists have provided much of the science underpinning the MPA proposal.

NIWA's work began with the comprehensive drawing together of information on all types of organisms in the region. Over many years, New Zealand and international scientists have acquired a wealth of information on Ross Sea species ranging in size from phytoplankton to whales. The area presents particular challenges because of the very wide range of habitats and ecosystem processes in the region, coupled with dramatic seasonal changes.

Our next task was to understand how all the data fit together, using a balanced food-web model. In areas where data are sparse, NIWA scientists used an approach called 'bioregionalisation'. This uses similarities in environmental conditions to infer similarity between biological communities in areas where sampling has not been conducted. In conjunction with other experts, NIWA scientists developed benthic and pelagic bioregionalisations of the Ross Sea region, as well as maps of important ecological processes including known feeding and breeding areas.

These three outputs were then used by MFAT and the Ministry for Primary Industries, with scientific support from NIWA scientists, to inform spatial management using a systematic conservation planning approach. An important part of this final step was to consider the direct effects of an MPA on the fishing industry, as well as its impact on existing fisheries management practices and systems.

Considerable consultation and negotiation between New Zealand stakeholders, using our data and analyses, is giving New Zealand a strong voice in CCAMLR, working towards building the consensus it needs to decide on an MPA in the Ross Sea region.

ENSURING THE SUSTAINABILITY OF ROSS SEA FISHERIES

New Zealand has an important role in the stewardship of the marine environment in the Ross Sea region of Antarctica. NIWA has been at the centre of the fish and ecosystem research in the area, and has developed and undertaken much of the science that supports our understanding of the Antarctic toothfish fishery and the wider marine ecosystem in the region.

Using our deepsea, ice-strengthened research vessel *Tangaroa*, and samples collected from fishing vessels, we have conducted extensive research in the Ross Sea region over several years. These data, and the considerable body of international research in the region, have provided us with information to create a balanced ecosystem model. At the scale of the Ross Sea, the model suggests that the groups with the highest indices of ecological importance are phytoplankton, mesozooplankton, Antarctic silverfish, small demersal fishes, krill and cephalopods – and not the commercially fished Antarctic toothfish, nor the higher predators. This means that changes to the abundance of toothfish due to fishing at current levels are unlikely to propagate widely through the wider Ross Sea food web. However, the model shows that any large decline in the abundance of Antarctic toothfish would be likely to have a relatively strong effect on their main prey: medium-sized demersal fishes. In addition, any large reduction in Antarctic toothfish numbers could impact their predators – Weddell seals and fish-eating (type-C) killer whales – because of feeding on toothfish by predators in particular areas and at specific times of the year when alternative food sources are not available.

This information was presented to the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) and has contributed directly to their ongoing efforts to sustainably manage the Ross Sea fishery.

For more information see www.niwa.co.nz/fisheries/ross-sea-toothfish-fishery.

BROADENING OUR UNDERSTANDING OF ROSS SEA BIODIVERSITY

The third International Polar Year (IPY) – a focus for collaboration by international scientists aimed at better understanding the planet's polar regions and enhancing public awareness of polar research – ran from 2007 to 2009. New Zealand's flagship IPY project was an epic, 50-day, 13,000km voyage of discovery involving NIWA's research vessel *Tangaroa*, to survey biodiversity in the Ross Sea region and provide a fuller picture of the area's unique marine ecosystem. Findings from the survey are now helping to inform fisheries management in the Ross Sea environment, and providing a baseline for our work to monitor the effects of climate change and human activities in the region.

The NIWA-led voyage involved close collaboration between a large number of government agencies and research providers. It formed part of the Census of Antarctic Marine Life, a 23-nation, 10-year, circumpolar survey to assess and explain the diversity, distribution and abundance of marine life in Antarctic waters.

The 44-strong team on board *Tangaroa* sampled 39 sites from the Ross Sea shelf and slope, as well as unexplored seamounts and abyssal plains to the north. They recorded everything from viruses to whales, from the sea surface to the seafloor, collecting more than 37,000 specimens using a huge variety of equipment. Our deepsea towed imaging system photographed seafloor communities and habitats down to 3500m – gaining 12,500 high-resolution still images and 55 hours of video in the process. Acoustic data produced the first abundance estimates of Antarctic silverfish – a key part of the Ross Sea food web.

NIWA's expertise and technical toolkit – headed by *Tangaroa* – were employed to their full potential during IPY. We are ideally placed to play an active role in new collaborative research of this nature, facilitated by the recently formed New Zealand Antarctic Research Institute – a public-private partnership with ongoing research objectives very closely aligned to IPY.

BENEFITS OF CORE FUNDING INVESTMENT

This section reports only on the core funding component of our Statement of Corporate Intent (SCI) programmes. In addition to core funding, SCI programmes may have associated research (e.g., Ministry of Science and Innovation contestable projects) and stakeholder-funded activities (e.g., co-funding). The outputs column here specifically reports only on the core funding, and the sector benefits column also focuses on the core-funded element. Comprehensive illustrations of three key innovations in each science area are given in the Our Science section on pages 14–29.

THE STATEMENT OF CORE PURPOSE (SCP) OUTCOMES ARE:

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.

Biological industries

MBIE priority area: Primary industry productivity and sustainability

SCI programme	2011–12 achievements (outputs) from core-funded component	Sector benefits	SCP No.*	Core funding investment ($)
Develop reliable and efficient techniques for commercial-scale production of high-value aquaculture species	2 journal papers 6 conference presentations 3 end-user reports/ presentations	Juvenile finfish can be consistently supplied to support finfish aquaculture. Breeding programmes will improve future commercial stocks.	1	2,127,778
Develop monitoring tools and management systems to quantify and minimise the environmental effects of aquaculture	7 journal papers 1 workshop 1 end-user article	Commercial mussel production in Marlborough and Coromandel is helped by understanding the influence of climate. Tools and options are applied to maximise the development of existing marine space. Modelling the impacts of aquaculture helps government, regional councils and industry assess potential, site new farms or convert existing farms.	1, 5	1,334,316
Develop elite breeding stocks	6 conference presentations 2 industry products 4 end-user reports/ presentations	Selective breeding has produced elite paua and finfish broodstock to improve the growth performance of commercial stocks.	1	1,493,720
Develop and apply standardised stock monitoring and assessment methodologies for marine and freshwater fisheries	1 journal paper 1 end-user product 2 workshops 1 other end-user transfer	Advice to stakeholders is based on state-of-the-art software and techniques to enable monitoring and prediction of changes in fish population biology, fish stock biomass and size and age composition.	1	670,000
Determine the impact of fisheries on the environment	7 end-user products (e.g., assessment tools, data access tools) 7 end-user presentations/ reports 1 journal paper	A range of tools are used to help improve management of living marine resources.	1, 5	600,000
Enhance the value of wild fisheries products by improving fishing practice	7 end-user presentations	Value is added by minimising bycatch, understanding the potential ecological impacts of bycatch, contributing to an ecosystems-based approach to management and through improved information to eco-label certifications.	1	300,000

* Statement of core purpose outcomes 1–6 above.

Energy and minerals

MBIE priority area: Energy resources

SCI programme	2011–12 achievements (outputs) from core-funded component	Sector benefits	SCP No.	Core funding investment ($)
Predict the renewable energy output and variability	5 conference presentations/ seminars 1 end-user product 3 end-user presentations	Better forecasts improve medium-term (5–15 days) planning by generators and irrigators.	2	280,000

MBIE priority area: Mineral resources

See *Marine resources and ecosystems*				

Hazards and infrastructure

MBIE priority area: Hazards

SCI programme	2011–12 achievements (outputs) from core-funded component	Sector benefits	SCP No.	Core funding investment ($)
Monitor, quantify and advise on weather, coastal and marine geological hazards	4 journal papers 6 conference presentations 3 end-user reports 3 other end-user transfers	Improved assessments of earthquake and tsunami hazard and risk guide planning, design and standards.	3	160,000
Develop an operational weather hazard forecasting system	19 journal papers 26 conference presentations 5 seminars 9 end-user workshops/ presentations 42 other end-user transfers	An integrated multi-hazard tool is being used to mitigate hazard risks here and in the Pacific Islands, and to increase efficiency in the fishing industry. Modelling tools underpin programmes on climate change and related impacts, water quality and quantity, renewable energy resources, climate resources, wildfire risk and tsunami prediction.	3	2,664,667
Inform planning for weather-related hazard mitigation and response	2 journal papers 8 conference presentations 4 seminars 6 end-user presentations/ reports 4 end-user products	The RiskScape model, a collaborative development with GNS Science, informs decision-making in natural hazard management.	3	988,889

Environmental research

MBIE priority area: Antarctica

SCI programme	2011–12 achievements (outputs) from core-funded component	Sector benefits	SCP No.	Core funding investment ($)
See *Climate and atmosphere*				

MBIE priority area: Climate and atmosphere

Observe, analyse and document the climate of New Zealand, the Southwest Pacific, Southern Ocean, and Antarctica – past and present	17 journal papers 13 conference presentations 7 end-user reports 9 end-user products	Key information is used by the Government, community and researchers, here and overseas, to better manage lives and businesses.	4, 6	925,500
Determine how the climate system influences atmosphere, ocean, ice and hydrosphere conditions in our region	11 journal papers 25 conference presentations 1 public presentation	Fundamental knowledge enhances the modelling and understanding of the climate and ocean circulation around New Zealand.	4	891,000
Improved predictions of climate and climate extremes	7 journal papers 13 conference presentations 108 public presentations/ publications 3 end-user workshops/ presentations 3 end-user reports	Better predictions of climate and climate extremes, from weeks to a 50–100 year timescale, improve management of climate-sensitive industries, for example, and central and local government risk assessment and planning.	3, 4	1,465,833
Determine vulnerability, impacts, and adaptation to climate variability and changes in New Zealand, the Southwest Pacific, Southern Ocean, and Antarctica	1 journal paper 24 end-user presentations 180+ media interviews/ publications 25 other end-user transfers	Climate information is used by local and regional councils, engineering consultancies, iwi/hapū, research institutes, media and the general public to inform, manage and plan their lives and businesses.	4	606,000
Improve long-term predictions of global change	24 journal papers 2 book chapters 45 science presentations 10 public presentations 7 other end-user transfers	Long-term, high quality measurements (in Wellington, Otago and Antarctica) are used by the international atmospheric research community to detect composition variability and change and test climate models. These are the most comprehensive set of internationally recognised high-quality measurements in the Southern Hemisphere, and New Zealand has international leadership in some measurements.	4, 6	2,671,667
Determine the role of oceans in greenhouse gas exchange, improve global models and inform geo-engineering options	2 journal papers 21 conference presentations 6 public presentations/ publications 3 data access sites	Data on the variability of CO_2 uptake by the oceans in the Southwest Pacific region are used in regional carbon models and by the international carbon research community.	4, 6	999,940
Quantify New Zealand's greenhouse gas emissions to improve national inventories and validate mitigation options	14 journal papers 22 conference presentations 1 international meeting hosted 3 end-user reports/transfers	Long-term, high-precision measurement of CO_2 and improved assessments of agricultural emission and mitigation efficacy helps farmers measure the efficacy of mitigation strategies, and informs guidelines for agricultural greenhouse gas emissions.	4	1,222,658
Determine the impacts of changing radiation and air pollutants on human health, and evaluate mitigation options	11 journal papers 35 conference presentations 13 end-user presentations 10 associated end-user reports	A variety of tools (e.g., for determining underlying trends in air quality) have been used in up to 10 urban areas, allowing councils to better plan and meet National Environmental Standards.	4	1,069,444

Environmental research

MBIE priority area: Land and freshwater resources

SCI programme	2011–12 achievements (outputs) from core-funded component	Sector benefits	SCP No.	Core funding investment ($)
Quantify water resources – how much, where, and when – to improve water resource management	3 conference presentations 3 seminars/poster presentations 1 journal paper 1 MSc thesis 1 website article	Reliable information on water resources (including snow) is fundamental to good management decisions. It has specifically contributed to better decisions on the viability of major water resource developments in two water-scarce regions of the country.	1, 5	110,000
Document and predict the effects of human use and modification of rivers and groundwater systems to better enable sustainable allocation of water	35 journal papers 2 book chapters 16 workshop/hui/end-user presentations 21 conference presentations 15 associated end-user reports 5 other end-user transfers	Management tools help identify effects of complex water use, set appropriate flow levels, and quantify trade-offs between water allocated to in-stream values and out-of-stream uses.	1, 5	2,173,377
Quantify and model the sources and consequences of water quality degradation for ecosystem management and use	2 end-user reports 1 planning tool 2 conference/seminar presentations	Accurate forecasts of the impact of contaminants (e.g., sediments, nutrients, and faecal microbes), increase effectiveness of limits set to achieve water-quality and ecosystem-health standards.	5	350,000
Develop tools for the management and restoration of aquatic taonga species	5 workshops/hui 3 stakeholder reports 2 website articles 1 web-based data management system	New tools and strategies help restore and enhance freshwater taonga.	1, 5	275,000
Develop knowledge and tools which increase investment and returns from the Māori economy	7 workshops/hui 2 reports, 1 journal paper 1 tool	A draft tool provides a framework for adaptive management which takes account of both mātauranga Māori and biophysical knowledge.	1, 5	45,000

Environmental research

MBIE priority area: Marine resources and ecosystems

SCI programme	2011–12 achievements (outputs) from core-funded component	Sector benefits	SCP No.	Core funding investment ($)
Assess New Zealand's ocean resources	21 journal papers 3 book chapters 60 conference presentations 17 associated end-user reports 16 workshops/hui/public presentations 18 other end-user reports/ products	Improved knowledge of the shape and composition of the seabed, and improved access by industry and government agencies to seafloor data, enables better management of seabed resources and the environment, as well as improved survey and operation by exploration companies. Hazard risk from offshore sources (e.g., Kermadec Arc) has been more tightly assessed.	1, 5	2,016,089
Develop the knowledge and tools to enable an ecosystem-based approach to the management and use of ocean resources	28 journal papers 31 conference/invited presentations 21 end-user presentations 13 associated end-user reports 16 other end-user reports 14 public presentations	Understanding ecosystem processes is fundamental to sustainably managing and gaining maximum economic benefit from our marine estate, including the Ross Dependency, and allows meaningful input into local, national and international policy development.	1, 5	2,554,000
Predicting the impacts of global environmental variability and change on ocean resources	1 journal paper 10 conference presentations 6 end-user workshops/ presentations	The first (globally) web-based Ocean Climate Change Atlas for policymakers and educators is being produced, and significant advances in geophysical modelling feed into applications such as tsunamis and inundation, tidal currents and eddy generation, and wind modelling.	5, 6	195,000
Develop information and models of coastal ecosystems to improve their management	14 journal papers 34 conference presentations 18 end-user presentations/ data sharing 10 associated end-user reports 11 other end-user transfers	Resource managers can make better decisions that balance resource use and the maintenance of biodiversity when there are multiple users with varying societal, economic and cultural values.	5	1,062,880
Quantifying and predicting the environmental effects of coastal disturbances such as discharges, coastal and harbour developments, and mining	1 conference presentation 1 modelling system	The modelling system is applied to support council decision-making and planning in relation to water quality, estuarine sediment transport, freshwater influence in estuaries, the impact of storm-surges in estuary basins and the impact of wind-driven transport on residual coastal circulation.	5	110,000
Model the connections between coasts, land and oceans to improve both regional land and coastal management and future ocean policy	1 end-user report	Fundamental modelling of river plumes and particle size distribution in estuaries and coastal waters informs coastal management decisions by councils.	5	210,000
Discover and define the aquatic biota of New Zealand, the Ross Sea region and the Southern Ocean to enable effective resource management and improved biosecurity	61 journal papers 25 books or chapters 31 conference presentations 50 public presentations/ publications 6 seminars 5 associated end-user reports	Knowledge of New Zealand's marine biota is fundamental to science programmes and policy decision-making by central government agencies.	5	1,711,213
Determine the value of New Zealand's aquatic biodiversity, and develop ways to ensure protection and restoration	14 journal papers 8 conference presentations 6 workshops/end-user presentations 6 other end-user transfers	New techniques for measuring, valuing, monitoring and modelling biodiversity, and prioritising management and restoration activities, improve decision-making, planning, and policy actions by central and local government to enhance the protection and restoration of aquatic biodiversity.	5	599,810
Identify and evaluate threats to aquatic ecosystems from non-indigenous species, minimise the risk of harmful species establishing, detect and describe aquatic pest populations, and develop tools to mitigate the impacts of non-indigenous species	22 journal papers, 3 book chapters 14 conference presentations 19 end-user workshops/ presentations 33 associated end-user reports 32 other end-user/public transfers	A wide variety of novel tools and information enables robust estimates of aquatic biosecurity risks, effective pest surveillance and monitoring and the development and implementation of effective, socially and environmentally acceptable mitigation options. An internet-based marine biosecurity porthole developed with the Ministry for Primary Industries for use by regional councils and other stakeholders, provides access to information to inform their development of surveillance and control plans for marine pests.	5	1,947,521

Databases and collections

MBIE priority area: Science collections and infrastructure

SCI programme	2011–12 achievements (outputs) from core-funded component	Sector benefits	SCP No.	Core funding investment ($)
Conduct national environmental monitoring programmes for climate and freshwater with consistent, state-of-the-art technologies and protocols to underpin robust environmental assessment and reporting	All data archived in relevant databases 1 journal paper 4 conference/invited presentations 5 end-user reports	Robust data contribute to NIWA projects and advice, international data repositories and projects undertaken by external agencies. Significant co-funding for cost sharing at a number of sites allows a larger network of hydrometric data to be available than through direct funding alone.	1–5	4,744,000
Implement and maintain robust information infrastructures to provide future-proof archives of New Zealand's climate, freshwater, marine, and biological information	4 data management products Extensive supply of data to end-users	A robust information infrastructure ensures the quality and integrity of New Zealand's environmental information for the benefit of all New Zealanders.	1–5	1,133,566
Develop state-of-the-art, user-centric delivery services which enable information access and re-use to improve resource management and business decisions	5 web-based access services	Improvements in information delivery mechanisms (e.g., standardised web-service protocols for information transfer, better web delivery portals) enhance discovery and delivery of available data for all stakeholders to use in internal decision-making, planning and other processes.	1–5	120,000

Capability

MBIE priority area: Capability

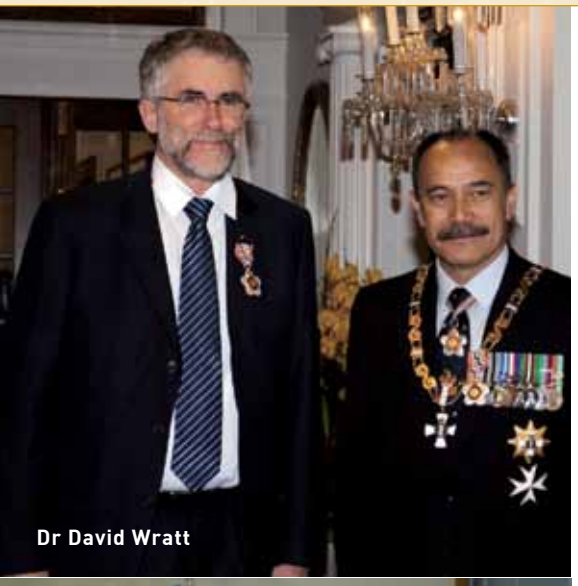
SCI programme	2011–12 achievements (outputs) from core-funded component	Sector benefits	SCP No.	Core funding investment ($)
National science centre operations and end-user engagement		NIWA's national science centres provide a communications, outreach and technology transfer framework for NIWA research 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.	1–6	1,099,016
Key activities to develop capability	3 studentships and 5 postdocs 2 sabbaticals and 11 visiting scientists 7 technical training awards	Benefits flow from strengthened international collaboration, building new skills and capabilities, transferring expertise to NIWA and assisting in core research.	1, 3–5	1,009,861
Innovation seed fund	12 projects funded	Research projects that are creative and discovery in nature, and focus on high quality, innovative science.	1, 4, 6	916,255


BRAVO

NIWA's strong reputation is built on the skills and knowledge of its people.

The following pages celebrate some of their achievements in 2011–12.

our people


Dr David Wratt


Dr Wendy Nelson

SHARED CREDIT FOR QSO

Chief Climate Scientist **Dr David Wratt** has been studying the complexities of the atmosphere for the better part of 40 years. In that time, his knowledge and enthusiasm for the subject have earned him significant responsibility – and high honour. He is a vice-chair of the Intergovernmental Panel on Climate Change (IPCC) Working Group 1, a Companion of the Royal Society of New Zealand, a past chair of the Society's Climate Expert Panel and director of the New Zealand Climate Change Centre. He also shares a Nobel Peace Prize – awarded to everyone who worked on the IPCC Fourth Assessment Report (2007).

In 2011, another rare accolade came the way of this unassuming and perpetually busy man from Motueka. He was awarded the Queen's Service Order (QSO) for his services to science.

David is typically quick to share credit for the achievement: "I see this award as very welcome recognition for the work of New Zealand's climate scientists," he says. "Developing and applying knowledge about climate and climate change is very much a collaboration between scientists, disciplines and organisations."

BOTANICAL EXPERTISE RECOGNISED

Marine biologist **Dr Wendy Nelson** is the latest recipient of the Allan Mere Award, for her outstanding contribution to New Zealand botany.

The Allan Mere (a traditional Māori hand club made from greenstone and carved in Hokitika) was gifted by the late Dr Lucy Moore to New Zealand botany in 1982, to commemorate the work of early botanist HH Allan. Today, it is awarded by the New Zealand Botanical Society to outstanding botanists to acknowledge their contribution and work.

Acknowledgement of Wendy's leadership, expertise and willingness to share her knowledge about the huge diversity of marine algae was supported by many individual members and branches of the Botanical Society.

"I feel very humbled to have received the award," Wendy says, "especially considering those who have been awarded it in the past."

A leading international expert on red algae seaweeds, Wendy is also a Member of the New Zealand Order of Merit and a Fellow of the Royal Society of New Zealand.

> "I see this award as very welcome recognition for the work of New Zealand's climate scientists."
> — Dr David Wratt

Outstanding contribution to marine science


Dr Malcolm Clark

Principal Scientist **Dr Malcolm Clark** was awarded the New Zealand Marine Sciences Society 2012 Award, in recognition of his continued and outstanding contribution to marine science in New Zealand. The award is presented annually to a person who has participated in activities representing the interests of the Society and who has been instrumental in the advancement of marine science in New Zealand.

Previous pages: *A NIWA diver surveys algal structures in 'Secret Lake', where pristine conditions are preserved by the healthy native forest surrounding it. [Crispin Middleton]*

CRUCIAL CLIMATE CHANGE STUDY RICHLY REWARDED

The team investigated the merits of adding iron to the ocean to lower levels of atmospheric carbon dioxide, thus helping to mitigate climate change.

World-leading research on geo-engineering saw a team of NIWA and University of Otago scientists win the prestigious New Zealand Prime Minister's Science Prize for 2011. The nine-member team, including NIWA's **Prof. Philip Boyd**, **Dr Kim Currie**, **Dr Cliff Law** and **Dr Rob Murdoch**, investigated the merits of adding iron to the ocean to lower levels of atmospheric carbon dioxide (CO_2), thus helping to mitigate climate change.

During the study, the team travelled to the remote Southern Ocean on board NIWA's research vessel *Tangaroa*, and to the Gulf of Alaska, to test the iron hypothesis first put forward in the early 1990s. Team leader Philip says that, while the hypothesis was proven, "the process [of iron enrichment] would be very costly, and is fraught with complex side effects." This is crucial knowledge for researchers exploring options to mitigate the effects of climate change.

Findings from the study have been published in prestigious international journals and have informed international geo-engineering workshops and government decision-making. The Prime Minister's Science Prize recognises transformative science. The award of $500,000 will be used for new laboratory infrastructure to further research on biogeochemistry of the Southern Ocean and its response to climate variability and change, says Dr Rob Murdoch, General Manager, Research.

NIWA and University of Otago scientists accept the Prime Minister's Science Prize for 2011.

Dr Paul Sagar

Fellowship surprises and humbles

Christchurch-based marine ecologist **Dr Paul Sagar** joined elite company this year, when he was made a Fellow of the Ornithological Society of New Zealand (OSNZ). The honour recognises Paul's significant contributions to our knowledge of New Zealand birds over many years, and acknowledges the international status of his work – achieved through publication in a wide range of ornithological journals.

TESTING THE LIMITS OF MAN AND MACHINE

NIWA marine biology technician **Dan Cairney's** skill and perseverance helped return the body of a helicopter pilot to his family.

In May 2012, Michael Mehrtens was spraying gorse on a remote Canterbury farm when his helicopter crashed into Lake Sumner.

Three weeks later, police sonar equipment found the helicopter, but an initial attempt to recover the body using a Navy remote operated vehicle (ROV) failed. Dan was called in to pilot NIWA's ROV and, after a difficult day, the body of the pilot was retrieved from the wreckage at a depth of 140m.

ROVs are not designed to lift the weight of a body, so Dan improvised a system of hooks and lines. He manoeuvred the ROV to push a small hook down the sleeve and into the material of the pilot's overalls. This allowed the body to be pulled up to a depth of 30m, where police divers took over to bring the body to the surface.

It was the deepest successful recovery in New Zealand. Senior Sergeant Bruce Adams, Officer in Charge of the police dive squad, credited Dan's skill, saying it was "like trying to drive a remote controlled car through a maze from the other end of a rugby field."

Police and family were extremely grateful to Dan and NIWA.

Dan says he has used the ROV in many innovative scientific operations, but says this operation really tested its limits.

"Working conditions were extremely difficult, but it was a privilege to be able to contribute as part of the multi-agency team to return the body of Mr Mehrtens to his family."

EFFICIENT, ACCESSIBLE SYSTEMS – DELIVERED 'WITH APLOMB'

Recommendations from the 2010 CRI Taskforce on how to enhance the value of New Zealand's Crown Research Institutes meant a number of significant changes to our systems and processes for planning and reporting were implemented during the year.

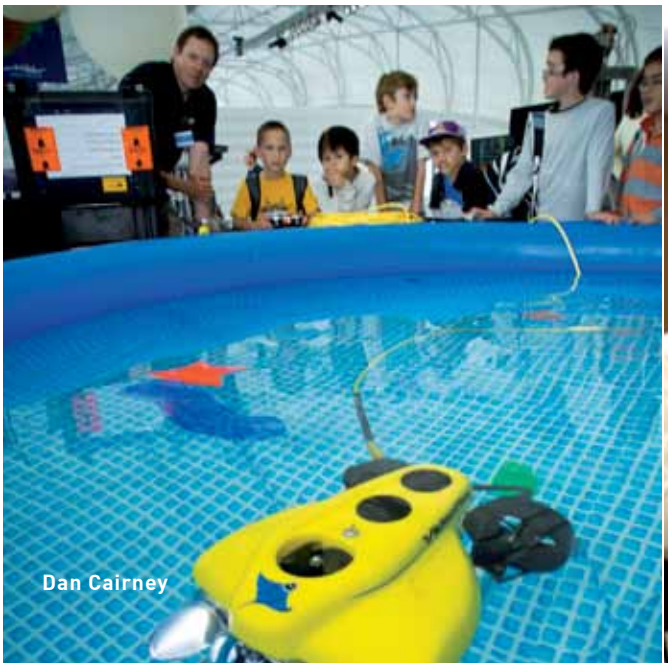
NIWA was allocated core funding to manage, allocate to priority areas, monitor and report on progress. We were also required to develop a more detailed Statement of Corporate Intent (SCI), which sets out our strategies for delivering benefits to New Zealand.

Emilie Williams, Executive Assistant to Dr Bryce Cooper, General Manager, Strategy, played an important role in developing the new systems and processes. Emilie consulted with science and support staff to deliver an efficient, accessible system able to track progress and science achievement from 'cradle to grave'.

Bryce says Emilie has been instrumental in developing an online tool that is now the 'central cog' for science planning, SCI development, and allocation and reporting on the use of NIWA's $42.9 million of core funds annually.

"This has been a massive achievement, which Emilie has done with aplomb and good humour, while also completing all the other work she does as Executive Assistant," says Bryce. "We are extremely grateful to Em. She should be proud of the tool she has delivered."

> It was "like trying to drive a remote controlled car through a maze from the other end of a rugby field."
> — Senior Sergeant Bruce Adams



Dan Cairney

Emilie Williams

NIWA EXCELLENCE AWARDS

This year we celebrated our inaugural NIWA Excellence Awards. These awards recognise the achievements of staff who have made an exceptional contribution to NIWA. Nominated by their peers, for final selection by the Executive Team, this year's winners were:

Research	Dr Dennis Gordon Group Manager, Marine Biodiversity
Applied Science	Dr John Quinn Programme Leader, Freshwater and Estuaries
Early Career Science	Dr Andrew Lorrey Climate Scientist
Science Communication	Dr Jacques Boubee Freshwater Fisheries Ecologist
Leadership	Dr Richard O'Driscoll Group Manager, Middle Depths and Acoustics
Project Delivery	Marty Flanagan Team Leader, Christchurch Field Team
Customer Focus	Ned Norton River Ecosystems and Resource Management
Operational Innovation	Dr Hilary Oliver Meteorology and Remote Sensing Scientist
Support Services	Geoff Latimer IT Projects Manager
Health and Safety Champion	Dr Graham Fenwick Assistant Regional Manager

NIWA National Photography Competition

At NIWA, we often use images to communicate our science to our audiences, whether through the website, the media, our calendar, our Annual Report or our flagship magazine *Water & Atmosphere*. We are very proud of the quality of our photography and work hard to recognise and acknowledge our photographers. This year's National Photography Competition winners reflect the best of our images this year. Visit www.niwa.co.nz/gallery/niwa-photography-competition-2012 to see the photos.

Our People	Tracey Edwards	**Special Award**	Crispin Middleton
Our Places	Dr Katja Riedel	**People's Choice**	Dr Katja Riedel
Our Work	Dr Craig Stevens		

Dr John Clayton

Kudos for LakeSPI

Principal Scientist **Dr John Clayton** won the Waikato Environmental Science Kudos Award – for his work developing LakeSPI (Lake Submerged Plant Indicators). The Kudos Awards are organised by the Hamilton Science Excellence Trust and recognise individuals who have advanced science in the Waikato region in an innovative and exceptional way. LakeSPI – the culmination of over 30 years' work and 1000 scuba dives by John – is a management tool that uses the condition and abundance of submerged plants to assess the ecological condition of New Zealand lakes and to monitor and report on state-of-the-environment trends.

KEEPERS OF OUR UNDERSEA TREASURES

Honeycomb sponges, bubblegum coral, snake stars, king crabs and sea pigs are just a few of the creatures in NIWA's Invertebrate Collection (NIC).

The collection holds marine invertebrates which have been collected over the past five decades from around New Zealand, the Southwest Pacific and the Ross Sea. It is run by a team of four core staff at our Wellington site with the help of a large network of experts, students and volunteers.

The collection is a treasure chest that represents the rich biodiversity in our oceans. Samples are constantly being added through research voyages, fisheries bycatch and private collections. These specimens provide an important resource for a range of scientists, from taxonomists to ecologists, biogeochemists to geologists. Information gained from the specimens is used to inform environmental management, resource use, conservation and biosecurity.

When the NIC team don't have their noses in the collection jars they participate in research voyages, work on seafloor image analysis, give tours or presentations or work on their own research projects.

A Facebook page was started earlier this year to "share information about the collection in a fun way" says Collection Manager **Dr Kareen Schnabel**. The page has been viewed around the globe and "helps us connect with scientists and non-scientists alike".

To catch up with our invertebrates, go to:
www.facebook.com/NIWAInvertebrateCollection

ALL OF LIFE THROUGH ALL OF TIME

New Zealand is the first country in the world to catalogue its entire known array of living and fossil life. The New Zealand Inventory of Biodiversity was completed in May 2012, by a team led by **Dr Dennis Gordon**.

The comprehensive three-volume inventory offers the first full review of New Zealand's entire known complement of species of animals, plants, fungi and microorganisms – more than 56,200 living species and 14,700 fossil species – covering all life in all environments, from the Cambrian (around 530 million years ago) to the present day.

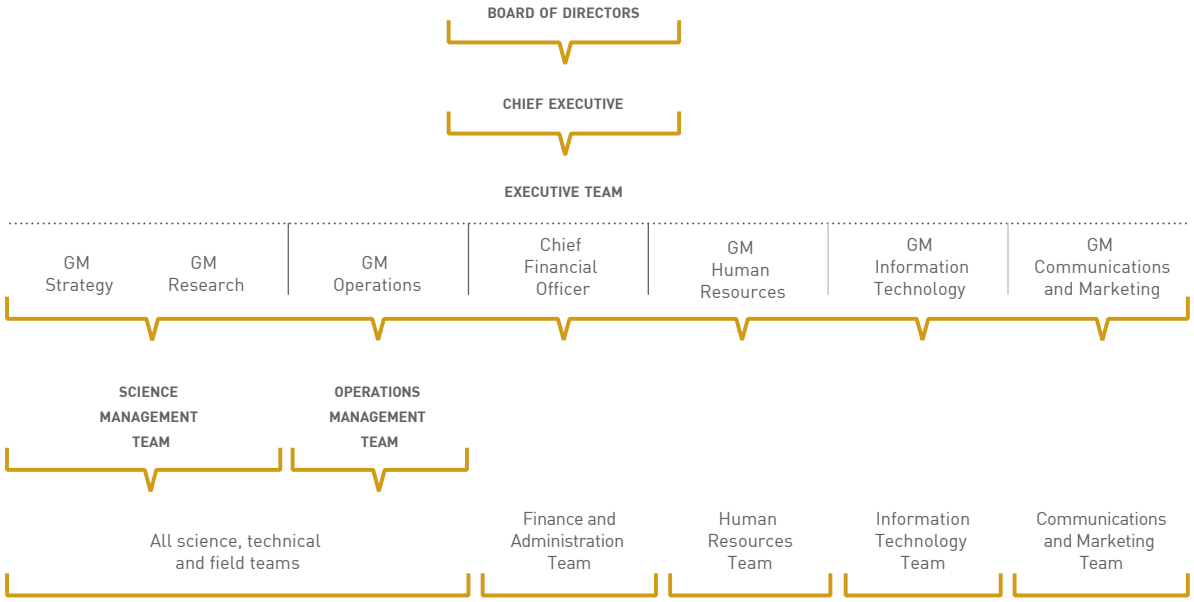
"This 1758-page review and inventory has taken a decade to complete," said Dennis. It involved 237 authors from 19 countries.

The series is associated with the Catalogue of Life, a global project that aims to record all named species on Earth in one online list. "Our species names are being given to the Catalogue through the New Zealand Organisms Register," says Dennis, who is a member of the Catalogue of Life international project team.

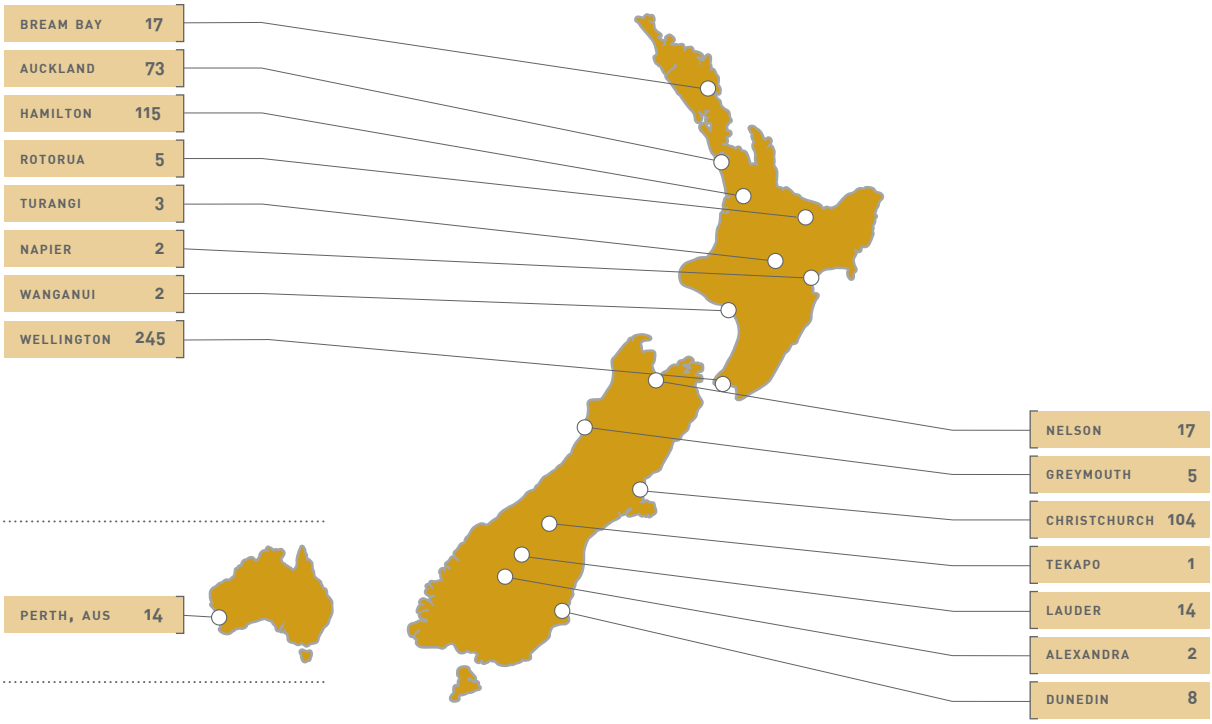
Top: *From left to right – Caroline Chin, Dean Stotter, Dr Kareen Schnabel and Sadie Mills.*
Bottom: *Dr Dennis Gordon.*

New Zealand is the first country in the world to catalogue its entire known array of living and fossil life.

NATIONAL INSTITUTE OF WATER & ATMOSPHERIC RESEARCH (NIWA)



As at 30 June 2012 NIWA had 627 staff



From left to right: *Dr Helen Anderson, Chairman Chris Mace, Chief Executive John Morgan, Ed Johnson, Helen Robinson, Prof. Keith Hunter, Craig Ellison, Jason Shoebridge.*

Chris Mace
Chairman

Chris Mace is an Auckland-based businessman. He chaired the Crown Research Institute ESR in the 1990s and later Antarctica New Zealand. He was a founding trustee of the Sir Peter Blake Trust and continues as a trustee of the Antarctic Heritage Trust. Chris was awarded a CNZM for services to Antarctica and the community and was appointed Chairman of NIWA in July 2009.

Craig Ellison
Deputy Chairman

Craig Ellison is a director on several boards, including the Poutama Trust, and chairs the New Zealand Seafood Standards Council, as well as providing consultancy services to a range of clients. Dunedin born and bred, Craig now lives in Wellington but also has commercial interests in Australia. He was deeply involved in the settlement of Māori commercial fisheries claims and maintains an interest in Māori governance structures and resource management.

Dr Helen Anderson

Helen Anderson is a board member of DairyNZ, BRANZ and Fulbright New Zealand. She was Chief Executive of the Ministry of Research, Science and Technology for six years, preceded by six years as Chief Scientific Adviser. She chairs advisory boards for LINZ, IRL and the construction sector. She has a PhD in geophysics from Cambridge University and enjoys making public presentations about topical earthquakes.

Prof. Keith Hunter

Keith has been Pro-Vice-Chancellor of Sciences at the University of Otago since the beginning of 2010. Before that, he was Head of the Department of Chemistry. A graduate of the University of Auckland, Keith joined the department at Otago in August 1979 following five years of PhD and postdoctoral study in Britain and France. His research speciality is chemical oceanography. He is one of New Zealand's delegates to the UN's Scientific Committee on Oceanic Research and a member of the International Council of Science Regional Committee for Asia and the Pacific.

Ed Johnson

Ed Johnson, FInstD, is Chairman of Fulton Hogan Ltd, Goldpine Industries Ltd, Indevin Ltd and Port Marlborough New Zealand Ltd and a director of several entities including the Bank of New Zealand. He retired as Chairman and CFO of Shell New Zealand in 2002. In 2001, Ed became the inaugural Honorary Fellow of Massey University's Centre for Business and Sustainable Development and was made a Fellow of the New Zealand Institute of Directors in 2003.

Helen Robinson

Helen Robinson has led many technology companies including as CEO of Microsoft NZ, as VP APAC for Pivotal Corporation and currently acts as CEO, Rex Bionics. Helen was the founding CEO of TZ1 Registry, acquired by London-based Markit Group Ltd. Helen chairs The Network for Learning Ltd and other directorships include the New Zealand Business Excellence Foundation.

Jason Shoebridge

Jason is Managing Director of 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.

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.

Kate Thomson
Chief Financial Officer and Company Secretary

Kate is a chartered accountant with a BCom from the University of Canterbury. An experienced Chief Financial Officer, she has held similar roles in the commercial sector, joining NIWA in 2006. Previously she advised a range of businesses on key commercial matters and was also a policy analyst with Treasury. Kate is a past member of the Financial Reporting Standards Board (FRSB).

Geoff Baird
General Manager, Communications and Marketing

Geoff has a BSc (Hons) in ecology from Victoria University of Wellington. He 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 and integrity underlying the NIWA brand.

Dr Barry Biggs
General Manager, Operations

Barry is an environmental scientist with degrees in geology and botany from Victoria University of Wellington, and a PhD in stream ecology from the University of Canterbury. His research fields include the effects of hydropower development on river ecosystems, environmental hydrology and ecohydraulics, eutrophication of lakes and rivers, stream periphyton ecology and freshwater bioinvasions. He was appointed General Manager, Operations in July 2008.

Dr Bryce Cooper
General Manager, Strategy

Bryce has a PhD in microbiology and 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.

Dr Mary-Anne Dehar
General Manager, Human Resources

Mary-Anne joined NIWA in March 2008. She has a PhD in psychology and is a registered psychologist, specialising in industrial/organisational psychology. Before joining NIWA, Mary-Anne worked as a senior human resources consultant for 15 years, both in private practice and for several large consulting firms.

Arian de Wit
General Manager, Information Technology

Arian has an MSc in software engineering from the University of Waikato and a Postgraduate Diploma in management studies. He joined NIWA in 1995 and became General Manager, Information Technology in 2007. Arian and the IT group strive to ensure that NIWA's information and technology infrastructure can readily adapt to NIWA's ever-changing scientific and organisational needs.

Dr Rob Murdoch
General Manager, Research

Rob has a PhD in marine science from the University of Otago and specialist interests in oceanography and marine ecology. 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.

From left to right:
Geoff Baird, Kate Thomson, Dr Barry Biggs, John Morgan, Dr Bryce Cooper, Dr Rob Murdoch, Dr Mary-Anne Dehar, Arian de Wit.

SCIENCE AND OPERATIONS MANAGEMENT TEAMS

SCIENCE MANAGEMENT TEAM

Andrew Forsythe [1]
Chief Scientist, Aquaculture

Andrew is a veterinarian with a DVM from the University of Prince Edward Island. He came to NIWA in 2005 with more than 20 years of aquaculture industry experience from North America and Europe, and took up his current role in 2007.

Dr Barb Hayden [2]
Chief Scientist, Coasts and Oceans

Barb holds a PhD in marine biology and has a research background in marine biosecurity and in the environmental sustainability of aquaculture. She leads NIWA's coasts and oceans research, which includes biodiversity and biosecurity and is also the Deputy Chair of the Biosecurity Ministerial Advisory Committee.

Dr Clive Howard-Williams [3]
Chief Scientist, Freshwater and Estuaries

Clive is an aquatic ecologist with a PhD from the University of London. He has specialised in research on water quality, lakes and wetlands and has worked in a number of countries. 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.

Dr Rosemary Hurst [4]
Chief Scientist, Fisheries

Rosemary has a PhD in zoology and 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 assessment of climate effects on fisheries and fish communities. She was a Regional Manager at NIWA Wellington for eight years.

Dr Murray Poulter [5]
Chief Scientist, Atmosphere, Natural Hazards, and Energy

Murray has a PhD in physics and has worked in Europe on wave propagation in the atmosphere and space. He has worked in New Zealand, Canada, the USA and Antarctica on radar methods to determine the role of ocean waves in coastal and air-sea interaction processes, before taking on a management role in NIWA.

Dr Jochen Schmidt [6]
Chief Scientist, Environmental Information

Jochen holds a PhD in geography from the University of Bonn and has a background in hydrology, geomorphology, soil science, and hazards and risk assessment. He joined NIWA in 2003 and coordinates NIWA's systems for collecting, managing and delivering environmental information to ensure that they are robust and meet best practice standards.

Dr Charlotte Severne [7]
Chief Scientist, Māori (Te Kūwaha)

Tēnei te mihi manahau o NIWA ki ngā iwi huri noa i te motu. Ko Charlotte Severne tōku ingoa. He uri tēnei nō Ngāti Tūwharetoa me Ngāi Tūhoe. Heoi anō he Tumu Whakarae ahau mō ngā tūranga e rua o roto o NIWA, arā, tētehi mō te whanaketanga Māori me tētehi atu mō ngā rangahau o te moana. Nāku i whakahaere tō mātou nei roopu rangahau pūtaiao Māori e kiia nei ko Te Kūwaha. Nō reira tēnā koutou katoa.

Dr David Wratt [8]
Chief Scientist, Climate

David has a PhD in atmospheric physics and has worked in the USA, Australia and New Zealand on climate and meteorology. He is also the Director of the New Zealand Climate Change Centre, an adjunct professor at Victoria University, a Companion of the Royal Society of New Zealand, a member of the Royal Society's New Zealand Climate Expert Panel, and a member of the Bureau of the Intergovernmental Panel on Climate Change.

Dr Mark Bojesen-Trepka [9]
Manager, Marketing and Industry Engagement

Mark has a Bachelor of Social Science, an MBA, and a PhD in marketing and technology management. He is a career industrial marketer, and has led the marketing, technology transfer and business development efforts of a number of industrial firms in a range of industry sectors in New Zealand and abroad.

Greg Foothead [10]
General Manager, Vessel Operations

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

Alan Grey [11]
Manager, MBIE Research

Alan holds an MSc in geology, and has a background in ecology and fluid dynamics. He has extensive experience in research administration and science and technology programme evaluation. He oversees NIWA's obligations to government funding agencies, as well as its responsibilities in undertaking research that will benefit New Zealand.

Douglas Ramsay [12]
Manager, Pacific Rim

Doug has degrees in civil and water engineering, an MBA, and is a chartered engineer. He joined NIWA in 2003 and specialises in coastal hazard management. Doug coordinates NIWA's international commercial work, focusing on the Pacific and Asia regions.

Fred Smits [13]
General Manager, Marine Business Services

Fred is a geotechnical engineer with an ME from the University of Auckland. He has worked in many countries as a contracts manager for major onshore and offshore civil engineering projects. He joined NIWA in 1994 as Marine Business Development Manager, and was in charge of the research vessels from 2004 to 2010.

OPERATIONS MANAGEMENT TEAM

Ken Becker [1]
Regional Manager, Auckland

Ken has 30 years' experience in marine science. Before joining NIWA 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 [2]
Assistant Regional Manager, Auckland (responsible for Bream Bay)

Michael has a PhD in aquaculture from the University of Stirling and 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 Bream Bay Aquaculture Park.

Dr Graham Fenwick [3]
Assistant Regional Manager, Christchurch

Graham's background in science, business and academia brings a diversity of experiences and perspectives to his role within the Operations Management Team. He also continues to apply his marine biology and crustacean biodiversity expertise to research and consulting problems in shallow marine and groundwater ecosystems. Graham has a PhD and Dip BA from the University of Canterbury, and joined the Operations Management Team in 2006.

Dr Ken Grange [4]
Regional Manager, Nelson

Ken is a marine ecologist with a PhD in marine ecology from Florida International University. He conducted research on the marine environment in New Zealand fiords, particularly the ecology of black corals, with the Oceanographic Institute, DSIR, and then NIWA in Wellington, before moving to Nelson as Regional Manager in 1994.

Dr Julie Hall [5]
Regional Manager, Wellington

Julie is a marine and freshwater biologist with a PhD from the University of Manitoba, Canada. She spent 20 years with DSIR and then NIWA, specialising in phytoplankton, microbial food web and zooplankton studies. She joined the Operations Management Team in July 2008.

Dr Andrew Laing [6]
Regional Manager, Wellington and Lauder

Andrew is a marine meteorologist and physical oceanographer with a PhD in fluid mechanics from the University of Canterbury. He had more than 20 years' experience with the New Zealand Meteorological Service, in the UK, and at NIWA, before becoming a Regional Manager in 2000.

Charles Pearson [7]
Regional Manager, Christchurch

Charles is a hydrologist with a BSc (Hons) from the University of Canterbury and an MSc (Hons) from the National University of Ireland. He specialises in the analysis of hydrological and other geophysical and climatological data for purposes such as estimating flood risks. He is a member of New Zealand's hydrological and meteorological societies and is the World Meteorological Organization's Hydrological Adviser for New Zealand.

Dr David Roper [8]
Regional Manager, Hamilton

David has a PhD in marine science from the University of Otago. He has worked as an environmental scientist for the past 30 years, specialising in environmental impact assessment and resource management with NIWA and then ECNZ (later Mighty River Power), before returning to NIWA as a Regional Manager in 2002.

NIWA'S ORGANISATIONAL RESPONSIBILITY CHARTER

NIWA is committed to contributing positively to the social, economic and environmental wellbeing of New Zealand.

Economic

NIWA is committed to operating with fiscal discipline to ensure that we retain our long-term viability and meet our core purpose science responsibilities to generate sustainable economic benefit to New Zealand.

We are committed to:

- fair trading and observing high standards of behaviour, integrity and ethics
- maintaining positive relationships with our customers, partners and collaborators
- taking a broad approach to decision-making and business development with the aim of benefiting all of New Zealand.

Social

NIWA is committed to work practices, operations and science outcomes that support our staff and the wider community.

We are committed to:

- ensuring that people are safe in our workplaces and subject to zero harm
- engaging positively with the communities in which we operate and live
- respecting cultural values and diversity in New Zealand and in the countries where we work
- fostering positive interactions with, and outcomes for, Māori.

Environmental

NIWA is committed to operating in an environmentally responsible way when carrying out our activities, and ensuring that we meet our core purpose science responsibilities to contribute to better environmental outcomes for New Zealand.

We are committed to:

- minimising the environmental effects of performing our business
- integrating environmental perspectives into our wider business planning
- complying with all regulatory requirements, standards and best practice guidelines.

OPERATING TO OUR CHARTER PRINCIPLES

We must ensure that the commitments we give are owned by all our people and demonstrated by their actions.

Economic

We will support the Organisational Responsibility Charter by:

- being fair and honest in all our business dealings
- maintaining objectivity in our service provision and avoiding actions that could damage NIWA's reputation for impartiality
- taking an 'NZ Inc' approach to business decisions and using any market advantage responsibly
- delivering on our project commitments – on time, to budget and with the expected quality
- employing our assets responsibly to benefit both the company and the wider community
- abiding by the laws of the lands in which we operate
- resolving differences without the need for litigation.

Social

We will support the Organisational Responsibility Charter by:

- being a good employer, particularly in relation to:
  - providing equitable access to employment opportunities
  - leadership, accountability and culture
  - recruitment, selection and induction
  - employee development, promotion and exit
  - flexibility and work design
  - remuneration, recognition and conditions
  - harassment and bullying prevention.
- treating our employees and all others with whom we interact with dignity and respect, including fostering long-term relationships built on trust and mutual benefits
- ensuring staff have opportunities to participate in workplace improvement programmes
- making available best practice systems and training to achieve zero harm to any individual in our workplaces
- empowering our employees to identify and resolve safety concerns so that potential hazards are eliminated and safe processes and work methods are under continual improvement
- maintaining open communication with local communities and ensuring our activities and staff respect their traditions and cultures
- supporting our employees to participate in voluntary activities that benefit the wider community
- working closely with individual employees to help them reach their goals and provide NIWA with talent for the future
- striving for 'no surprises' in our internal and external relationships.

Environmental

We will support the Organisational Responsibility Charter by:

- ensuring that all our activities and assets comply with resource consents, relevant environmental standards, biosecurity and biodiversity regulations, and permitting requirements
- maintaining full compliance with animal ethics procedures and ensuring that all sampling and work with live animals complies with the Animal Welfare Act 1999
- minimising material waste and resource use, and making maximum practical use of recycling and electronic media
- minimising energy consumption and greenhouse gas emissions, within the constraints of business sustainability
- supporting our employees to take positive actions to reduce the effects of their activities on the environment at work and beyond.

financial information


MARINE RESEA
OUR
RESEARCH
YOUR

REPORT OF THE DIRECTORS TO THE SHAREHOLDERS

The directors take pleasure in presenting the National Institute of Water & Atmospheric Research Ltd (NIWA) and Group (NIWA Group) Annual Report for the financial year ended 30 June 2012.

Business activities

The NIWA Group provided scientific research and consultancy services in New Zealand and overseas during the financial year. In New Zealand, services were provided to the Ministry of Science and Innovation and a range of other public and private sector customers. Internationally, services were provided by NIWA and its subsidiaries to public and private sector customers, predominantly in the USA and Australia.

Results

This financial year the NIWA Group achieved a net profit of $5.5 million (2011: $1.3 million), against a budgeted net profit of $3.0 million. This was achieved on a turnover of $121.4 million (2011: $117.9 million) against budgeted revenue of $123.5 million.

Average shareholders' equity for the year ending 30 June 2012 totalled $93.0 million (2011: $89.6 million). Total average assets were $137.2 million for the year ending 30 June 2012 (2011: $133.6 million).

Group actual performance versus Statement of Corporate Intent (SCI)

Year ended 30 June in thousands of New Zealand dollars	**Actual 2012**	**SCI 2012**	**Actual 2011**
Total revenue (includes interest income)	121,386	123,520	117,861
Operating expenses, depreciation, and amortisation	113,464	119,321	115,510
Operating profit before tax	7,450	4,199	1,860
Net profit after tax	5,541	3,023	1,266
Average total assets	137,165	132,193	133,583
Average shareholders' funds	92,984	90,652	89,666
Profitability			
Operating profit margin (%) (EBITDAF/revenue)	15.6	17.4	13.8
Adjusted return on average equity after tax (%) (net surplus/adjusted average equity)	7.9	4.5	1.9
Return on average equity after tax (%) (net surplus/average equity)	6.0	3.3	1.4
Return on assets (%) (EBIT/average total assets)	5.8	3.5	1.7
Profit volatility (%) (non-adjusted ROE)	15.2	15.4	15.0
Forecasting risk (%)	3.6	6.7	6.9
Liquidity and efficiency			
Current ratio	0.9	0.9	0.8
Quick ratio	1.2	1.3	0.9
Financial leverage			
Debt to average equity (%)	41	40	55
Gearing (%)	7	4	14
Proprietorship (%) (shareholders' funds/total assets)	68	68	67

Previous pages: *National Invertebrate Collection Manager Dr Kareen Schnabel talks about New Zealand's rich biodiversity with members of the public at 'Science in the City'. [NIWA]*

Directors

The appointment of Dr Helen Anderson on 1 July 2011 and the retirement of Dr Wendy Lawson on 30 June 2012 were the changes to the Board of Directors for the year ended 30 June 2012. Prof. Keith Hunter was appointed to the Board of Directors on 1 July 2012 and Chris Mace and Jason Shoebridge were reappointed to the Board of Directors on 1 July 2012.

During the financial year ended 30 June 2012, the Board comprised seven independent non-executive directors (including the Chairman). The directors' profiles are presented on page 44. Board meetings are held monthly. The Board met formally thirteen times during the financial year.

The Audit Committee comprises three directors (the Chairman is an ex-officio member of the Audit Committee). All Board members are invited to attend all Audit Committee meetings.

Membership and attendance

Director	Date of appointment	Appointment term expires	Board	Audit Committee	Remuneration Committee
Dr Wendy Lawson	1 July 2006	30 June 2012	13	3	
Craig Ellison (Deputy Chairman)	1 July 2007	30 June 2013	11	5	
Ed Johnson	9 June 2005	30 June 2014	12	5	
Helen Robinson	1 July 2008	30 June 2014	12	2	
Dr Helen Anderson	1 July 2011	30 June 2014	12	2	
Chris Mace (Chairman)	1 July 2009	30 June 2015	13	5	1
Jason Shoebridge	1 July 2009	30 June 2015	13	5	1

Membership of subsidiary Boards as at June 2012

Director	NIWA Vessel Management Ltd	NIWA Australia Pty Ltd	NIWA Environmental Research Institute	Unidata Pty Ltd
Chris Mace	√*	√*	√*	
Craig Ellison	√	√	√	
Dr Helen Anderson	√	√	√	
Ed Johnson	√	√	√	
Helen Robinson	√	√	√	
Jason Shoebridge	√	√	√	
Dr Wendy Lawson	√	√	√	
Dr Bryce Cooper [2]				√
David Saunders [1]				√
Kate Thomson [2]				√*
Matt Saunders (resigned 20 January 2012) [3]				√

* Chairman.
1 Director representing minority interest.
2 Management members of the parent company.
3 Management member of Unidata Pty Ltd.

REPORT OF THE DIRECTORS TO THE SHAREHOLDERS (continued)

Auditors

In accordance with Section 21(1) of the Crown Research Institutes Act 1992, the auditors, Deloitte on behalf of the Auditor-General, continue in office. Their audit remuneration and fees paid for other services are detailed in note 5 of the 'Notes to the financial statements'.

Interests register

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

Parent and subsidiary companies

Interested transactions

Any business the NIWA Group has transacted in which a director has an interest has been carried out on a commercial 'arms-length' basis. Any potential conflict is recorded and minuted in Board meetings. An interests register containing all relevant directorships is updated on a monthly basis.

Directors' remuneration

Details of the directors' remuneration are provided in the statutory information on page 81.

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

There were no recorded loans by the NIWA Group to any director.

The directors are pleased with the state of affairs of the NIWA Group.

For and on behalf of the Board:

Chris Mace
Chairman
20 August 2012

Craig Ellison
Director

STATEMENT OF COMPREHENSIVE INCOME

for the year ended 30 June 2012

in thousands of New Zealand dollars	Notes	Group 2012 Actual	Group 2012 Budget	Group 2011 Actual	Parent 2012 Actual	Parent 2011 Actual
Revenues and other gains	4					
Research		62,358	61,618	64,624	57,494	64,624
Applied science		57,384	61,889	53,148	48,652	46,844
Other gains		1,562	—	57	1,562	57
Total income		**121,304**	**123,507**	**117,829**	**107,708**	**111,525**
Operating expenses	5					
Employee benefits expense		(60,690)	(61,224)	(62,572)	(54,103)	(56,205)
Other expenses		(41,697)	(40,756)	(38,980)	(40,275)	(39,023)
		(102,387)	**(101,980)**	**(101,552)**	**(94,378)**	**(95,228)**
Profit/(loss) before interest, income tax, depreciation, and amortisation		**18,917**	**21,527**	**16,277**	**13,330**	**13,330**
Depreciation and impairment	15	(10,995)	(16,699)	(12,970)	(8,026)	(12,023)
Amortisation	17	(82)	(190)	(988)	(81)	(893)
Profit/(loss) before interest and income tax		**7,840**	**4,638**	**2,319**	**5,223**	**3,381**
Interest income		82	13	32	37	11
Finance expense		(472)	(452)	(491)	(434)	(454)
Net interest and other financing income	6	**(390)**	**(439)**	**(459)**	**(397)**	**(443)**
Profit/(loss) before income tax		**7,450**	**4,199**	**1,860**	**4,826**	**2,938**
Income tax credit/(expense)	7	(1,909)	(1,176)	(594)	(1,306)	(874)
Profit/(loss) for the period		**5,541**	**3,023**	**1,266**	**3,520**	**2,064**
Other comprehensive income						
Foreign currency translation differences for foreign operations		12	—	(183)	—	—
Total comprehensive income for the period		**5,553**	**3,023**	**1,083**	**3,520**	**2,064**
Profit/(loss) attributable to:						
Parent interest		5,516	2,905	1,232	3,520	2,064
Non-controlling interest		25	118	34	—	—
Profit for the period		**5,541**	**3,023**	**1,266**	**3,520**	**2,064**
Total comprehensive income attributable to:						
Parent interest		5,528	2,905	1,049	3,520	2,064
Non-controlling interest		25	118	34	—	—
Total comprehensive income for the period		**5,553**	**3,023**	**1,083**	**3,520**	**2,064**

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

STATEMENT OF CHANGES IN EQUITY

for the year ended 30 June 2012

GROUP

in thousands of New Zealand dollars	Notes	Share capital	Retained earnings	Non-controlling interest	Foreign currency translation reserve	Total equity
Balance at 1 July 2010		**24,799**	**64,213**	**94**	**17**	**89,123**
Profit for the year		—	1,232	34	—	1,266
Translation of foreign operations		—	—	—	(183)	(183)
Total comprehensive income		—	1,232	34	(183)	1,083
Balance at 30 June 2011		**24,799**	**65,445**	**128**	**(166)**	**90,206**
Balance at 1 July 2011		**24,799**	**65,445**	**128**	**(166)**	**90,206**
Profit for the year		—	5,516	25	—	5,541
Translation of foreign operations		—	—	—	12	12
Total comprehensive income		—	5,516	25	12	5,553
Balance at 30 June 2012		**24,799**	**70,961**	**153**	**(154)**	**95,759**

PARENT

in thousands of New Zealand dollars	Notes	Share capital	Retained earnings	Total equity
Balance at 1 July 2010		**24,799**	**50,989**	**75,788**
Profit for the year		—	2,064	2,064
Total comprehensive income		—	2,064	2,064
Balance at 30 June 2011		**24,799**	**53,053**	**77,852**
Balance at 1 July 2011		**24,799**	**53,053**	**77,852**
Profit for the year		—	3,520	3,520
Total comprehensive income		—	3,520	3,520
Balance at 30 June 2012		**24,799**	**56,573**	**81,372**

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

STATEMENT OF FINANCIAL POSITION

as at 30 June 2012

in thousands of New Zealand dollars	Notes	Group 2012 Actual	Group 2012 Budget	Group 2011 Actual	Parent 2012 Actual	Parent 2011 Actual
EQUITY AND LIABILITIES						
Equity						
Share capital	8	24,799	24,799	24,799	24,799	24,799
Equity reserves		70,807	67,301	65,279	56,573	53,053
Shareholders' interest		**95,606**	**92,100**	**90,078**	**81,372**	**77,852**
Non-controlling interest		153	70	128	—	—
Total equity		**95,759**	**92,170**	**90,206**	**81,372**	**77,852**
Non-current liabilities						
Unsecured loans	9	380	362	344	—	—
Provision for employee entitlements	10	624	777	646	517	539
Deferred tax liability	11	6,666	4,339	6,176	5,137	4,519
Total non-current liabilities		**7,670**	**5,478**	**7,166**	**5,654**	**5,058**
Current liabilities						
Payables and accruals	12	10,454	12,678	13,041	9,213	11,760
Revenue in advance	12	3,998	4,824	5,872	3,998	3,124
Borrowings	13	7,500	3,839	14,830	7,500	14,830
Provision for employee entitlements	10	1,244	2,537	1,259	1,133	1,190
Accrued employee entitlements	10	7,860	8,000	7,451	7,020	6,810
Intercompany	14	—	—	—	2	—
Forward exchange derivatives		—	—	20	—	20
Total current liabilities		**31,056**	**31,878**	**42,473**	**28,866**	**37,734**
Total equity and liabilities		**134,485**	**129,526**	**139,845**	**115,892**	**120,644**

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

STATEMENT OF FINANCIAL POSITION

as at 30 June 2012

in thousands of New Zealand dollars	Note	Group 2012 Actual	Group 2012 Budget	Group 2011 Actual	Parent 2012 Actual	Parent 2011 Actual
ASSETS						
Non-current assets						
Property, plant, and equipment	15	103,835	99,383	107,171	70,170	71,361
Identifiable intangibles	17	417	—	—	384	—
Investments	18	—	—	—	12,709	12,709
Receivables	19	187	—	221	187	221
Prepayments		24	—	85	24	85
Intercompany	14	—	—	—	1,072	1,186
Total non-current assets		**104,463**	**99,383**	**107,477**	**84,546**	**85,562**
Current assets						
Cash and cash equivalents		2,781	—	1,447	1,719	477
Receivables	19	17,944	20,638	20,078	16,422	18,352
Prepayments		1,836	1,500	1,560	1,710	1,482
Taxation receivable		436	1,348	1,550	183	626
Uninvoiced receivables	20	3,989	4,375	4,937	3,979	4,927
Inventory	21	3,036	2,282	2,796	1,669	1,629
Intercompany	14	—	—	—	5,664	7,589
Total current assets		**30,022**	**30,143**	**32,368**	**31,346**	**35,082**
Total assets		**134,485**	**129,526**	**139,845**	**115,892**	**120,644**

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:

Chris Mace
Chairman
20 August 2012

Craig Ellison
Director

CASH FLOW STATEMENT

for the year ended 30 June 2012

in thousands of New Zealand dollars	Note	Group 2012 Actual	Group 2012 Budget	Group 2011 Actual	Parent 2012 Actual	Parent 2011 Actual
Cash flows from operating activities						
Cash was provided from:						
Receipts from customers		122,522	121,385	114,378	111,430	106,789
Dividends received		3	—	4	3	4
Interest received		82	13	32	37	11
Cash was disbursed to:						
Payments to employees and suppliers		(104,771)	(99,266)	(99,334)	(96,758)	(92,631)
Interest paid		(472)	(393)	(491)	(434)	(454)
Taxation (paid)/refund		(302)	(865)	(2,523)	(244)	(1,357)
Net cash inflow from operating activities	22	**17,062**	**20,874**	**12,066**	**14,034**	**12,362**
Cash flows from investing activities						
Cash was provided from:						
Sale of property, plant, and equipment		33	—	37	33	20
Cash was applied to:						
Purchase of property, plant, and equipment	15	(7,929)	(10,071)	(21,045)	(7,078)	(7,343)
Purchase of intangible assets	17	(497)	—	(982)	(463)	(893)
Net cash (outflow) in investing activities		**(8,393)**	**(10,071)**	**(21,990)**	**(7,508)**	**(8,216)**
Cash flows from financing activities						
Cash was applied to:						
Borrowing proceeds (repaid)	13	(7,330)	(10,803)	8,924	(7,330)	8,925
Subsidiary loan proceeds		—	—	—	17,635	15,643
Subsidiary loan (repaid)		—	—	—	(15,594)	(29,612)
Net cash inflow/(outflow) from financing activities		**(7,330)**	**(10,803)**	**8,924**	**(5,289)**	**(5,044)**
Net increase/(decrease) in cash and cash equivalents		**1,339**	**—**	**(1,000)**	**1,237**	**(898)**
Effects of exchange rate changes on the balance of cash held in foreign currency		(5)	—	51	5	(26)
Opening balance of cash and cash equivalents		1,447	—	2,396	477	1,401
Closing cash and cash equivalents balance		**2,781**	**—**	**1,447**	**1,719**	**477**
Made up of:						
Cash at bank		1,351	—	1,447	289	477
Short-term deposits		1,430	—	—	1,430	—
Closing cash and cash equivalents balance		**2,781**	**—**	**1,447**	**1,719**	**477**

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

1. Reporting entity

The National Institute of Water & Atmospheric Research Ltd (NIWA) and Group are profit-oriented. NIWA is a registered company in New Zealand under the Companies Act 1993.

The consolidated (or 'Group') financial statements comprise NIWA (the 'parent company'), its subsidiaries, and the Group's interest in associates and joint ventures. The financial statements for NIWA and the 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 1993. The NIWA financial statements are for the parent company as a separate entity.

2. Nature of activities

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

3. Statement of accounting policies

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). The financial statements were authorised for issue by the directors on 20 August 2012.

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 below. Cost is based on the fair value of consideration given in exchange for assets.

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

Accounting policies are selected and applied in a manner to ensure 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 2012 and the comparative information for the year ended 30 June 2011.

Adoption of new and revised standards

Standards and interpretations effective in the current period

There are no new standards and interpretations effective in the current period with a material impact.

Standards and interpretations approved but not yet in effect

New or revised standards and interpretations that have been approved but are not yet in effect, have not been adopted for the annual reporting period ended 30 June 2012. The adoption of these standards and interpretations is not expected to have a material recognition or measurement impact on the financial statements. These will be applied when they become mandatory.

Accounting judgements and major sources of estimation uncertainty

In the application of the Group's accounting policies, the directors are required to make judgements, estimates, and assumptions about the carrying amounts of assets and liabilities that are not readily apparent from other sources. The estimates and associated assumptions are based on historical experience and other factors that are considered to be relevant. Actual results may differ from these estimates.

Judgements in applying accounting policies

The following are the judgements, apart from those involving estimations, that the directors have made in the process of applying the entity's accounting policies and that have the most significant effect on the amounts recognised in these financial statements:

Revenue recognition

In determining the revenue to be recognised in the year from the rendering of services the directors have exercised their judgement in respect of the percentage of completion of contracts as outlined in policy (b).

In making their judgement, the directors considered:

- whether total contract revenue could be measured reliably;
- the probability that economic benefits associated with the contract will flow to the Group;
- whether the contract costs to complete the contract and the stage of contract completion at balance date could be reliably measured; and
- whether the contract costs attributable to the contract can be clearly identified and measured reliably so that the actual contract costs incurred can be compared with prior estimates.

Following review of the Group's contract transactions the directors are satisfied that the above criteria have been met and the recognition of the revenue in the current year is appropriate, in conjunction with the recognition of an appropriate uninvoiced receivables/revenue in advance.

Major sources of estimation uncertainty

The following are the key assumptions concerning the future, and other major sources of estimation uncertainty at 30 June 2012, that have a significant risk of resulting in a material adjustment to the carrying amounts of assets and liabilities within the next financial year:

Useful lives of property, plant, and equipment

As described in policy (l) and note 15, the Group reviews the estimated useful lives of property, plant, and equipment during each annual reporting period.

Significant accounting policies

The following significant accounting policies have been adopted in the preparation and presentation of the financial reports and have been applied consistently to all periods, unless otherwise stated.

(a) Basis of consolidation

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

Non-controlling interests in the net assets of the consolidated subsidiaries may be initially measured either at fair value or at the non-controlling interest's proportionate share of the fair value of the acquirer's identifiable net assets. The choice of measurement basis is made on an acquisition-by-acquisition basis. Subsequent to acquisition, non-controlling interests consist of the amount attributed to such interests at initial recognition and the non-controlling interest's share of changes in equity since the date of the combination. Total comprehensive income is attributed to non-controlling interests even if this results in the non-controlling interests having a deficit balance.

The results of subsidiaries acquired or disposed of during the year are included in profit or loss from the effective date of acquisition or up to the effective date of disposal, as appropriate. Where necessary, adjustments are made to the financial statements of subsidiaries to bring the accounting policies used into line with those used by other members of the Group.

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

Changes in the Group's interests in a subsidiary that do not result in a loss of control are accounted for as equity transactions. Any difference between the amount by which the non-controlling interests are adjusted and the fair value of the consideration paid or received is recognised directly in equity and attributed to owners of the Company.

When the Group no longer has control of a subsidiary, the profit or loss on disposal is calculated as the difference between:

1. the aggregate of the fair value of the consideration received and the fair value of any retained interest; and
2. the previous carrying amount of the assets (including goodwill), and liabilities of the subsidiary and any non-controlling interests.

Amounts previously recognised in other comprehensive income in relation to the subsidiary are accounted for (i.e., reclassified

to profit or loss or transferred directly to retained earnings) in the same manner as would be required if the relevant assets or liabilities were disposed of. The fair value of any investment retained in the former subsidiary at the date when control is lost is regarded as the fair value on initial recognition for subsequent accounting under NZ IAS 39 Financial Instruments: Recognition and Measurement or, when applicable, the cost on initial recognition of an investment in an associate or jointly controlled entity.

Investments in subsidiaries are recorded at cost less any impairment in the parent company's financial statements.

i) Accounting for jointly controlled operations

Where the Group has joint control in a jointly controlled operation, the Group recognises the assets that it controls and the liabilities that it incurs, along with expenses that it incurs and the Group's share of income it earns from the sale of goods and services by the joint venture.

ii) Accounting for goodwill

Goodwill arising on the acquisition of a subsidiary or jointly controlled entity is recognised as an asset at the date that control is acquired (the acquisition date). Goodwill is measured as the excess of the sum of the consideration transferred, the amount of any non-controlling interest in the acquiree, and the fair value of the acquirer's previously-held equity interest (if any) in the acquiree over the fair value of the identifiable net assets recognised.

If, after reassessment, the Group's interest in the fair value of the acquiree's identifiable net assets exceeds the sum of the consideration transferred, the amount of any non-controlling interests in the acquiree and the fair value of the acquirer's previously-held equity interest (if any) in the acquiree, the excess is recognised immediately in profit or loss as a bargain purchase gain.

Goodwill is not amortised, but is reviewed for impairment at least annually. For the purpose of impairment testing, goodwill is allocated to each of the Group's cash-generating units expected to benefit from the synergies of the combination. Cash-generating units to which goodwill has been allocated are tested for impairment annually, or more frequently when there is an indication that the unit may be impaired. The recoverable amount is the higher of fair value less cost to sell and value in use. If the recoverable amount of the cash-generating unit is less than the carrying amount of the unit, the impairment loss is allocated first to reduce the carrying amount of any goodwill allocated to the unit and then to the other assets of the unit pro rata on the basis of the carrying amount of each asset in the unit. Any impairment loss is recognised immediately in profit or loss and is not subsequently reversed.

On disposal of a subsidiary or jointly controlled entity, the attributable amount of goodwill is included in the determination of the profit or loss on disposal.

(b) Revenue recognition

Rendering of services

Revenue from services rendered is recognised in profit or loss in proportion to the stage of completion of the transaction at reporting date. The amount of revenue unbilled is represented by 'uninvoiced receivables', which are stated at the proportion to the stage of completion in the statement of financial position. Revenue received but not earned is recognised as revenue in advance on the face of the statement of financial position.

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.

Transfers of risks and rewards vary depending on the individual terms of the contract sale. For sales of instruments, transfer occurs upon receipt by the customer.

Dividend revenue

Dividend revenue from investments is recognised when the shareholders' right to receive payment has been established.

(c) Government grants

Government grants are assistance by the government in the form of transfers of resources to the Group in return for past or future compliance with certain conditions relating to the operating activities of the Group. The primary condition is that the Group should undertake research activities as defined under the contractual agreements which award the funding.

Government grants relating to this funding are recognised as income in the profit or loss on a systematic basis in the equivalent period in which the expense is recognised.

Government grants received during the year were $42.854 million GST exclusive (2011: Nil).

(d) Finance costs

Interest expense is accrued on a time basis using the effective interest method.

(e) 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.

(f) Employee benefits

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 at their nominal values 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 of 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.

(g) Impairment of tangible and intangible assets (excluding goodwill)

Intangible assets that have an indefinite life are not subject to amortisation and are tested annually for impairment. Other assets are reviewed for impairment whenever events or changes in circumstances indicate that the carrying amount may not be recoverable. If such an indication exists, the recoverable amount of the asset is estimated in order to determine the extent of the impairment loss. The recoverable amount is the higher of fair value less cost to sell and value in use.

If the recoverable amount of the asset is estimated to be less than its carrying value, the carrying value is reduced to its recoverable amount. An impairment loss is recognised in profit or loss.

Where an impairment loss subsequently reverses, the carrying amount of the asset is increased to the revised recoverable amount, but only to the extent that the increased carrying value does not exceed the carrying amount that would have been recognised if the asset had no impairment loss recognised in the past. This reversal is recognised in profit or loss.

(h) 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.

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 the case of a business combination, the tax effect is taken into account in calculating goodwill or in determining the excess of the acquirer's interest in the net fair value of the acquiree's identifiable assets, liabilities, and contingent liabilities over the cost of the business combination. The carrying amount of deferred tax assets is reviewed at each balance date and reduced to the extent that it is no longer probable that sufficient taxable profits will be available to allow all or part of the asset to be recovered.

(i) Purchased intangible assets

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 their estimated useful lives. The estimated useful life and amortisation method are reviewed each balance date.

The estimated useful life for copyrights is 5 years.

The estimated useful life for software is 3 years (2011: 1 year).

(j) Development costs

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

- the product or process is clearly defined and the costs attributable to the product or process can be identified separately and measured reliably;
- the Group has the ability to use or sell the product or process;
- the Group intends to produce and market, or use, the product or process;
- the existence of a market for the product or process or its usefulness to the Group, if it is to be used internally, can be demonstrated; and
- adequate resources exist, or their availability can be demonstrated, to complete the projects and market or use the product or process.

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.

(k) Property, plant and equipment

Property, plant and equipment are 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 the assets' 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 sales proceeds and the carrying amount of the asset and is recognised in profit or loss.

(l) Depreciation

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

Buildings and leasehold improvements	
Buildings	40 years
Leasehold improvements, freehold property	10 years
Leasehold improvements, rented property	5–12 years
Vessels	
RV *Tangaroa* hull	31 years
RV *Kaharoa* hull	16 years
RV *Ikatere* hull	20 years
Plant and equipment	
Plant and equipment	10 years
Scientific equipment	8 years (2011: 4 years)
Electronic data processing equipment	
Supercomputer	8 years
Electronic data processing equipment	3 years
Other	
Office equipment	5 years
Furniture and fittings	10 years
Small boats	10 years (2011: 5 years)
Motor vehicles	6 years (2011: 4 years)

(m) Receivables

Receivables are categorised as loans and receivables.

Loans and receivables are stated at amortised cost using the effective interest rate, less any impairment.

Collectability of receivables is reviewed on an ongoing basis. Debts which are known to be uncollectable are written off against the provision, once approved by the Board of Directors. 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.

(n) Inventory

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

(o) Foreign currencies

i) Transactions

Transactions in foreign currencies are converted to the functional currency of the Parent 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 taken to profit or loss.

ii) 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.

(p) 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.

The Group has not contracted for any leases which would be classified as finance leases.

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

(q) Statement of cash flows

The statement of cash flows is prepared exclusive of GST, which is consistent with the method used in the statement of comprehensive income. Operating activities comprise the provision of research services, consultancy, and manufacture of scientific instruments and other activities that are not investing or financing activities. Investing activities comprise the purchase and disposal of property, plant, and equipment, intangible assets, and advances to subsidiaries. Financing activities are those which result in changes in the size and composition of the capital structure of the Group.

Cash and cash equivalents comprise cash on hand, cash in banks, and investments in the money market, net of outstanding bank overdrafts.

(r) Financial instruments

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, and 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.

The fair value of outstanding derivative financial instruments at 30 June 2012 is Nil. (2011: $20k liability).

Other financial assets

Non-derivative financial assets comprise receivables, cash and cash equivalents, uninvoiced receivables, and intercompany, and are initially recorded at fair value plus transaction costs (except for financial assets at fair value through profit or loss, which are initially recorded at fair value).

Financial assets are classified into the following specified categories; classification depends on the nature and purpose of the financial asset and is determined at the time of initial recognition.

Financial assets at fair value through profit or loss:

Financial assets are classified at fair value through profit or loss where the financial asset is either held for trading or it is designated at fair value through profit or loss.

A financial asset is classified as held for trading if:

- it has been incurred principally for the purpose of selling in the near future; or
- it is a derivative that is not designated and effective as a hedge instrument; or
- it is part of an identified portfolio of financial instruments that the Group manages together and has a recent actual pattern of short-term profit-making.

A financial asset other than a financial asset held for trading may be designated as at fair value upon recognition if:

- such designation eliminates or significantly reduces a measurement or recognition inconsistency that would otherwise arise; or
- the financial asset forms part of a group of financial assets or financial liabilities or both, which is managed and its performance is evaluated on a fair value basis, in accordance with either the Group's documented risk management or investment strategy, and information about the grouping is provided internally on that basis; or
- it forms part of a contract containing one or more embedded derivatives, and it is allowable to be designated at fair value through profit or loss.

Financial assets at fair value through profit or loss are classified as current assets and are stated at fair value, and changes resulting in a gain or loss are recognised in profit or loss.

Loans and receivables:

Loans and receivables have 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 less impairment.

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 cashflows 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 of 60 days, as well as observable changes in national or local economic conditions that correlate with default on receivables.

For financial assets carried at amortised cost, the amount of the impairment is the difference between the asset's carrying amount and the present value of estimated future cashflows, discounted at the financial asset's original effective interest rate.

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 an allowance account. When a trade receivable is considered uncollectible, it is written off against the allowance account. Changes in the carrying amount of the allowance account 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 at fair value through profit or loss where the liability is either held for trading or it is designated as at fair value. A financial liability is classified as held for trading if it meets similar criteria as financial assets held for trading.

A financial liability other than a financial liability held for trading may be designated as at fair value through profit or loss upon recognition if it meets similar criteria as financial assets designated as at fair value through profit or loss.

Financial liabilities at fair value are stated at fair value with any resultant gain or loss recognised in profit or loss. This incorporates any interest paid on the financial liability.

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 effective interest method is the method of calculating the amortised cost of a financial liability and of allocating interest expense over the relevant period. The effective interest rate is the rate that discounts estimated future cash payments through the expected life of the financial liability, or, where appropriate, a shorter period to the net carrying amount of the financial liability.

(s) Changes in accounting policies

There have been no changes in accounting policies this period.

4. Revenues and other gains

Revenue

in thousands of New Zealand dollars	Group 2012	Group 2011	Parent 2012	Parent 2011
Sale of goods	9,100	6,418	2,400	2,300
Rendering of services	110,639	111,350	103,743	109,164
Dividends	3	4	3	4
Total operating revenue	**119,742**	**117,772**	**106,146**	**111,468**

Other gains

in thousands of New Zealand dollars	Group 2012	Group 2011	Parent 2012	Parent 2011
Net gain on sale from property, plant, and equipment	33	18	33	18
Insurance proceeds	1,529	39	1,529	39
Total other gains	**1,562**	**57**	**1,562**	**57**

5. Operating expenses and other gains

Employee benefit expense

in thousands of New Zealand dollars	Group 2012	Group 2011	Parent 2012	Parent 2011
Defined contribution plans	2,577	2,647	2,306	2,370
Termination benefits	746	1,236	746	1,236
Other employee benefits	57,367	58,689	51,051	52,599
Employee benefit expense	**60,690**	**62,572**	**54,103**	**56,205**

Other expenses

in thousands of New Zealand dollars	Group 2012	Group 2011	Parent 2012	Parent 2011
Operating expenses include:				
Rental and operating lease costs	2,295	2,228	2,194	2,123
Remuneration of directors	297	297	297	297
Bad debts written off	—	—	—	—

Other gains and (losses) included in operating expenses

in thousands of New Zealand dollars	Group 2012	Group 2011	Parent 2012	Parent 2011
Other expenses include:				
Movement within doubtful debt provision	(41)	257	(41)	257
Change in the fair value of derivatives	—	50	—	50
Foreign currency gain (loss)	(28	340	(5	240

Auditor's remuneration

in thousands of New Zealand dollars	Group 2012	Group 2011	Parent 2012	Parent 2011
Auditor's remuneration to Deloitte comprises:				
Audit of the financial statements	158	140	135	122
Other assurance services	—	—	—	—
Total auditor's remuneration	**158**	**140**	**135**	**122**

6. Net interest and other financing income

in thousands of New Zealand dollars	Group 2012	Group 2011	Parent 2012	Parent 2011
Interest income on bank deposits	82	32	37	11
Finance income	**82**	**32**	**37**	**11**
Finance expense	(472)	(491)	(434)	(454)
Net interest and other financing income	**(390)**	**(459)**	**(397)**	**(443)**

7. Income tax

The income tax expense is determined as follows:

in thousands of New Zealand dollars	Group 2012	Group 2011	Parent 2012	Parent 2011
Income tax expense				
Current tax	1,419	(556)	688	87
Deferred tax relating to temporary differences	490	1,150	618	787
Income tax expense	**1,909**	**594**	**1,306**	**874**

Reconciliation of income tax expense

in thousands of New Zealand dollars	Group 2012	Group 2011	Parent 2012	Parent 2011
Operating profit before income tax	**7,450**	**1,860**	**4,826**	**2,938**
Tax at current rate of 28% (2011: 30%)	2,086	558	1,351	881
Adjustments to taxation:				
Other non-deductible expenses	26	40	24	29
R&D tax concession	(31)	—	—	—
Other deferred taxation adjustments	15	68	(23)	3
Under/(over) provision in previous year	(187)	(72)	(46)	(39)
Income taxation expense	**1,909**	**594**	**1,306**	**874**

The 2010 Government of New Zealand budget introduced the reduction in the company tax rate from 30 per cent to 28 per cent effective from the 2011/12 tax year. The rate reduction has an impact on the income taxation expense for the 2011/12 tax year.

8. Share capital

in thousands of New Zealand dollars	Group 2012	Group 2011	Parent 2012	Parent 2011
Issued and fully paid capital	24,799	24,799	24,799	24,799
24,798,700 ordinary shares (2011: 24,798,700 ordinary shares)				

All shares carry equal voting and distribution rights; if the company is to be wound down, all proceeds are distributed equally amongst the shareholders.

9. Unsecured loan

in thousands of New Zealand dollars	Group 2012	Group 2011	Parent 2012	Parent 2011
Loan	380	344	—	—

The loan is unsecured, denominated in Australian dollars, and relates to a vendor finance agreement (Forrester Management Limited and David Saunders) on the acquisition of a subsidiary, Unidata Pty Ltd. The loan is not subject to any interest charge. Repayment will be made when, and in such amounts as, the cash flow and profitability of Unidata Pty Ltd permit, with full repayment due on 7 May 2014. The loan is recognised at amortised cost using the effective interest rate method.

10. Employee entitlements

in thousands of New Zealand dollars	Group 2012	Group 2011	Parent 2012	Parent 2011
Remuneration				
Salary accrual	3,030	2,775	2,634	2,527
Annual leave	4,830	4,676	4,385	4,283
Training leave	167	142	166	142
Long service leave	1,077	1,117	968	1,048
Retirement leave	624	646	517	539
Total employee entitlements	**9,728**	**9,356**	**8,670**	**8,539**
Comprising:				
Current	9,104	8,710	8,153	8,000
Non-current	624	646	517	539

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 using the benefits. Any changes in these assumptions will impact on the carrying amount of the liability. In determining long service leave the employment period is based upon historical length of service to determine the appropriate liability. Training leave is based upon historical usage of the benefit to calculate the likelihood of further benefits incurring.

11. Deferred tax liability and assets

Deferred tax assets (liabilities) arise from the following:

GROUP

As at 30 June 2012 in thousands of New Zealand dollars	Opening balance	Charged to profit or loss	Closing balance
Temporary differences			
Property, plant, and equipment	(6,677)	(858)	(7,535)
Library	13	(2)	11
Uninvoiced receivables	(1,382)	265	(1,117)
Employee benefits	1,759	94	1,853
Doubtful debts	111	11	122
	(6,176)	**(490)**	**(6,666)**

As at 30 June 2011 in thousands of New Zealand dollars	Opening balance	Charged to profit or loss	Closing balance
Temporary differences			
Property, plant, and equipment	(5,998)	(679)	(6,677)
Library	18	(5)	13
Uninvoiced receivables	(1,240)	(142)	(1,382)
Employee benefits	1,998	(239)	1,759
Doubtful debts	196	(85)	111
	(5,026)	**(1,150)**	**(6,176)**

PARENT

As at 30 June 2012 in thousands of New Zealand dollars	Opening balance	Charged to profit or loss	Closing balance
Temporary differences			
Property, plant, and equipment	(4,835)	(918)	(5,753)
Library	12	(1)	11
Uninvoiced receivables	(1,340)	226	(1,114)
Employee benefits	1,533	64	1,597
Doubtful debts	111	11	122
	(4,519)	**(618)**	**(5,137)**

11. Deferred tax liability and assets (continued)

As at 30 June 2011 in thousands of New Zealand dollars	Opening balance	Charged to profit or loss	Closing balance
Temporary differences			
Property, plant, and equipment	(4,545)	(290)	(4,835)
Library	18	(6)	12
Uninvoiced receivables	(1,215)	(125)	(1,340)
Employee benefits	1,814	(281)	1,533
Doubtful debts	196	(85)	111
	(3,732)	**(787)**	**(4,519)**

The NIWA Group is not required to establish or maintain an imputation credit account by virtue of its classification as a Crown Research Institute. The Income Tax Act 2007 confirms this requirement.

12. Payables and accruals, and revenue in advance

in thousands of New Zealand dollars	Group 2012	Group 2011	Parent 2012	Parent 2011
Trade payables and accruals	10,454	13,041	9,213	11,760
Revenue in advance	3,998	5,872	3,998	3,124
Total	**14,452**	**18,913**	**13,211**	**14,884**

Trade payables are payable per normal commercial terms.

Revenue in advance relates to contracted services which have been billed in advance, yet not recognised as revenue in the statement of comprehensive income.

13. Borrowings

in thousands of New Zealand dollars	Group 2012	Group 2011	Parent 2012	Parent 2011
Borrowings	7,500	14,830	7,500	14,830

The facility is unsecured, but subject to various covenants that were complied with during the year. The facility is operated on an on-call basis and a short-term advance with a limit available to borrow of $19 million (2011: $19 million). Interest rates that were applicable during this period are referred to in note 24.

14. Intercompany

in thousands of New Zealand dollars	Parent 2012	Parent 2011
Current asset	5,664	7,589
Non-current asset	1,072	1,186
Current liability	2	—

An amount of $5.7 million relates to advances to NIWA Vessel Management Ltd (2011: $7.6 million relates to advances to NIWA Vessel Management Ltd). This is consistent with the Group policy that all surplus funds are managed by NIWA.

Parent Company advanced NIWA Australia Pty Ltd $338k (2011: $403k), and Unidata Pty Ltd $734k (2011: $783k) during the year.

NIWA Environmental Research Institute advanced the Parent Company $2k during the year (2011: Parent Company advanced $1k).

All balances are unsecured, have no set repayment terms, and are payable upon demand, and some are not expected to be repaid within one year of balance date. The balances are not subject to interest.

During the year NIWA contracted vessel charters from its subsidiary NIWA Vessel Management Ltd totalling $6.2 million (2011: $6.3 million) and purchased workshop services totalling $70k (2011: $51k). NIWA Vessel Management Ltd contracted services from its Parent, NIWA Science, totalling $359k (2011: $35k).

During the year NIWA contracted scientific research from its subsidiary NIWA Australia Pty Ltd totalling Nil (2011: Nil) and provided research services to NIWA Australia Pty Ltd of $99k (2011: $124k).

NIWA earned revenue of Nil (2011: Nil) from research subcontracts with NIWA Environmental Research Institute and provided research services to NIWA Environmental Research Institute of $2k (2011: $5k).

During the year Unidata Pty Ltd contracted services from NIWA totalling $402k (2011: $391k). At balance date, Unidata Pty Ltd had an accounts receivable balance for NIWA of $52k (2011: $130k) and had an accounts payable balance of Nil (2011: $32k) payable to NIWA.

NIWA charged its subsidiaries for administration expenses and management services totalling $1.0 million for the financial year (2011: $1.0 million).

The carrying amount of intercompany balances approximates their fair value.

There were no other significant transactions between any of the companies in the Group.

15. Property, plant, and equipment

in thousands of New Zealand dollars	Land	Buildings & leasehold improvements	Vessels	Plant & equipment	Electronic data processing equipment
GROUP					
Cost					
Balance at 1 July 2011	12,450	49,510	27,938	79,432	24,498
Additions	—	771	9,061	4,467	1,476
Transfers	—	—	524	2,771	—
Disposals	—	11,509	(735)	(2,287)	(815)
Foreign currency	—	(145)	(59)	4	2
Balance at 30 June 2012	12,450	9	—	84,387	25,161
Accumulated depreciation and impairment losses					
Balance at 1 July 2011	—	17,694	10,747	59,664	15,628
Depreciation charge	—	2,400	2,281	3,290	2,343
Disposals	—	(130)	(32)	(2,045)	(813)
Balance as at 30 June 2012	—	19,964	12,996	60,909	17,158
Net book value at 30 June 2012	**12,450**	**30,181**	**26,916**	**23,478**	**8,003**
GROUP					
Cost					
Balance at 1 July 2010	12,450	49,298	19,612	77,295	26,584
Additions/transfers	—	256	9,061	3,793	1,405
Disposals	—	(44)	(735)	(1,662)	(3,505)
Foreign currency	—	—	—	6	14
Balance at 30 June 2011	12,450	49,510	27,938	79,432	24,498
Accumulated depreciation and impairment losses					
Balance at 1 July 2010	—	15,264	11,034	54,957	16,284
Depreciation charge	—	2,474	138	6,215	2,838
Foreign currency	—	—	1	6	10
Disposals	—	(44)	(426)	(1,514)	(3,504)
Balance as at 30 June 2011	—	17,694	10,747	59,664	15,628
Net book value at 30 June 2011	**12,450**	**31,816**	**17,191**	**19,768**	**8,870**
PARENT					
Cost					
Balance at 1 July 2011	12,450	49,330	—	68,919	22,079
Additions/transfers	—	768	—	4,482	1,213
Disposals	—	(145)	—	(1,866)	(810)
Balance at 30 June 2012	12,450	49,953	—	71,535	22,482
Accumulated depreciation and impairment losses					
Balance at 1 July 2011	—	17,520	—	52,417	13,324
Depreciation charge	—	2,393	—	2,796	2,241
Impairment	—	—	—	—	—
Disposals	—	(141)	—	(1,626)	(808)
Balance as at 30 June 2012	—	19,772	—	53,587	14,757
Net book value at 30 June 2012	**12,450**	**30,181**	**—**	**17,948**	**7,725**
PARENT					
Cost					
Balance at 1 July 2010	12,450	49,118	—	65,163	24,268
Additions/transfers	—	256	—	5,362	1,317
Disposals	—	(44)	—	(1,606)	(3,506)
Balance at 30 June 2011	12,450	49,330	—	68,919	22,079
Accumulated depreciation and impairment losses					
Balance at 1 July 2010	—	15,103	—	47,942	14,374
Depreciation charge	—	2,461	—	5,929	2,456
Impairment	—	—	—	—	—
Disposals	—	(44)	—	(1,454)	(3,506)
Balance as at 30 June 2011	—	17,520	—	52,417	13,324
Net book value at 30 June 2011	**12,450**	**31,810**	**—**	**16,502**	**8,755**

Office equipment	Furniture & fittings	Motor vehicles	Small boats	Work in progress	Total
7,942	2,186	3,617	3,089	14,280	224,942
392	7	272	20	—	7,929
—	—	—	—	(14,280)	—
(243)	—	(93)	(37)	—	(3,679)
—	—	—	—	—	15
8,091	2,193	3,796	3,072	—	229,207
7,049	1,981	3,293	1,715	—	117,771
399	38	140	104	—	10,995
(243)	—	(93)	(38)	—	(3,394)
7,205	2,019	3,340	1,781	—	125,372
886	174	456	1,291	—	**103,835**
7,869	2,196	3,692	3,236	8,000	210,232
360	—	7	(117)	6,280	21,045
(289)	(15)	(84)	(30)	—	(6,364)
2	5	2	—	—	29
7,942	2,186	3,617	3,089	14,280	224,942
6,822	1,952	2,911	1,456	—	110,680
513	40	466	286	—	12,970
2	6	2	—	—	27
(288)	(17)	(86)	(27)	—	(5,906)
7,049	1,981	3,293	1,715	—	117,771
893	**205**	**324**	**1,374**	**14,280**	**107,171**
7,557	1,721	3,482	1,866	17	167,421
332	8	272	20	(17)	7,078
(236)	—	(93)	(17)	—	(3,167)
7,653	1,729	3,661	1,869	—	171,332
6,702	1,542	3,170	1,385	—	96,060
373	33	136	54	—	8,026
—	—	—	—	—	—
(238)	—	(93)	(18)	—	(2,924)
6,837	1,575	3,213	1,421	—	101,162
816	**154**	**448**	**448**	—	**70,170**
7,526	1,737	3,559	1,795	34	165,650
319	—	7	99	(17)	7,343
(288)	(16)	(84)	(28)	—	(5,572)
7,557	1,721	3,482	1,866	17	167,421
6,528	1,524	2,802	1,184	—	89,457
462	35	453	227	—	12,023
—	—	—	—	—	—
(288)	(17)	(85)	(26)	—	(5,420)
6,702	1,542	3,170	1,385	—	96,060
855	**179**	**312**	**481**	**17**	**71,361**

The opening net book value for the Group at 1 July 2010 was $99,552k.

The opening net book value for the Parent at 1 July 2010 was $76,193k.

During the year ended 30 June 2012 the useful life of scientific equipment, motor vehicles and small boats was reassessed to reflect management's estimation of useful life. The useful life of scientific equipment increased from 4 to 8 years, motor vehicles increased from 4 to 6 years, and small boats increased from 5 to 10 years. Depreciation expense decreased by $3,319k for the Group and $3,257k for the Parent. (2011: the useful life and residual value of RV *Tangaroa* and related assets were reassessed and depreciation expense decreased by $557k. The useful life of RV *Tangaroa* increased from 26 years to 31 years. The residual value of RV *Tangaroa* has changed from zero to $4 million in the 2011 year).

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

16. 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.

17. Identifiable intangibles

GROUP

in thousands of New Zealand dollars	Software	Copyrights	Total
Cost			
Balance as at 1 July 2011	6,602	215	6,817
Additions	497	—	497
Disposals	(76)	—	(76)
Balance as at 30 June 2012	7,023	215	7,238
Accumulated amortisation and impairment losses			
Balance as at 1 July 2011	6,602	215	6,817
Amortisation	82	—	82
Disposals	(78)	—	(78)
Balance as at 30 June 2012	6,606	215	6,821
Net book value at 30 June 2012	**417**	—	**417**

The opening net book value at 1 July 2010 was $6k.

GROUP

in thousands of New Zealand dollars	Software	Copyrights	Total
Cost			
Balance as at 1 July 2010	5,622	215	5,837
Additions	982	—	982
Disposals	(2)	—	(2)
Balance as at 30 June 2011	6,602	215	6,817
Accumulated amortisation and impairment losses			
Balance as at 1 July 2010	5,622	209	5,831
Amortisation	982	6	988
Disposals	(2)	—	(2)
Balance as at 30 June 2011	6,602	215	6,817
Net book value at 30 June 2011	—	—	—

17. Identifiable intangibles (continued)

PARENT

in thousands of New Zealand dollars	Software	Copyrights	Total
Cost			
Balance as at 1 July 2011	6,215	—	6,215
Additions	463	—	463
Disposals	(31)	—	(31)
Balance as at 30 June 2012	6,647	—	6,647
Accumulated amortisation and impairment losses			
Balance as at 1 July 2011	6,215	—	6,215
Amortisation	81	—	81
Disposals	(33)	—	(33)
Balance as at 30 June 2012	6,263	—	6,263
Net book value at 30 June 2012	**384**	**—**	**384**

The opening net book value at 1 July 2010 was Nil.

PARENT

in thousands of New Zealand dollars	Software	Copyrights	Total
Cost			
Balance as at 1 July 2010	5,324	—	5,324
Additions	893	—	893
Disposals	(2)	—	(2)
Balance as at 30 June 2011	6,215	—	6,215
Accumulated amortisation and impairment losses			
Balance as at 1 July 2010	5,324	—	5,324
Amortisation	893	—	893
Disposals	(2)	—	(2)
Balance as at 30 June 2011	6,215	—	6,215
Net book value at 30 June 2011	—	—	—

During the year ended 30 June 2012 the useful life of software was reassessed to reflect management's estimation of useful life. The useful life of software increased from 1 to 3 years.

18. Investments

in thousands of New Zealand dollars	Group 2012	Group 2011	Parent 2012	Parent 2011
Investments in subsidiaries	—	—	12,709	12,709
	—	—	**12,709**	**12,709**

Investments in subsidiaries

Name	Principal activities	Ownership and voting interest 2012 %	2011 %
NIWA Vessel Management Ltd	Vessel charters for scientific research	100	100
NIWA Australia Pty Ltd	Scientific research and consultancy services	100	100
NIWA Environmental Research Institute	Scientific research and consultancy services	100	100
Unidata Pty Ltd	Supplier of environmental technology products	80	80
NIWA Natural Solutions Ltd	Non-trading shell company	100	100
EcoConnect Ltd	Non-trading shell company	100	100

All subsidiaries have a balance date of 30 June.

NIWA Vessel Management Ltd, NIWA Natural Solutions Ltd, and EcoConnect Ltd are incorporated in New Zealand. NIWA Australia Pty Ltd and Unidata Pty Ltd are incorporated in Australia. NIWA Environmental Research Institute is incorporated in the USA.

19. Receivables

in thousands of New Zealand dollars	Group 2012	Group 2011	Parent 2012	Parent 2011
Trade receivables	18,194	20,678	16,675	18,952
Sundry receivables	375	19	372	19
Provision for doubtful debts	(438)	(398)	(438)	(398)
Total	**18,131**	**20,299**	**16,609**	**18,573**
Classified as:				
Non-current	187	221	187	221
Current	17,944	20,078	16,422	18,352
	18,131	**20,299**	**16,609**	**18,573**

Included in the Group and the Parent's trade receivables balance at the end of the year is one debtor's balance which equates to 38 per cent for the Group and 42 per cent of the Parent's total trade receivables balance (2011: Group 46 per cent and Parent 51 per cent). Contracts with a Crown-owned debtor specify retentions are held on each invoice until the individual contracts are complete, which can take up to 5 years. The non-current component of receivables relates to the long-term portion of these contract retentions.

A large proportion of the Group's commercial customers are from central government, local government, and private sectors which the Group considers to be low credit risk.

Before accepting a new customer, a credit check is undertaken when deemed appropriate to ensure validity of the customer before any service or goods are provided to the customer.

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

Past due but not impaired trade receivables

in thousands of New Zealand dollars	Group 2012	Group 2011	Parent 2012	Parent 2011
Between 60 and 90 days	129	234	129	83
Between 91 and 180 days	83	99	69	99
Over 181 days	1,168	122	284	122
	1,380	**455**	**482**	**304**

Included in the Group's trade receivable balance are debtors with a carrying amount of $1,380k (2011: $455k) 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 Parent's trade receivable balance are debtors with a carrying amount of $482k (2011: $304k) which are past due at the reporting date for which the Parent has not provided as the amounts are still considered recoverable. The Parent does not hold any collateral over past due or impaired balances.

The above balances indicate the past due receivables which have not been provided for as the amounts are still recoverable. The balances above exclude the Crown owned debtor who has a significant amount owing to the Group as indicated above for which management consider there is low credit risk.

Provision for doubtful debts

in thousands of New Zealand dollars	Group 2012	Group 2011	Parent 2012	Parent 2011
Balance at the beginning of the year	398	655	398	655
Impairment loss recognised	41	1	41	1
Impairment losses reversed	(1)	(272)	(1)	(272)
Amounts written off as uncollectible	—	—	—	—
Amounts recovered during the year	—	14	—	14
	438	**398**	**438**	**398**

Included in the provision for doubtful debts are individually selected debtors of $438k (2011: $398k) for the Group and the Parent 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.

20. Uninvoiced receivables

in thousands of New Zealand dollars	Group 2012	Group 2011	Parent 2012	Parent 2011
Uninvoiced receivables	3,989	4,937	3,979	4,927

The amount of revenue unbilled at balance date is represented by 'uninvoiced receivables', which are stated at the proportion to the stage of completion 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.

21. Inventory

in thousands of New Zealand dollars	Group 2012	Group 2011	Parent 2012	Parent 2011
Consumables	1,091	764	109	105
Finished goods	1,761	1,716	1,376	1,262
Work in progress	184	316	184	262
Total	**3,036**	**2,796**	**1,669**	**1,629**

Inventories are not pledged as security for liabilities, nor are any inventories subject to retention of title clauses

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

in thousands of New Zealand dollars	Group 2012	Group 2011	Parent 2012	Parent 2011
Profit for the period	**5,541**	**1,266**	**3,520**	**2,064**
Add/(less) items classified as investing activities				
Net loss/(gain) on disposal of property, plant and equipment	236	442	207	133
	236	**442**	**207**	**133**
Add/(less) non-cash items				
Depreciation and impairment	10,994	12,970	8,026	12,023
Amortisation of identifiable intangibles	82	988	81	893
(Increase)/decrease in unsecured loan	(36)	(65)	—	—
Net foreign currency (gain)/loss	88	(123)	(5)	26
Increase/(decrease) in deferred tax liability	490	1,147	618	787
	11,617	**14,917**	**8,719**	**13,729**
Add/(less) movements in working capital items				
Increase/(decrease) in payables and accruals and revenue in advance	(4,461)	2,907	(1,671)	481
Increase/(decrease) in employee entitlements	374	(36)	129	(29)
(Increase)/decrease in receivables and prepayments	1,954	(3,260)	1,798	(1,767)
(Increase)/decrease in inventory and uninvoiced receivables	707	(1,045)	908	(930)
(Increase)/decrease in taxation receivable	1,114	(3,075)	444	(1,269)
Increase/(decrease) in forward exchange derivatives	(20)	(50)	(20)	(50)
	(332)	**(4,559)**	**1,588**	**(3,564)**
Net cash flows from operating activities	**17,062**	**12,066**	**14,034**	**12,362**

23. Related party transactions

In addition to the disclosures in note 19, the Government of New Zealand (the Crown) is the ultimate shareholder of the NIWA Group. All transactions with other Government-owned entities do not fall within the scope of related party transactions. 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 'arms-length' basis. Any potential conflict is recorded and minuted in 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	Group 2012	Group 2011	Parent 2012	Parent 2011
Short-term benefits	6,579	6,016	6,417	5,869

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

24. Financial instruments

Capital management

The Group has externally imposed requirements 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 The ANZ National Bank is subject to two covenants:

1. Maintain shareholders' funds of not less than $50 million of net tangible assets; and
2. Reserve 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 and Parent.

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

Fair value of financial instruments

The fair values of financial assets and financial liabilities are determined as follows:

1. The fair value of financial assets and financial liabilities with standard terms and conditions and traded on active liquid markets is determined with reference to quoted market prices;
2. The fair value of other financial assets and financial liabilities (excluding derivative instruments) is determined in accordance with valuation techniques based on discounted cash flow analysis using prices from observable recent market transactions, or dealer quotes for similar instruments; and
3. The fair value of derivative instruments is calculated using quoted prices. Where such prices are not available, use is made of discounted cash flow analysis using the applicable yield curve for the duration of the instruments for non-optional derivatives, and option pricing models for optional derivatives.

The Group has no level 3 financial instruments. The carrying value of all financial instruments is considered to approximate fair value.

24. Financial instruments (continued)

Categories of financial instruments

GROUP

Balance at 30 June 2012 in thousands of New Zealand dollars	Note	Loans and receivables	Held for trading	Financial liabilities at amortised cost	Total
Assets					
Cash and cash equivalents		2,781	—	—	
Receivables	19	18,131	—	—	
Uninvoiced receivables	20	3,989	—	—	
Total financial assets		24,901	—	—	24,901
Total non-financial assets					109,584
Total assets					**134,485**
Liabilities					
Payables and accruals	12	—	—	14,452	
Unsecured loans	9	—	—	380	
Borrowings	13	—	—	7,500	
Employee entitlements	10	—	—	9,728	
Total financial liabilities		—	—	32,060	32,060
Total non-financial liabilities					6,666
Total liabilities					**38,726**

Fair value through profit or loss financial instruments are all level 2 of the hierarchy.

Balance at 30 June 2011 in thousands of New Zealand dollars	Note	Loans and receivables	Held for trading	Financial liabilities at amortised cost	Total
Assets					
Cash and cash equivalents		1,447	—	—	
Receivables	19	20,299	—	—	
Uninvoiced receivables	20	4,937	—	—	
Total financial assets		26,683	—	—	24,901
Total non-financial assets					109,584
Total assets					**134,485**
Liabilities					
Payables and accruals	12	—	—	18,913	
Unsecured loans	9	—	—	344	
Borrowings	13	—	—	14,830	
Employee entitlements	10	—	—	9,356	
Forward exchange derivatives		—	20	—	
Total financial liabilities		—	20	43,443	43,463
Total non-financial liabilities					6,176
Total liabilities					**49,639**

24. Financial instruments (continued)

PARENT

Balance at 30 June 2012 in thousands of New Zealand dollars	Note	Loans and receivables	Held for Trading	Financial liabilities at amortised cost	Investment in subsidiary accounted for at cost	Total
Assets						
Cash and cash equivalents		1,719	—	—	—	
Receivables	19	16,609	—	—	—	
Investments	18	—	—	—	12,709	
Uninvoiced receivables	20	3,979	—	—	—	
Intercompany	14	6,736	—	—	—	
Total financial assets		29,043	—	—	12,709	41,752
Total non-financial assets						74,140
Total assets						**115,892**
Liabilities						
Payables and accruals	12	—	—	13,211	—	
Borrowings	13	—	—	7,500	—	
Intercompany	14	—	—	2	—	
Employee entitlements	10	—	—	8,670	—	
Total financial liabilities		—	—	29,383	—	29,383
Total non-financial liabilities						5,137
Total liabilities						**34,520**

Balance at 30 June 2011 in thousands of New Zealand dollars	Note	Loans and receivables	Held for Trading	Financial liabilities at amortised cost	Investment in subsidiary accounted for at cost	Total
Assets						
Cash and cash equivalents		477	—	—	—	
Receivables	19	18,573	—	—	—	
Investments	18	—	—	—	12,709	
Uninvoiced receivables	20	4,927	—	—	—	
Intercompany	14	8,775	—	—	—	
Total financial assets		32,751	—	—	12,709	45,462
Total non-financial assets						75,182
Total assets						**120,644**
Payables and accruals	12	—	—	14,884	—	
Borrowings	13	—	—	14,830	—	
Intercompany	14	—	—	—	—	
Employee entitlements	10	—	—	8,539	—	
Forward exchange derivatives		—	20	—	—	
Total financial liabilities		—	20	38,253	—	38,273
Total non-financial liabilities						4,519
Total liabilities						**42,792**

24. Financial instruments (continued)

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 dealt with. There are no significant concentrations of credit risk.

The maximum exposure to credit risk for the Group is $24,901k (total exposed to credit risk, which is cash and cash equivalents $2,781k, uninvoiced receivables $3,989k, and trade receivables net of provisions $18,131k) (2011: $26,681k).

The maximum exposure to credit risk for the Parent is $29,043k (total exposed to credit risk, which is cash and cash equivalents $1,719k, uninvoiced receivables $3,979k, trade receivables net of provisions $16,609k, and intercompany $6,737k) (2011: $32,754k).

Receivables and prepayments include further analysis on the trade receivables (refer note 19).

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	Group 2012	Group 2011	Parent 2012	Parent 2011
New Zealand	22,922	23,754	28,757	31,312
Australia	1,774	1,688	481	1,600
USA	213	146	65	30
United Kingdom	3	35	3	4
Other Asia Pacific countries	144	1,128	144	81
Other regions	283	312	31	125
Provision for doubtful debts	(438)	(398)	(438)	(398)
Total credit risk	**24,901**	**26,681**	**29,043**	**32,754**

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 cost of borrowing and the return on investments.

The interest rates on the Group and Parent borrowings as at 30 June:

	2012	2011
Borrowings	3.61 – 3.65%	3.62 – 4.05%

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

	2012	2011
Cash (on call)	2.5%	2.5%

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

All borrowings and intercompany balances are managed by NIWA on behalf of the Group.

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

24. Financial instruments (continued)

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, unless explicitly authorised otherwise by the Board. To manage these exposures, the Group uses forward foreign exchange contracts. At balance date, the Group had forward foreign exchange arrangements in place with a New Zealand dollar (NZD) notional value of Nil (2011: $260k).

The following table details the forward foreign currency exchange contracts outstanding as at 30 June 2012 and 2011 for the Parent and the Group.

	Average exchange rates		Foreign currency		Notional value		Fair value	
in thousands of New Zealand dollars	2012	2011	2012	2011	2012	2011	2012	2011
Buy SGD								
3 to 6 months	—	0.9822	—	243	—	260	—	(20)

2011: The Parent and the Group entered into forward exchange contracts to economically hedge the exchange rate risk for the forecast purchase of goods and services for the fit out of RV *Tangaroa*.

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	AUD	EUR	USD	SGD	AUD	EUR	USD	SGD
	30 June 2012				30 June 2012			
Cash balances	962	2	218	1	828	28	232	—
Trade receivables	709	33	122	—	541	30	16	—
Trade payables	(161)	(59)	(91)	(69)	(397)	(28)	(196)	—
Statement of financial position exposure	**1,510**	**(24)**	**249**	**(68)**	**972**	**30**	**(52)**	—

The Parent's exposure to foreign currency denominated non-derivative financial instruments (excluding derivatives) was as follows, based on notional amounts:

in thousands	AUD	EUR	USD	SGD	AUD	EUR	USD	SGD
	30 June 2012				30 June 2012			
Cash balances	1	2	125	1	1	28	134	—
Trade receivables	73	33	78	—	158	30	—	—
Trade payables	(91)	(52)	(71)	—	(285)	(28)	(196)	—
Statement of financial position exposure	**(17)**	**(17)**	**132**	**1**	**(126)**	**30**	**(62)**	—

The following significant exchange rates applied:

NZD	Reporting date spot rate	
	2012	2011
AUD	0.7830	0.7725
USD	0.7946	0.8303
NOK	4.7712	4.4553
SGD	1.0112	1.0199
EUR	0.6319	0.5721
YEN	63.01	66.73

A 10 per cent strengthening of the NZD against the following currencies at 30 June would have increased (decreased) the profit and the equity by the amounts shown below. This analysis assumes that all other variables, in particular interest rates, remain constant. The analysis is performed on the same basis for 2011.

in thousands of New Zealand dollars	Group 2012	Group 2011	Parent 2012	Parent 2011
AUD	168	108	(2)	(14)
EUR	(3)	3	(2)	3
USD	28	6	12	(7)
YEN	—	2	—	2
NOK	(8)	—	—	—
SGD	(1)	(27)	(1)	(27)

A 10 per cent weakening of the NZD against the above currencies at 30 June would have had approximately an equal but opposite effect on the above currencies to the amounts shown above, on the basis that all other variables remain constant.

24. Financial instruments (continued)

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.

The NIWA Group's current liabilities exceed its current assets by $1.034 million (2011: $10 million) due to the decision to secure borrowings on a short-term basis which have favourable terms and interest rates in comparison with long-term debt. This on-going banking arrangement suits NIWA's expected cashflows with both short- and long-term positive operating cashflows projected. NIWA is able to meet all of its obligations as they fall due.

The following table details the Group's and the Parent's contractual maturity analysis. The table has been based upon the earliest date on which the Group and the Parent can be required to pay.

GROUP

As at 30 June 2012 in thousands of New Zealand dollars	On demand	Less than 1 year	Later than 1 year and not later than 5 years	Later than 5 years	Total
Payables and accruals	—	10,454	—	—	10,454
Unsecured loan	—	19	457	—	476
Borrowings	—	7,500	—	—	7,500
Employee entitlements	—	9,104	624	—	9,728
Total	—	**27,077**	**1,081**	—	**28,158**

As at 30 June 2011 in thousands of New Zealand dollars	On demand	Less than 1 year	Later than 1 year and not later than 5 years	Later than 5 years	Total
Payables and accruals	—	13,041	—	—	13,041
Unsecured loan	—	19	457	—	476
Borrowings	3,830	11,066	—	—	14,896
Employee entitlements	—	8,710	646	—	9,356
Forward exchange derivative	—	20	—	—	20
Total	**3,830**	**32,856**	**1,103**	—	**37,789**

PARENT

As at 30 June 2012 in thousands of New Zealand dollars	On demand	Less than 1 year	Later than 1 year and not later than 5 years	Later than 5 years	Total
Payables and accruals	—	9,213	—	—	9,213
Intercompany	—	2	—	—	2
Borrowings	—	7,500	—	—	7,500
Employee entitlements	—	8,153	517	—	8,670
Total	—	**24,868**	**517**	—	**25,385**

As at 30 June 2011 in thousands of New Zealand dollars	On demand	Less than 1 year	Later than 1 year and not later than 5 years	Later than 5 years	Total
Payables and accruals	—	11,760	—	—	11,760
Intercompany	—	—	—	—	—
Borrowings	3,830	11,066	—	—	14,896
Employee entitlements	—	8,000	539	—	8,539
Forward exchange derivative	—	20	—	—	20
Total	**3,830**	**30,846**	**539**		**35,215**

24. Financial instruments (continued)

Financing facilities

The Group has access to financing facilities; the total facility is $19.5 million (2011: $19.5 million). $7.5 million was drawn down at 30 June 2012 (2011: $14.8 million). The total facility of $19.5 million relates to an overdraft facility of $0.5 million (on-call) and an overnight placement and short term advance facility of $19 million (2011: $19.5 million). These facilities are available for the Parent company.

25. Commitments

25a. Operating lease arrangements

in thousands of New Zealand dollars	Group 2012	Group 2011	Parent 2012	Parent 2011
Obligations payable after balance date on non-cancellable operating leases:				
Within 1 year	2,576	2,429	2,489	2,340
Between 1 and 2 years	2,198	2,020	2,198	2,020
Between 2 and 5 years	6,026	5,613	6,026	5,613
Over 5 years	9,422	13,222	9,422	13,222
	20,222	**23,284**	**20,135**	**23,195**

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.

25b. Capital commitments

There are no capital commitments (2011: Nil).

26. Contingent liabilities

There are no material contingent liabilities (2011: Nil).

27. Subsequent events

There were no subsequent events.

STATUTORY INFORMATION

Directors' remuneration

Directors' remuneration received or due and receivable during the year is:

in thousands of New Zealand dollars	2012	2011
Directors of the National Institute of Water & Atmospheric Research Ltd		
Chris Mace (Chairman)	72	72
Craig Ellison (Deputy Chairman)	45	45
Dr Helen Anderson	36	—
Dennis Cairns	—	36
Ed Johnson	36	36
Helen Robinson	36	36
Jason Shoebridge	36	36
Dr Wendy Lawson	36	36

No fees were paid in respect of directors of the subsidiaries NIWA Vessel Management Ltd, NIWA Environmental Research Institute, NIWA Australia Pty Ltd, NIWA Natural Solutions Ltd, EcoConnect Ltd, and Unidata Pty Ltd, other than those shown above.

Directors' insurance

The NIWA Group has arranged policies for directors' liability insurance which, with a deed of indemnity, ensures that generally directors will incur no monetary loss as a result of lawful actions undertaken by them as directors. Certain actions are specifically excluded; for example, incurring penalties and fines which may be imposed in respect of breaches of the law.

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 National Institute of Water & Atmospheric Research Ltd and Group for the year ended 30 June 2012.

Chris Mace
Chairman
20 August 2012

Craig Ellison
Director

Employees' remuneration

The numbers of employees (not including directors) whose total remuneration exceeded $100,000 are:

	Group	
	2012	**2011**
100,000–109,999	41	51
110,000–119,999	25	26
120,000–129,999*	23	19
130,000–139,999	10	15
140,000–149,999	7	5
150,000–159,999	6	10
160,000–169,999*	7	5
170,000–179,999	3	3
180,000–189,999	2	5
190,000–199,999	2	3
200,000–209,999	3	—
210,000–219,999	2	—
230,000–239,999	—	2
240,000–249,999	1	—
250,000–259,000	—	2
260,000–269,000	1	—
270,000–279,999	—	2
280,000–289,999	2	—
540,000–549,999**	—	1
560,000–569,999**	1	—

* In 2011–12, the Parent and Group paid compensation or other benefits to 18 people who ceased to be an employee during the financial year. The total value of the payment was $571,830 (2010–11: $998,336). Of these 18 people, 2 are included in the table above.

** Chief Executive's remuneration band (varies based on at risk salary component).

Remuneration includes salary, accrued at risk salary components, severance, and exit payments.

Remuneration exceeding $100,000 was received by 92 Science staff, 11 Science Support, 19 Management, and 15 Subsidiaries. (2011: 92 Science staff, 10 Science Support, 26 Management, and 21 Subsidiaries).

Donations

Donations of $3,968 were made during the year (2011: $7,822).

Dividends

No dividend payments (2011: Nil) were made to the Government of New Zealand as the sole shareholder.

To the readers of National Institute of Water & Atmospheric Research Limited and Group's financial statements for the year ended 30 June 2012

Deloitte.

The Auditor-General is the auditor of National Institute of Water and Atmospheric Research Limited (the company) and group. The Auditor-General has appointed me, Andrew Dick, using the staff and resources of Deloitte, to carry out the audit of the financial statements of the company and group, on her behalf.

We have audited the financial statements of the company and group on pages 55 to 80, that comprise the statement of financial position as at 30 June 2012, the statement of comprehensive income, statement of changes in equity and statement of cash flows for the year ended on that date and the notes to the financial statements that include accounting policies and other explanatory information.

Opinion on the financial statements

In our opinion the financial statements of the company and group on pages 55 to 80:

- comply with generally accepted accounting practice in New Zealand;
- comply with International Financial Reporting Standards; and
- give a true and fair view of the company and group's:
  - financial position as at 30 June 2012; and
  - financial performance and cash flows for the year ended on that date.

Opinion on other legal requirements

In accordance with the Financial Reporting Act 1993 we report that, in our opinion, proper accounting records have been kept by the company as far as appears from an examination of those records.

Our audit was completed on 20 August 2012. This is the date at which our opinion is expressed.

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

Basis of opinion

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

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

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

An audit also involves evaluating:

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

We did not examine every transaction, nor do we guarantee complete accuracy of the financial statements. In accordance with the Financial Reporting Act 1993, we report that we have obtained all the information and explanations we have required. We believe we have obtained sufficient and appropriate audit evidence to provide a basis for our audit opinion.

Responsibilities of the Board of Directors

The Board of Directors is responsible for preparing financial statements that:

- comply with generally accepted accounting practice in New Zealand; and
- give a true and fair view of the company and group's financial position, financial performance and cash flows.

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

The Board of Directors' responsibilities arise from the Crown Research Institutes Act 1992 and the Financial Reporting Act 1993.

Responsibilities of the Auditor

We are responsible for expressing an independent opinion on the financial statements and reporting that opinion to you based on our audit. Our responsibility arises from section 15 of the Public Audit Act 2001 and the Crown Research Institutes Act 1992.

Independence

When carrying out the audit, we followed the independence requirements of the Auditor-General, which incorporate the independence requirements of the New Zealand Institute of Chartered Accountants.

Other than the audit, we have no relationship with or interests in the company or any of its subsidiaries.

Andrew Dick
Deloitte
On behalf of the Auditor-General
Auckland, New Zealand

Matters relating to the electronic presentation of the audited financial statements

This audit report relates to the financial statements of National Institute of Water and Atmospheric Research Limited (the company) and group for the year ended 30 June 2012 included on the company's website. The company's Board of Directors is responsible for the maintenance and integrity of the company's website. We have not been engaged to report on the integrity of the company's website. We accept no responsibility for any changes that may have occurred to the financial statements since they were initially presented on the website.

The audit report refers only to the financial statements named above. It does not provide an opinion on any other information which may have been hyperlinked to or from the financial statements. If readers of this report are concerned with the inherent risks arising from electronic data communication they should refer to the published hard copy of the audited financial statements and related audit report dated 20 August 2012 to confirm the information included in the audited financial statements presented on this website.

Legislation in New Zealand governing the preparation and dissemination of financial information may differ from legislation in other jurisdictions.

High-visibility warning: The dazzling colours of this gem nudibranch (*Dendrodoris denisoni*), photographed near the Poor Knights Islands in Northland, warn predators to steer well clear. [Megan Carter]

NATIONAL INSTITUTE OF WATER & ATMOSPHERIC RESEARCH LTD

Directors

Chris Mace
Chairman

Craig Ellison
Deputy Chairman

Dr Helen Anderson

Prof. Keith Hunter
(appointed 1 July 2012)

Ed Johnson

Helen Robinson

Jason Shoebridge

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NIWA's Māori name Taihoro Nukurangi describes our work as studying the waterways and the interface between the Earth and the sky.

Taihoro is the flow and movement of water (from tai 'coast, tide', and horo which means 'fast moving').

Nukurangi is the interface between the sea and the sky (i.e., the atmosphere).

Together, we have taken it to mean 'where the waters meet the sky'.

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Taihoro Nukurangi

National Institute of Water & Atmospheric Research

enhancing the benefits of New Zealand's natural resources