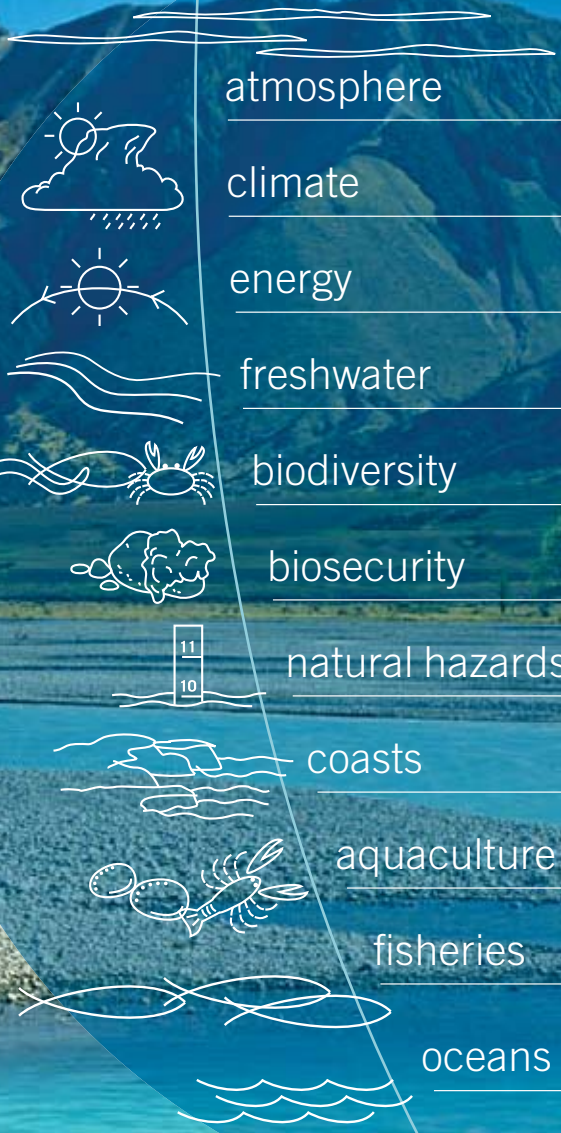
NIWA
Taihoro Nukurangi

annual report 2007

making a difference

from the upper atmosphere to the bottom of the ocean –
our research touches the whole natural environment



NIWA at a glance

NIWA's mission is to be an internationally respected research organisation dedicated to creating and delivering innovative and excellent science that enables New Zealanders to make informed decisions on the sustainable use of their natural environment and its living resources.

The key focuses of our expertise are:

- atmosphere
- climate
- energy
- freshwater
- biodiversity
- biosecurity
- natural hazards
- coasts
- aquaculture
- fisheries
- oceans

NIWA was established as a Crown Research Institute in 1992. It operates as a stand-alone company with its own board of directors and its shares are held by the Crown. In its establishment year, the company had 329 staff, revenue of $35.5 million, and assets of $20 million. Today, these measures have more than doubled or trebled: NIWA now has 667 permanent staff at 15 sites around New Zealand and another 15 in Perth, Australia, revenue of $114 million, and assets of $78 million.

www.niwa.co.nz

Taihoro Nukurangi

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'.

Cover: Upper Rakaia River (Andris Apse)
Inside front cover: Lake Pukaki (Andris Apse)

The 2007 NIWA Annual Report is printed on paper produced using the ECF (Elemental Chlorine Free) process at an ISO 14001 accredited mill from timber harvested from sustainably managed forests. The printer uses soya-based inks and recycles ink cartridges, waste paper, aluminium plates, and used cartons. Waste chemicals are collected and destroyed by a certified company.

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Making a difference

The growth and success of NIWA over the past six years is truly one of the untold success stories of New Zealand. Building on the legacy of NIWA's origins, our 730 people have positioned our company, and country, at the forefront of the world's knowledge about environmental science. The fact that many of NIWA's scientists are recognised globally for their expertise is testimony to that.

Knowing that they really can make a difference to the sustainability of New Zealand's, and the world's, resources and environment is what has driven NIWA people for decades. The fact that society in general has woken up to the importance of issues like climate change, managing water resources, and improving air quality is motivating NIWA scientists and support staff to continue to excel in their fields. We are well aware that the time has come where society is recognising and embracing the knowledge and solutions we can provide.

Strong financial results

NIWA has a proud record of providing excellent science whilst achieving strong financial results. 2006–07 was no exception. For the year to 30 June 2007, NIWA achieved a group operating surplus after tax of $10.5 million ($10.3 million in 2005–06). Gross revenue from research, consulting, vessel operations, and all other business activities was $113.9 million ($106.4 million in 2005–06). Shareholders' funds at 30 June 2007 stood at $46.4 million ($42.5 million in 2005–06). NIWA's after-tax return on average shareholders' equity was 22.6% for the year to 30 June 2007 (24.4% in 2005–06).

This year's revenue came principally from public good research (47%), commercial consulting (38%), and Ministry of Fisheries contracts (15%). Revenue increased in all three areas, and we continue to invest in our major research programmes even though pressure on public funding poses challenges in recruiting and retaining key staff. The Capability Fund is making a difference, and NIWA benefited from several specific funding initiatives, including short-term energy research. We were pleased to host the Prime Minister at Greta Point for her announcement of additional money for research in the International Polar Year, including a 50-day Antarctic marine biodiversity voyage by *Tangaroa* in early 2008.

This year's success is a direct reflection of the commitment and effort of staff, management, and the Board. I would like to thank them all for their contribution.

Sustainable development

As the leading environmental science provider, sustainability is what we are about. It always has been. This year, however, the company has sharpened its focus on sustainability. NIWA takes an integrated approach to sustainability, and in this year's Sustainable Development Report we have increased reporting in the social areas of community, people, and health and safety, along with our usual extensive reporting of environmental performance.

For the coming year, our commitment to sustainability includes providing advice to the public and government bodies on major sustainability issues, demonstrating alternative energy sources, investing in more energy-efficient systems at our regional offices, defining our carbon footprint, investigating and taking initiatives towards carbon neutrality, and continuously monitoring our performance.

Major investment in infrastructure planned

Strong operational and financial discipline will continue to be necessary as we implement major planned investment in core infrastructure. Over the next 3 years we have a programme to upgrade several of our research facilities, improve our working environments, strengthen our information technology platforms, and upgrade our equipment and skill base to keep our science leading-edge.

Our aim is to ensure NIWA is well positioned in the future to respond to the ever increasing thirst for knowledge and solutions in water and atmospheric research. Our vision is to provide a working environment and support infrastructure that will attract, retain, and inspire our people to excel, while our stakeholders continue to recognise NIWA as a world leader in environmental science.

Year of transition

In closing, I would note that 2006–07 was a year of transition. I would like to acknowledge the contribution of Dr Rick Pridmore, who resigned after 13 years in senior management roles at NIWA. With singular drive and vision, Rick helped transform the company from a sector-based research organisation to one that is highly integrated and proactive in meeting stakeholder needs. I would like to thank Dr Bryce Cooper, who, with the support of the Executive Team, led NIWA ably as Acting Chief Executive until John Morgan took up the role on 1 May. John has an outstanding track record as a leader of innovative, science-based companies and will without doubt add significant value to NIWA's management team.

The Board itself has undergone change. This year we welcomed Wendy Lawson and farewelled Miranda Cassidy. David Sharp's term ended on 30 June 2007, and he is replaced by Craig Ellison, who has a similarly strong background in the fishing industry.
I would like to thank the departing Board members for their tremendous contribution to governance of the company.

To our collaborators and stakeholders: your partnership is vital and we don't take it for granted. And to NIWA staff: you are our greatest asset.

Finally, the Board noted with sadness the passing of former Deputy Chief Executive Dr Rod East.

Sue Suckling
Chair

Financial summary

	2007 $'000	2006 $'000	2005 $'000	2004 $'000	2003 $'000
Total Revenue	113,911	106,414	91,137	84,631	84,200
– Public Good Science	53,418	50,374	43,729	39,591	39,780
– Ministry of Fisheries	17,183	16,060	16,626	14,602	16,705
– Commercial and Other	43,310	39,980	30,782	30,438	27,715
Net profit before tax	15,843	15,706	9,654	7,036	7,216
Net profit after tax	10,461	10,342	6,434	5,276	4,726
Capital expenditure	9,107	8,480	7,348	8,389	9,064
Return on average equity (%)	22.6	24.4	13.5	10.7	10.6

Providing solutions

Almost every week, outside the tiny township of Lauder in Central Otago, NIWA staff don flame-retardant overcoats, shelter near a massive concrete slab, and carefully fill a balloon with hydrogen. Then they attach a small package of scientific instruments to measure ozone in the atmosphere. When it's launched, the balloon is about 1.5 metres in diameter. It expands as it rises until it gets to about 30 kilometres above the ground, when the balloon reaches the size of a garage and bursts. A small parachute is then automatically deployed and the equipment descends gently back to earth. NIWA scientists watch the ozone readings come through line by line on a Lauder ground station computer.

Those ozone balloon measurements this year provided the first evidence of a recovery in southern mid-latitude ozone – a signal of the success of concerted international effort under the Montreal Protocol to combat a global environmental problem. NIWA scientists were part of that effort from the beginning, as they are now with the even more complex challenge of global climate change.

Meanwhile, at Bream Bay, near Whangarei, NIWA scientists are working on paua, kingfish, and hapuka (groper), with the aquaculture industry. After five years of investment, we are selecting for desirable genetic traits, and identifying optimal feeding and breeding conditions. Breeding generation-upon-generation of animals with substantially improved performance is one factor behind the success of pastoral farming. We are attempting to do the same for aquaculture.

Elliot Tuck, NIWA

Focus on climate change

Every day, NIWA science makes a difference. Back at Lauder, for instance, we recently installed a massive dome. This high-speed X-band satellite receiver is the only system of its kind in New Zealand. It gives us real-time access to key satellite data streams, which we can plug into our supercomputer in Wellington to assist with accurate environmental forecasting. NIWA scientists in Wellington, Christchurch, and Hamilton are developing these forecast systems for key hazards including floods, high waves, and storm surge. We are confident our forecasts will ultimately help reduce property damage, save lives, and improve New Zealand's economic performance.

Focus on sustainability

As I read over NIWA's past Annual Reports I'm struck by the consistent theme of sustainability. The emphasis is twofold: NIWA's environmental science supports sustainable development; and NIWA itself is committed to operating in a sustainable manner.

NIWA's Sustainable Development Report has been independently verified since 2003. Each year the report has grown in substance, and from last year we published a summary of the report in the Annual Report, while the full, verified report was published on our website. Examples of our commitment to sustainability include simple measures like video-conferencing facilities at all major sites to reduce travel, and more significant measures like reduced cruising speeds on our research vessels, and regular energy audits of our buildings.

There are limits to how much we can shrink our environmental footprint, especially when it comes to operating research vessels, but we can – and will – do more. As I go around the company, I find deep, personal commitment to sustainability. In this Annual Report you'll find a strategically-focused summary of our sustainability activities in the front section, signalling our ongoing commitment to the issue.

Extensive collaboration

Another consistent theme which is addressed more explicitly in this year's Annual Report is collaboration. NIWA collaborates extensively with a vast number of research institutions, central and local government organisations and entities, Māori, non-governmental organisations, and private companies. Our Foundation for Research, Science & Technology-funded research programmes alone involved more than 770 working relationships in 2006–07. I thank all these organisations and individuals wholeheartedly and look forward to continued productive partnerships for the benefit of New Zealand and the wider world.

NIWA making a difference

Science is a cumulative process. Discovery can be the product of both hard slog and inspiration. The diversity of our activities and the multifaceted nature of the scientific problems we tackle mean we have a responsibility to demonstrate to stakeholders that what we do adds value.

Contributing to global environmental management
In this Annual Report we have included feature-length case studies, highlighting NIWA's contribution to three current environmental issues. NIWA scientists this year played a significant role in the 4th Assessment Report of the Intergovernmental Panel on Climate Change, and extensively advised local government, engineers, planners, the insurance industry, and many other groups on how to adapt to climate change. We provide expert advice and solutions to vexed questions in the allocation of scarce water resources. And our scientists are leading the world in understanding the invasive alga didymo.

Contributing to economic growth
This year, *Tangaroa* completed surveys for the oil and gas industry, and mapped more of our Exclusive Economic Zone (EEZ) through the government-funded Ocean Survey 20/20. NIWA's climate database, 15-day probabilistic forecasts, and seasonal climate outlooks are used by a range of businesses from farmers to major retailers. We provide essential hydrological data every day to the electricity market, and expert advice and resource assessment for hydro, wind, and marine energy generation proposals. Our fisheries stock assessments for the Ministry of Fisheries provide a basis for quota management decisions.

Contributing to environmental sustainability
In freshwater, NIWA is developing integrated solutions to improve the quality, management, and efficient use of water. Our Topnet model links climate, soil science, and hydrology to answer the question 'How much water can a catchment yield sustainably?' And we are part of the CLUES collaboration which integrates land,

NIWA

High-value species for aquaculture

Alan Blacklock, NIWA

Focus on water resources

Providing solutions

water, and socio-economic research to help answer the question 'How do we manage land-use change and contaminants in waterways?' Equally, we integrate our freshwater and coastal research in projects such as developing models to predict the impact of river sediment loads on coastal erosion.

Contributing to better health for New Zealanders
NIWA's work on UV levels is assisting with advice on summertime sunsmart behaviour, and with the investigation of the effects of relatively low winter UV on vitamin D deficiency. Our air quality programme is helping regional councils reduce pollution. We are working with ESR on models which help quantify and rank the human health risks of sewage discharges. And we contribute to the assessment of the human health risk of illnesses which can be transmitted from animals to people, such as campylobacteriosis.

Contributing to New Zealand's national identity
NIWA's taxonomy team have boosted the number of known crustacean species from New Zealand and the Antarctic Ross Sea by 350%. The NIWA Invertebrate Collection at Greta Point is a recognised Nationally Significant Database. A joint New Zealand-US voyage on *Tangaroa* this year found the first record in the entire southwest Pacific of communities (including tubeworms and clams) living around cold methane seeps on the seafloor off the east coast of the North Island.

Contributing to protecting our wildlife
Understanding and minimising the potential impact of human activity on aquatic wildlife requires robust science-based monitoring and research. We are using electronic tracking and monitoring devices to monitor the activities of important species like great white sharks and white-capped and Buller's albatrosses.

Contributing to keeping New Zealand safe
NIWA now has an all-hazards forecasting capability thanks to several years' intense work by a team of 25 scientists and international collaborators. This year, for example, we measured the wake of waves of the vessels of one Cook Strait ferry operator to check compliance with the Marlborough Sounds Resource Management Plan. And our Marine Invasives Taxonomic Service handles all identifications of marine species for MAF Biosecurity New Zealand.

NIWA is justly recognised for the excellence of its science and its strong financial performance. The magnificent science examples and the detailed financial information included in this Annual Report attest to that. But we do need to continually evolve as we face the challenges of an increasingly competitive environment for resources and services.

Building on NIWA's success

The success of NIWA will continue to be driven by the high performance of its science, operations, and support infrastructure. However, the substantial growth of the company and the increasing demand for its services require a more focused leadership of strategic science directions, stakeholder management, and operational management. Accordingly, we have reorganised the company's senior leadership into three key management teams to better reflect the size and breadth of the science and associated activities we undertake:

The Executive Management Team, which is responsible for NIWA-wide strategy and performance.

The Science Executive Team, which is responsible for identifying and leading the company's research strategy, stakeholder management, and the development of services, products, and market opportunities. We expanded this team in 2006 with a General Manager, Environmental Information & International, and we have just appointed a General Manager, Climate Change, reflecting the strategic importance of this issue to NIWA and to New Zealand.

The Regional Management Team, which is responsible for the operational performance and effective delivery of NIWA's science, products, and services.

Robert Stuart, IRL

Renewable energy

Alen Blacklock, NIWA

Environmental forecasting

Investing in science for New Zealand

Many of NIWA's core science areas are highly capital intensive, and in recent years we have invested about $10 million per annum to keep our science at the leading edge and to ensure we continue to contribute substantially to New Zealand's economy and the welfare of its citizens.

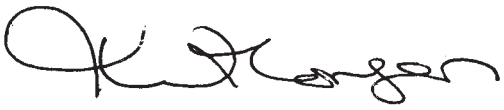
Over the next three years, however, we will be lifting our game significantly with capital investments of nearly $60 million. Those investments will help transform our infrastructure and facilities so we can more rapidly advance our science and commercialisation opportunities, and improve the work environment of our staff.

These exciting plans include:

- upgrading our information technology infrastructure and supercomputer to model nationally important areas such as the impact of climate change, water resource allocation, and real-time hazard forecasting;
- upgrading our environmental monitoring networks to allow real-time data capture and information transfer;
- increasing capacity at our Bream Bay Aquaculture Facility to accelerate commercialisation of high-value aquaculture species;
- purchasing a dynamic positioning system for *Tangaroa* to improve our oceanographic research capabilities and support the future needs of the oil, gas, and mineral exploration sector;
- upgrading our research and operational facilities in Auckland and Hamilton to meet expanding demands for our services.

One cannot help but be tremendously proud of NIWA's contribution to New Zealand, and of the part the company plays in solving global environmental problems. Even this full Annual Report can only provide 'tasters' of what we do.

NIWA has added immense value to its stakeholders over the years ... somehow I think the best is yet to come.



John Morgan
Chief Executive

Alan Blacklock, NIWA

Alan Blacklock, NIWA

The Prime Minister, Rt Hon Helen Clark, at NIWA's Wellington site with CRI Minister Steve Maharey and CEO John Morgan, announces additional money for Antarctic research in the International Polar Year.

The future – our strategic direction

In the time since its establishment in 1992, NIWA has developed into a successful research organisation and commercial consultancy with a reputation for its great science and an outstanding financial performance.

NIWA was restructured in 1994 to embody the innovative 'One NIWA' concept. This removed the divisional barriers within the company, so that research policies and strategies could be applied evenly across the organisation and multidisciplinary work could flourish. Since then, the company has developed into a very successful research organisation and commercial consultancy firm, with a reputation for excellent science, excellent services, highly skilled and motivated staff, and an outstanding financial performance.

Our growth has been based on strong revenue gains in both public good research and commercial projects. In 1992, NIWA had 329 staff, revenue of $35.5 million, and assets of $20 million. Fifteen years later, these measures have largely doubled or trebled: NIWA now has 682 permanent staff, revenue of nearly $114 million, and more than $78 million of assets.

Our strategic priorities

Crown Research Institutes are expected to 'play a broad transformative role in New Zealand's economy, society, and environment and contribute to the government's economic transformation goals'. We have identified a set of 12 desired national outcomes where our skills can play a role in transforming New Zealand's economy and environment.

- New Zealand reduces emissions of greenhouse gases and local air pollutants, mitigating long-term climate change and human health impacts.
- New Zealand is well prepared for and adapts efficiently to the impacts of climate change and variability, climate extremes, and natural hazards.
- New Zealand is powered by sustainable and secure energy, optimising renewable and low emissions solutions at national and local levels.
- New Zealand's aquatic biodiversity is understood, conserved, and managed sustainably. There are no further human-induced extinctions, and threatened species and important habitats are protected or are on their way to recovery. Biosecurity systems reduce the arrival of undesirable aquatic species, and those that are here are effectively controlled so they do not threaten aquatic biodiversity and the economic use and enjoyment of our waters by all New Zealanders.
- New Zealand's freshwater resources are wisely allocated and have measurably improved water quality and ecosystem health, with sustainable management decisions being made on the basis of sound knowledge of the resource and robust predictive capability.
- New Zealand's estuaries and coasts will have measurably improved water quality and ecosystem health, with sustainable management decisions being made on the basis of sound knowledge of the resource and robust predictive capability.

- New Zealand manages exploitation of its marine resources in a way that maintains the environmental health of the oceans and meets the needs of all stakeholders.
- New Zealand has a nationally integrated environmental data and information collection, storage, and dissemination system for tracking environmental change, reporting environmental state, and making informed decisions on natural resource use.
- The innovation potential of Māori knowledge, resources, and people is unlocked to help New Zealanders create a better future. Kia tū Rangatira ai te ao Māori – Māori aspirations are pursued in partnership with others.
- New Zealand aquaculture is a financially and environmentally sustainable billion dollar export industry by 2025, through the production of high-value species and value-added products.
- New Zealand manages and develops its marine fishery resources in a sustainable and environmentally sound manner.
- New Zealand is recognised as a global leader and provider of the research and technology required for sound environmental management and sustainable use of natural resources.

Contributing to these long-term outcomes is the focus of each of our science portfolios, and helps set priorities in allocating human and capital resources, our research collaborations, and developing stakeholder relationships and technology transfer tools.

Our five medium-term priorities

In the short- to medium-term we have identified five strategic priorities where our skills and knowledge will make a significant difference to resolving current issues and achieving the desired outcomes for New Zealand Inc.

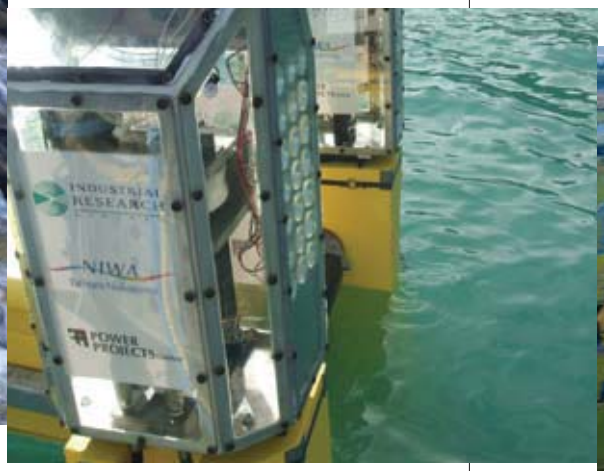
- mitigating and adapting to climate change;
- ensuring a secure and sustainable energy supply;
- achieving high returns from aquaculture by farming high-value species;
- ensuring the wise allocation of freshwater resources and protecting water quality;
- improving responses to impending weather-related hazards by using new real-time technologies for data capture and forecasting.

Retaining our staff

NIWA's past success can be attributed to the high quality skills, adaptability, and dedication of our staff. Our future success will depend on recruiting and retaining the skills we need through being an employer of choice. NIWA is committed to providing staff with a safe and healthy working environment that is collegial, enhances career development, promotes work/life balance, rewards staff for performance, and encourages innovation and excellence.

Our commitment to sustainability

NIWA is fully committed to operating in a sustainable manner and working with others to achieve the government's economic, environmental, and social goals. In 2007–08 we plan to take a leadership role in sustainability by providing advice to the public and government bodies on major sustainability issues, demonstrating alternative energy sources, investing in more energy efficient systems at our regional offices, defining our carbon footprint, investigating and taking initiatives towards carbon neutrality, and continuously monitoring our performance for structured improvements.



Our mission

As a Crown Research Institute, NIWA is expected to play a broad transformative role in New Zealand's economy, society, and environment and to contribute to the government's economic transformation goals. We do this by carrying out environmental research, by transferring and applying knowledge gained from that research, by applying best sustainable practice and helping all New Zealanders do the same, and by our strong financial performance.

To be an internationally respected research organisation dedicated to creating and delivering innovative and excellent science that enables New Zealanders to make informed decisions on the sustainable use of their natural environment and its living resources.

Our Vision

NIWA will have a reputation for:

- scientific excellence in aquatic and atmospheric research;
- providing objective science-based advice and leadership to enhance the sustainable management of natural resources;
- producing new tools and providing information that enables enhanced environmental management, improved wealth creation, and increased public safety;
- working with the fisheries and aquaculture sectors to create new business opportunities and optimise returns;
- transferring commercialisation opportunities to private enterprise in a manner that maximises both their chances of success and their economic benefits to New Zealand;
- working collaboratively with other researchers to enhance scientific creativity and to maximise associated benefits to New Zealand and the globe;
- partnering with others to ensure our science positively influences environmental, economic, social, and cultural outcomes;
- operating a financial strategy that ensures both a continual investment in its people, facilities, and equipment to ensure appropriate science capability in areas of strategic benefit to New Zealand while providing an appropriate return on shareholders' funds.

Our Values

We are committed to:

- promoting creativity, innovation, and opportunity-seeking;
- ensuring national capabilities in core aquatic and atmospheric sciences are appropriately staffed and supplied with sufficient equipment and resources;
- encouraging a workplace culture which is empowering, collegial, adaptable, and openly communicative;
- operating with integrity, skill, and professionalism;
- providing a remuneration system that attracts, retains, and rewards high quality staff;
- providing a safe and healthy working environment, including appropriate work/life balance;
- ensuring that all staff are treated in a fair and equitable manner;
- taking social responsibility, valuing our environment, and operating in a sustainable manner;
- encouraging staff and stakeholder participation in the setting of our research strategies;
- working collaboratively with others where this adds value and enhances benefits to New Zealand;
- honouring the principles of the Treaty of Waitangi.

Our many partners

NIWA has a broad skill base in atmospheric and aquatic sciences, but it is essential that we collaborate with other researchers and end-users so we can maintain and deliver excellent science and outcomes that benefit New Zealand and the globe. This collaborative approach has resulted in the establishment of an extensive and enormous number of working relationships with research institutions, central and local government organisations and entities, Māori, non-governmental organisations, and private companies. Our research programmes funded through the Foundation for Research, Science & Technology alone had more than 770 working relationships in 2006–07.

Acting Chief Executive Bryce Cooper and US Assistant Secretary of State Claudia McMurray sign a memorandum of understanding on joint research and services on water resources.

Our collaboration with New Zealand universities is especially important. Not only does it provide us with the opportunity to harness additional complementary expertise, but it also enables us to develop the future research capability we need by training postgraduate students. NIWA provided New Zealand universities with more than $1.7 million of research funding in 2006–07 to support collaboration and student projects.

Many of our collaborations are long-term and ongoing, but we established a number of significant new collaborations with New Zealand and overseas organisations in 2006–07. These included:

- A formal alliance with CRL Energy, Industrial Research Limited, GNS Science, and Scion for collaboration and coordination of research to meet New Zealand's future energy needs. This integrated four new energy research programmes: an assessment of New Zealand's total energy resources, biomass as an energy source, a hydrogen-based energy system, and carbon capture and storage.
- Joint research with New Zealand King Salmon on the co-culture of different species of marine plants and animals to ensure sustainable aquaculture.
- Agreement between the Crown Research Institutes AgResearch, GNS Science, Landcare Research, and NIWA, in collaboration with a number of universities, especially Victoria University of Wellington, to form a centre for climate change research. The aim is to coordinate climate change research and information to help New Zealand manage the threats and exploit the opportunities associated with predicted climate change.
- Joining, as a partner member, the Joint Antarctic Research Institute with GNS Science and Victoria University of Wellington to further collaborate in Antarctic scientific research.
- Collaborating with SurfCo (Aotearoa Fisheries Ltd) on a multi-year project to assess New Zealand surf clam populations.
- Agreeing to merge the salmonid research of the Cawthron Institute into NIWA's larger research programme on the sustainable allocation of New Zealand's water to facilitate greater coordination and integration of water resource research.
- A 3-year collaborative modelling project between the Food Safety Authority, ESR, Massey University, the Ministry for the Environment, and NIWA to identify effective control measures for campylobacteriosis.
- Agreement through a Memorandum of Understanding with the US Geological Survey to collaborate on research and services associated with water resource measurement technologies.
- Developing intellectual property and data sharing agreements with Neptune Resources to advance environmentally sustainable mineral exploration of the submarine Kermadec region.
- A joint programme of research with the Bluff Oyster Management Company to develop ecosystem-based management techniques to restore Bluff oyster populations within Foveaux Strait.
- A new initiative with Environment Waikato, Ngāti Whanaunga, and Thames Coromandel District Council to develop the necessary information and tools that will enable central and local government and communities adapt to the impacts of climate-induced change on the coastal environment.
- Co-investment by the Department of Conservation, Wellington Regional Council, and NIWA in a project to identify natural hazards and the different habitats within Wellington Harbour through high resolution mapping of the bathymetry.

Collaborations involved	Total number of parties
New Zealand researcher or organisation	
• University	71
• Crown Research Institute	67
• Other	31
Overseas researcher or organisation	327
Central government	57
Local government	37
Māori	25
New Zealand private business or associations	106
Overseas organisations (non-research)	55
Total	**776**

Sustainable development

"NIWA is committed to maintaining the health of New Zealand's environmental systems. We do this by providing sustainability advice and services, and by operating in an environmentally, socially, culturally, and financially responsible manner. We firmly believe that this behaviour contributes to sustained economic growth and value creation. Principles for sound environmental and social behaviour are fully embedded in the organisation."

John Morgan, Chief Executive

NIWA's mission is to be an internationally respected research organisation dedicated to creating and delivering innovative and excellent science that enables New Zealanders to make informed decisions on the sustainable use of their natural environment and its living resources. In the coming year our key focuses will be:

- mitigating and adapting to climate change;
- ensuring a secure and sustainable energy supply;
- developing high-value species for sustainable aquaculture;
- wise allocation of freshwater resources and the protection of water quality;
- improved responses to weather-related hazards.

NIWA's sustainability initiatives

To NIWA, sustainability is about meeting the needs of the present without compromising the ability of future generations to meet their own needs. We take an integrated view of sustainability, incorporating all aspects of our business.

Our aspirations are:

- **Environmental** – We help maintain the health of the environment and minimise our operational impact, and through our science we help others to do the same. We believe in pragmatic sustainable development and that prevention is better than cure.
- **Social** – We create a safe, supportive, enriching environment for our staff in our quest to be an employer of choice.
- **Cultural** – We actively contribute to the communities we live and work in and are developing relationships between environmental science and Māori interests that reflect a working partnership for the future benefit of all New Zealanders.
- **Economic** – We ensure sustainable growth of the company and provide added value to the national economy. We contribute to job growth and reinvest a substantial part of our profits into science that benefits New Zealand.

In 2007–08 we plan to expand our leadership role in sustainability by continuing to provide essential advice to the public and government bodies on major sustainability issues, demonstrating alternative energy sources, investing in more energy efficient systems at our regional offices, defining our carbon footprint, investigating and taking initiatives towards carbon neutrality, and continuously monitoring our performance for structured improvements. We made major progress this year with the endorsement by the Chief Executive and the Board of the development of a sustainable development action plan with a specific budget to guide the internal operations of the company.

Fit with NIWA's strategy

NIWA's sustainability philosophy flows from the company's strategic direction.

NIWA aims to continue to grow as a successful research organisation and a commercial consultancy, offering value-added science-based products and services. High achievement in all four sustainability performance areas – environmental, social, cultural, and economic – is critical for long-term growth. Financial returns are essential for developmental investment; outstanding environmental performance drives the quality and relevance of our products and services; and it is our motivated and dedicated staff who will achieve the company's strategy.

Context for sustainable development

Sustainability is a key policy theme for central government, and NIWA is committed to helping the government, and the country as a whole, achieve its environmental, social, cultural, and economic goals. NIWA achieves this through its science, and by ensuring the government receives sound advice.

Internationally, scientific research and debate on climate change have increased the pace of action on greenhouse gas emissions and preparedness for natural hazards. NIWA staff serve on the Bureau of the Intergovernmental Panel on Climate Change (IPCC), and carry out research for New Zealand on climate change, climate forecasts, the effects of climate (present and future), and climate-related hazards. NIWA also represents New Zealand at a large range of scientific meetings and governmental forums.

About NIWA's sustainability reporting

This year, we have provided an overview of our sustainable development reporting in this section to identify our key strategies, whilst the full sustainability report is published on our website at www.niwa.co.nz/ar/2007. We are continuously improving our reporting and find that the amount of information presented now warrants this approach.

Our sustainability reporting covers the activities of the parent company, NIWA Science, and incorporates selected information from NIWA Vessel Management.

Because of the nature of our business, we have reported extensively on our environmental performance over the years. This year we have increased reporting in the social areas of community, and people, health, and safety.

Verification

This summary section and our full online sustainability report have been verified by ERM New Zealand Ltd. Their assurance statement comments on accuracy, materiality, completeness, and responsiveness to stakeholder interests. NIWA acts on verifier recommendations and, in line with comments last year, began implementing ways in which the company could work more closely with partners and suppliers to explore sustainability issues. The company also provides more commentary on any targets not achieved in 2006–07.

Improved reporting and benchmarking

As a first step towards international benchmarking, we have done what we can this year to measure our performance against the updated G3 sustainability reporting guidelines of the Global Reporting Initiative (GRI). We have aimed at achieving the first rung, Level C. The GRI is a collaborating centre of the United Nations Environment Programme. The G3 guidelines provide an internationally recognised framework for benchmarking. They were developed with input from a large pool of experts from around the globe, including New Zealand, and are designed for companies and organisations of any size and sector. More information on the GRI and G3 framework can be seen at www.globalreporting.org.

Stakeholder engagement

NIWA actively engages with its key stakeholder groups and maintains open, two-way communications. Information on stakeholder engagement is located throughout the annual report and online sustainability report. This is an overview of our stakeholders, their interests in NIWA, our methods of engagement, and where to find more information.

Key stakeholder group	Stakeholders' interests in NIWA	Forms of stakeholder engagement	Stakeholder engagement information
Shareholding Ministers (Minister of Finance and Minister of Crown Research Institutes) Crown Company Monitoring Advisory Unit (CCMAU)	Performance against the Statement of Corporate Intent, financial return, solutions for NZ's environmental issues, governance, strategy, investment for the future	Direct engagement, performance reports, quarterly, half-yearly, and annual reports	Online sustainability report Annual report 2007
Foundation for Research, Science & Technology (FRST)	Value for investment, contribution to government's sustainability goals	Direct engagement, funding proposals and performance reports, annual report	Online sustainability report Annual report 2007
National, regional, and local government and other authorities	Solutions for environmental and ecological issues	Direct engagement, client reports, workshops, annual report	Online sustainability report Annual report 2007
Commercial clients	Solutions for environmental issues, value, service delivery, cost, business continuity	Direct engagement, client reports, annual report	Online sustainability report Annual report 2007
Iwi and other partners	Contribution of science to environmental protection, conservation, food sources and land use, alternative energy; Te Kūwaha: working with Māori	Direct engagement and partnership programmes, hui, workshops, annual report, website	Online sustainability report Annual report 2007
Suppliers	Facilitation of agreed service, prompt payment, fair treatment, safe workplace, procurement policies	Direct engagement, annual report	Online sustainability report Annual report 2007
Employees and their representatives	Competitive remuneration, fair treatment, involvement, professional development, safe work environment	Culture review, annual one-on-one performance reviews, intranet, website, Public Service Association Partnership Forums	Online sustainability report Annual report 2007
Communities and the wider New Zealand public	Impact of operations, involvement by the organisation, benefits such as education and sponsorships	Consultation programmes, website, workshops, training programmes, publications, media releases, sponsorships	Online sustainability report Annual report 2007

Performance highlights 2006–07

NIWA revised and significantly extended its list of voluntary indicators that track the company's performance to improve understanding and where the challenges lie, and to more closely link with stakeholder interests and requirements.

The following table is a brief summary of our performance for the year. For more highlights and information, see the full sustainability report on www.niwa.co.nz/ar/2007.

Category	Highlights 2006–07	Further action for 2007–08
Environmental	• International and NZ achievements in atmospheric, climate change, natural hazard, energy, freshwater, coastal, aquatic biodiversity & biosecurity, fisheries, aquaculture & biotechnology, and oceanic science and research • Purchase of hybrid vehicles, increased videoconferencing to reduce travel • Internal energy audits • Increased paper recycling by 17.7%; reduction of solid waste by 2.5%	• Establishment of the company's carbon footprint and measures to reduce it • Development of a 'green' purchasing and new building policy • Further reduction of waste and paper usage
Social	• Internal culture review and workshops with staff • New human resources framework • Ratification of two collective employment agreements	• Staff turnover of less than 10% • Reduction of workplace injuries • Introduction of mentoring schemes and new induction programme for staff • Improved staff feedback mechanisms
Cultural	• Re-launch of Sea & Learn shipboard education programme for high schools • Sponsorship of NIWA Interactive Room at Kelly Tarlton's for primary school students • Funding of 22 postdoctoral scholarships • 10 public environmental training courses • Te Kūwaha: workshop on customary coastal and kaimoana management	• Increase from 10 to 20 days in the Sea & Learn programme • Continued sponsorship of the Interactive Room • 22 courses scheduled • Continued growth in research and services of benefit to Māori
Economic	• Record revenue of $114 million and net surplus of $10 million, with a return on equity of 22.6%	• Allocation of revenue for sustainable development

Sustainability contact

Enquiries about NIWA's sustainability reporting can be directed to:

Geoff Baird, General Manager, Communications & Marketing

g.baird@niwa.co.nz

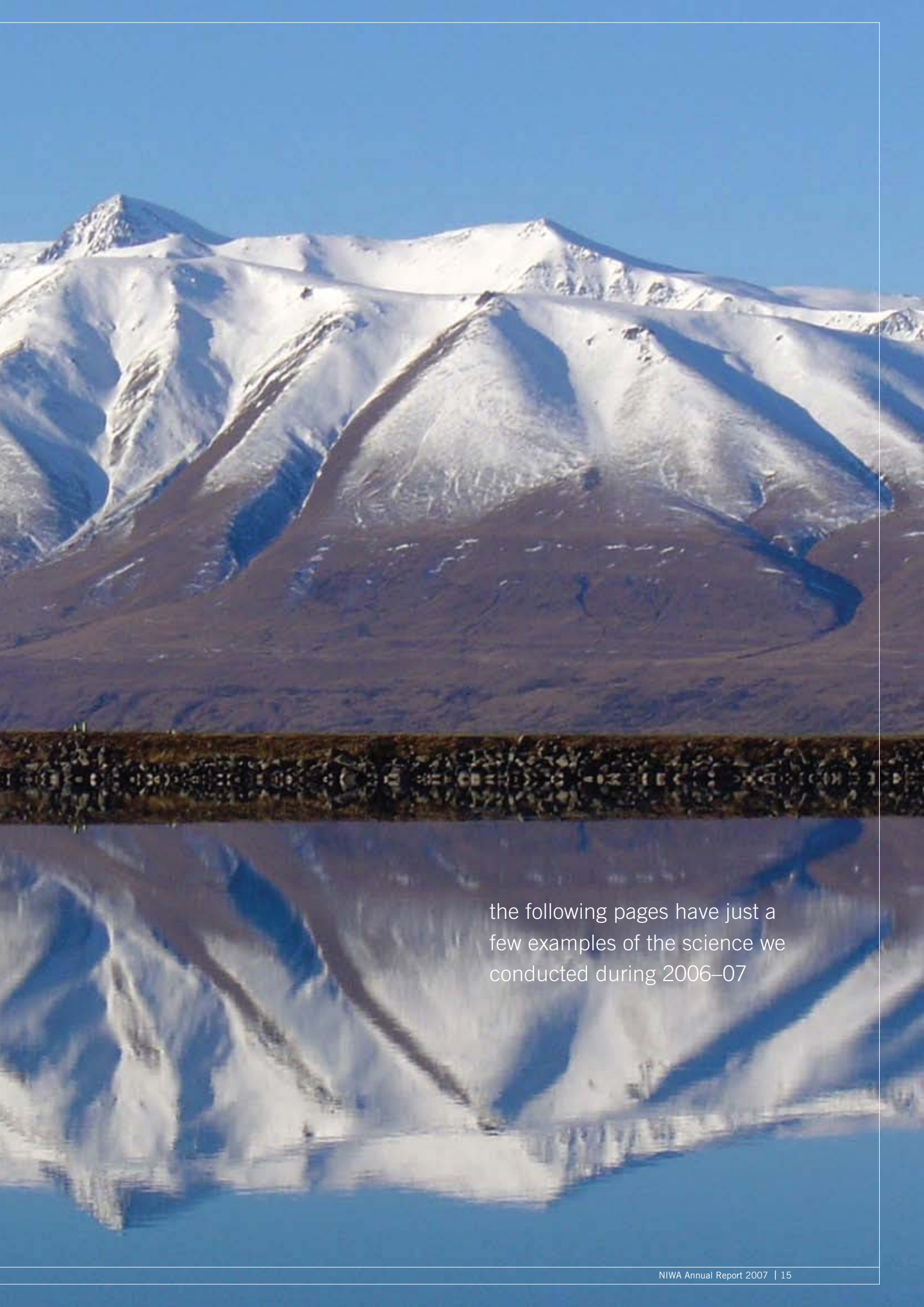
For further information, see our full and verified online sustainability report: www.niwa.co.nz/ar/2007.

our science

contributing to the sustainable development of the natural environment and its living resources

Tekapo Canal

Elliot Tuck, NIWA



the following pages have just a few examples of the science we conducted during 2006–07

Alan Blacklock, NIWA

Signs of ozone recovery: what about UV?

NIWA scientists were extensively involved in international assessments published this year under the Montreal Protocol for the protection of the ozone layer.

Measurements made at Lauder, Central Otago, and reported in the ozone assessment, provided the first evidence of a recovery in southern mid-latitude ozone.

NIWA was also one of 13 groups worldwide to contribute chemistry-climate model simulations to the assessment. This work is fundamental to advancing scientific understanding of the interactions between ozone depletion and climate change. Ozone over southern mid latitudes is now expected to return to 1980 values around 2040, with Antarctica following between 2060 and 2075. After 2050, interactions with climate change may produce a 'super-recovery' in ozone outside polar regions.

So what does this mean for New Zealand? Even if UV reverts to its pre-ozone hole levels, New Zealand will still get much more UV in the summer than corresponding latitudes in the northern hemisphere. Conversely, the country has low winter UV levels, and we have stepped up research into the implications for vitamin D deficiency.

This research is funded by the Foundation for Research, Science & Technology.

Alan Thomas at NIWA's Lauder site launching one of the balloons that carry ozone sondes to altitudes of 30 km.

New atmospheric science laboratory in Antarctica

The Prime Minister Helen Clark formally opened the new atmospheric science laboratory at Arrival Heights on 20 January 2007, as part of the celebrations of the 50th anniversary of Scott Base.

The lab is owned by Antarctica New Zealand and NIWA is the major tenant. We use it as a base for remote sensing and taking air samples to monitor and understand changing atmospheric composition, including greenhouse gases, the annual ozone hole, and associated stratospheric chemistry. So it was a busy summer season at Arrival Heights, moving sensitive instruments, installing new equipment, while continuing existing research. In addition, NIWA and Antarctica New Zealand operated a high-precision UV spectro-radiometer for two months to validate UV measurements made by US scientists.

The new building is designed to withstand winds of 216 km/h (an average 1-in-50 year event) and to maintain an internal temperature of 20 °C (outside temperatures are –5 to –50 °C). The old lab has been removed from Antarctica.

Top: The Prime Minister, Rt Hon Helen Clark, unveils the plaque to officially open the new Arrival Heights Research Laboratory.

Bottom: Installing solar tracker devices on the roof of the new lab at Arrival Heights.

(c) G Powell, Antarctica NZ Pictorial Collection: K250 06/07

Stephen Wood, NIWA

Wayne Webley, Applied Research Services Ltd

Clearing the air: helping councils meet environmental standards

NIWA leads a collaborative research programme aimed at helping regional councils meet the National Environmental Standards for Air Quality by the regulatory deadline of 2013.

This year, at least three regional councils used model-based tools developed by the research team to predict likely future emissions and assess new pollution sources.

After end-user feedback, this year our research included studies of so-called non-tailpipe vehicle emissions, and of real-life domestic solid fuel heater emissions.

On non-tailpipe emissions, we worked with the Auckland Regional Council, monitoring the effects of road dust and brake and tyre wear on air quality in North Shore City.

NIWA in the living room: real-life measurement of emissions from domestic solid fuel heaters.

The results will enable councils to estimate such emissions with much more certainty.

During the winter we measured the emissions from domestic solid fuel heaters in Nelson, Rotorua, and Taumarunui. One regional council said it will provide vital data to help address this issue, and hence help in compiling accurate emission inventories, guiding policy, and developing new real life test procedures.

The research is funded by the Foundation for Research, Science & Technology. Many end-users also contribute data, time, and funds.

Dave Gibb, NIWA

Air quality as you move: a NZ first

This year, NIWA designed and built a mobile air quality monitoring system – a first for New Zealand.

Fixed-location air quality monitoring is comparatively expensive. Even the bigger cities can only afford to operate a few stations, and the question arises as to how representative are fixed-point measurements of the air quality city-wide.

The NIWA system samples air through an intake mounted on the roof of the vehicle. The air passes through two instruments that provide a good profile of both the amount and source of air pollution. One instrument measures particulates in three sizes: PM10, for verifying compliance with air quality standards, and the smaller PM2.5 and PM1, which are more likely to lodge in the lungs or pass into the blood stream. The other instrument measures two 'kinds' of black carbon, giving information about the source of pollution (vehicles or home heating).

The system includes a Global Positioning System (GPS) which records the exact location of the measurements and will enable scientists to develop maps showing the pollution contours within a city at a specific time.

Simulating future climate change

Alan Blacklock, NIWA

This year, NIWA produced the first climate change simulations using a regional climate model for New Zealand.

Until now, we have used statistical downscaling from global models. This technique is reasonably robust, and requires less time and computing power, but has limitations; for instance, it may underestimate extreme events.

One of the beauties of a regional climate model is that it provides daily or even hourly data – essential for looking at short, sharp events like intense downpours, where we want to know how the return periods may be changing.

We used a moderately high and a moderately low greenhouse gas emission scenario to span a reasonable range of possible futures, and ran the model for the 30-year period 2071–2100 inclusive.

The results are still being analysed but temperatures rise, heavy rain increases, and snow cover shrinks under both scenarios. We can feed climate change model results into riverflow models, notably NIWA's Topnet, to look at the downstream implications including flood frequency and intensity, and the amount and timing of water available for irrigation and hydro-generation.

The research is funded by the Foundation for Research, Science & Technology.

NIWA snow & ice specialist, Dr Jordy Hendrikx, describes the monitoring network to a TV3 film crew on Panorama Ridge, near the Godley Glacier at the head of Lake Tekapo. This site is owned by Meridian Energy.

Clint Miles, Tekapo Helicopters

Snow & ice monitoring gets underway

Surprising perhaps, but no one knows how much snow we've got in New Zealand.

NIWA has started a national snow and ice monitoring network. The first three sites are now operating – at Mt Cook village, Arthur's Pass, and the Château at Ruapehu – and up to another nine are planned.

There's intense interest in this work. Changes in winter precipitation and earlier snowmelt under climate change would be advantageous for electricity generation (assuming current demand patterns are unchanged), but undesirable for irrigators and tourism/skifield operators.

The monitoring data on snow extent and thickness, combined with our advanced model capabilities, will allow NIWA to better understand seasonal snow in New Zealand and assist with calculating glacier mass balance throughout the Southern Alps. Network maintenance is being scheduled to coincide with glacier field measurements, where possible, to assist university researchers.

The sites are mainly in the South Island and have been selected to achieve maximum coverage across New Zealand alpine areas and compliment other research.

Tony Bromley, NIWA

On the farm: better greenhouse gas measurement

FarmGas 2006, an international experiment on a North Canterbury dairy farm, proved the usefulness of high tech approaches to measuring nitrous oxide (N_2O) emissions.

N_2O is 296 times more powerful as a greenhouse gas than carbon dioxide. Almost all of it comes from the breakdown of nitrogen in agricultural soils by bacteria, including urine-soaked patches.

N_2O emissions are notoriously hard to measure. NIWA's work here matters because:

- we need to test the real-life effectiveness of measures to limit N_2O emissions;
- emission estimates in New Zealand's greenhouse gas inventory determine our liability under the Kyoto Protocol;
- we have an obligation to report emissions as accurately as possible.

For FarmGas 2006, NIWA joined forces with a Canadian federal government agency (Agriculture and Agri-Food Canada) and Landcare Research to field test a 'tunable diode laser' alongside other techniques. In the largest method comparison for N_2O emission ever conducted in New Zealand, the team demonstrated the advantages of laser precision in measuring emissions around the clock in real farm conditions.

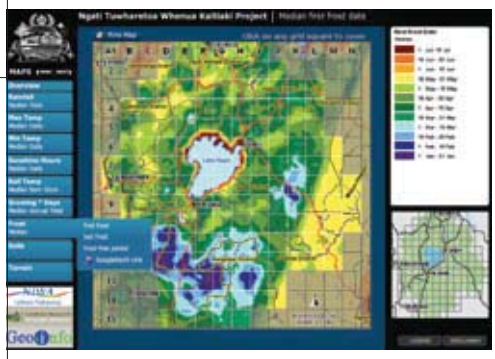
FarmGas 2006 was supported by the Foundation for Research, Science & Technology. We thank Medcroff Dairy Farm.

Caring for the land: new tool for Ngāti Tuwharetoa

When Ngāti Tuwharetoa wanted a web-based tool to help them make informed resource-use decisions, they came to NIWA. We worked with Geo Info, a Northland company, to produce a fast, simple, user-friendly web tool which provides detailed information about the land and climate. Now it is easy for any iwi member to identify, for example, where might be the most suitable places to grow frost-tender crops.

Tina Porou of Ngāti Tuwharetoa says "This tool provides a key part in understanding our environment and how we can adapt to it rather than having our land-use try to change the environment. The final stage will be to connect information and expert advice through online interaction, making the tool relevant and useful to our people."

The Ngāti Tuwharetoa Whenua Kaitiaki Project includes maps derived from observations in the National Climate Database of rainfall, temperature, sunshine, soil temperature, frost, and growing degree days. Data on soils came from Landcare Research, and terrain information from Land Information New Zealand. Maps can be downloaded and added as a layer to Google Earth.



Case study: climate change (under fold)

National Climate Centre

guiding responses to global change

helping people prepare for & deal with the climate now & in the future:

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- climate data & summaries
- climate maps & GIS layers
- climate forecasts & seasonal outlooks
- influences on climate, including El Niño, sea surface temperatures
- climate change
- effects of climate – present & future
- climate-related hazards

www.niwascience.co.nz/ncc

Making a difference

Public awareness of climate change has shifted over the past year, in part because of high profile events such as Al Gore's Inconvenient Truth and the Stern Report.
But it is the increasingly clear scientific evidence that lies behind this sea change in public opinion. And it is in building this evidence that NIWA has made a significant contribution.

Over the last few years, NIWA has made a huge commitment to the Intergovernmental Panel on Climate Change (IPCC) and its latest assessment round on the current state of scientific knowledge on climate change.

The release of the IPCC's three working group reports in the first half of 2007 provided the clearest evidence yet of the impact of human activity on the rate of global warming. The IPCC will release an overall 'Synthesis Report' in November 2007.

Dr David Wratt, NIWA's General Manager, Climate Change and sole New Zealander on the IPCC Bureau (or steering committee), says the scientific evidence left no doubt.

"We can see it's not all in the lap of the gods," says David, "which means that what we do will influence what happens in the future. What's come out is that if we want to keep global temperatures within two to two and a half degrees of pre-industrial times, then we must reduce emissions substantially over coming decades. New Zealand can't turn global climate change around on its own – we need to be part of an international effort."

David has been involved with the IPCC from the outset. The process has engaged more than 1200 scientific authors and 2500 expert reviewers from more than 130 countries. He's helped select the authors and has worked closely with them to ensure the integrity of the final reports.

Three other NIWA scientists were lead authors: Dr Jim Renwick and Dr Dave Lowe for the first report on the physical science of climate change (released in February 2007); while Dr Jim Salinger was lead author for the New Zealand/Australia chapter in the second report on impact, vulnerability, and adaptation. The third report, on mitigation, involved other New Zealand scientists and had NIWA input.

The process was rigorous and impartial.

Dave Lowe says: "I have never in my entire scientific career had my written work subjected to such an exhaustive multi-level review process. It was incredibly rigorous and has resulted in what I think is a remarkable report."

The working groups dealt with a vast amount of information. The second group alone looked at more than 29 000 sets of data on observed changes in natural processes.

Jim Salinger says: "We are now seeing physical and natural systems responding to warming, such as bird species laying their eggs and migrating earlier, trees budding earlier, and glacial lakes expanding in size and number."

In some areas, adaptation is already occurring to combat observed climate change. However, ongoing vulnerability is demonstrated by substantial economic losses caused by droughts, floods, tropical cyclones, and hail, across the globe.

The third report, on mitigation, outlined a range of measures that could be taken worldwide over the next two to three decades to reduce or at least stabilise the amount of greenhouse gas in the atmosphere.

The reports are about 1000 pages long and include details pertinent to New Zealand as well as the rest of the world. Distilled summaries have been released for policymakers.

In New Zealand, the impact of regional climate change is already evident in increasing stresses on water supply and agriculture, changed natural ecosystems, reduced seasonal snow cover, and ongoing glacier shrinkage.

Jim Renwick says: "With further global warming, New Zealand's climate will get a bit harsher: the winds will get stronger, wet areas will get wetter, dry areas will get drier. It won't happen overnight, and farmers will adapt. For city dwellers, energy will be the big issue, although the demand for more electricity to cool houses may be offset by the lower demand in winter."

David Wratt adds: "A consistent research result is that climate change is likely to lead to an increased frequency of very heavy rainfall events, and potentially of flooding, as the century progresses. For New Zealand, we also expect to see more drought in some eastern and northern regions, and some increases in coastal

Alan Blacklock, NIWA

Alan Blacklock, NIWA

hazards. NIWA is currently updating guidance material for councils to help them plan for such changes, in a project for the Ministry for the Environment".

Producing the scientific evidence is only half the challenge. The other half is getting the information out to the policymakers and public, and acting on it.

NIWA scientists have briefed central and local government politicians, officials, and the media on the IPCC findings. They've also held public seminars throughout New Zealand and in the Pacific.

They're joining forces with organisations such as the Institution of Professional Engineers New Zealand, BRANZ, and the Resource Management Law Association to run workshops on how those involved in designing and building infrastructure, such as roads, buildings, bridges, and stormwater drains, can factor in climate change.

NIWA staff are also updating guidelines for local government about identifying and adapting to climate change based on the latest IPCC projections.

Meanwhile, the research continues. NIWA has a range of climate-related projects underway, including tracking climate changes, looking at how climate change will affect existing weather patterns such as El Niño and La Niña, using climate change models for particular regions, and collaborating with other researchers on issues such as the impact of climate change on Māori land use and health.

NIWA's National Centre for Climate-Energy Solutions is also looking at how New Zealand can reduce emissions substantially and at manageable cost in line with IPCC findings.

The role of NIWA in helping New Zealanders (and the global community) get to grips with climate change is significant, and its value cuts across many groups, from householders to horticulturalists to hydroelectricity providers.

As for the IPCC, Dave Lowe sums up the feelings of those involved:

"What a privilege and an honour it was to work with the world's best scientists on this report. It was a remarkable experience, and as well as contributing, we learned a huge amount. I certainly don't regret all the hard work. It was a chance to make a difference with a problem that will affect all of us. We have to change now."

The participation of New Zealand scientists from NIWA and other organisations as lead authors was supported by the Ministry for the Environment and the Foundation for Research, Science & Technology.

The IPCC was set up in 1988 by the United Nations Environment Program (UNEP) and the World Meteorological Organization (WMO) to provide assessments of scientific, technical, and socio-economic information on climate change issues relevant to policymakers. Every six years it produces a full assessment of the current state of knowledge on climate change.

The plenary is based on three working groups: the first focuses on the physical science of climate change (how and why global warming occurs), the second focuses on the impact of global warming, adaptation, and vulnerability, and the third focuses on mitigation, or what might be done to stall global warming.

Robert Stuart, IRL

From desktop to device: wave energy hits the water

This year saw major advances in the WET-NZ (Wave Energy Technology-NZ) project with construction and sea trials of a proof-of-concept wave energy device.

WET-NZ is a collaboration between Industrial Research Ltd (IRL), NIWA, and Power Projects Ltd, funded by the Foundation for Research, Science & Technology.

The proof-of-concept device is a one-quarter scale model of the unique design developed by the WET-NZ team. It is a streamlined device in which power is generated by the device's rotation at a pivot point between the main spar (below water) and the float (on the surface).

This year, four sea trials were successfully completed, all in Lyttelton Harbour. These trials are a staged process, where the team test out how the device responds, then introduce a new element or planned modification.

To date, the device has either been free floating or tethered by a single line. Next, the device will be moved to Wellington so NIWA can trial mooring configurations. In addition, IRL will build a full-scale prototype, required to test the complete electro-mechanical componentry.

www.wavenergy.co.nz

Top: WET-NZ wave energy device during sea trials at Lyttelton.

Bottom: The proof-of-concept device (one-quarter size) hanging upside down in IRL's Christchurch workshop. Power is generated by rotation at the pivot point between the shafts and the float (centre bottom).

Home wind turbines: assessing the potential

"Household wind turbines way of the future", "Would you consider a home wind turbine?", "Home wind turbine cuts power bills"...

This year, the prospect of micro-scale wind turbines on home roofs sparked the public and media imagination. The consistency and strength of wind at the turbine site is an important factor in whether such technology proves economic. Wind at roof-level tends to be relatively low speed and turbulent, and not all homes are ideally situated, so Vector commissioned NIWA to examine whether some suburbs in a city were better suited for home wind turbines than others.

For such work, we use Gerris – a computational fluid dynamics code which accurately simulates complex wind patterns. We ran Gerris for both predominant wind directions, estimating the mean annual wind speed at grid points 100 metres apart, and mapped the results.

In general, the upper slopes of the hills were best. For a more accurate estimate, we can run Gerris at a finer (e.g., 10 metre) resolution incorporating the effects of the vegetation and the house itself.

Vector

This Swift Turbine is mounted on the Waitakere City Council building at Henderson, Auckland, for a trial by Vector. The turbine is about 2 metres in diameter and weighs about 50 kilograms. It could provide about a quarter of an average New Zealand household's annual electricity use.

Biogas: fuel from wastewater

Imagine thousands of tiny bacteria which thrive on little or no oxygen. In a big city near you, these bacteria are hard at work breaking down sewage sludge. The gas they release is 50–60% methane, and is often collected to generate electricity.

Such 'anaerobic digestion' also occurs in farm effluent ponds and small town wastewater treatment plants, but not very efficiently. The methane-rich gas usually goes to waste.

NIWA is developing and demonstrating pond technologies, especially covered anaerobic ponds, which maximise biogas recovery, achieve better wastewater treatment, and make financial sense.

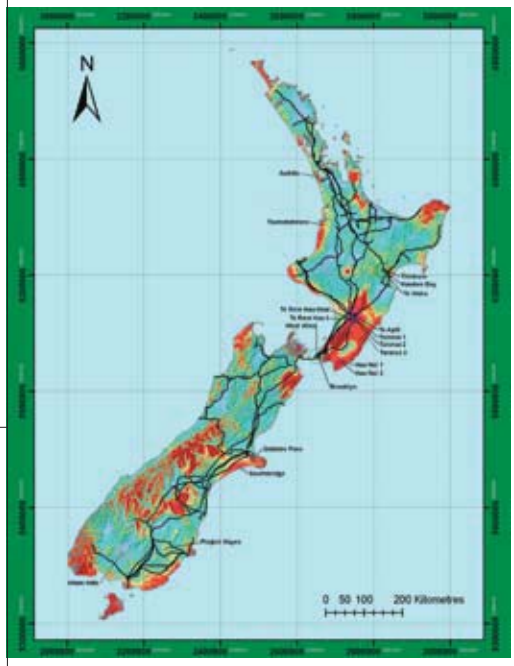
Highlights this year include:

- Construction of a large-scale demonstration system at a piggery, working with Waratah Farms and the Pork Industry Board. In the coming year, we plan to produce compressed biogas to run the piggery tractor.
- The simple conversion of an 'off-the-shelf' petrol generator to run on biogas from a dairy farm's effluent pond, with the assistance of Entec Services, Auckland.
- Implementation of a full-scale demonstration of biogas collection from anaerobic digestion of algae in the Waihi domestic wastewater treatment plant, in conjunction with Hauraki District Council.

This programme is funded by the Foundation for Research, Science & Technology.

Rupert Craggs, NIWA

Stephan Heubeck demonstrates a generator converted to run on biogas from a dairy farm effluent pond.



Potential wind power density.

Framing New Zealand's Energyscape

The debate about New Zealand's energy future is sometimes characterised by vociferous promotion of particular solutions and lip-service to the fact there are no silver bullets. There is little guidance as to how trade-offs between potential outcomes – economic growth, security of supply, environmental sustainability – should be tackled.

The NIWA-led project, The New Zealand Energyscape, will identify the scale of change required to meet a given policy objective, e.g., a greenhouse gas reduction target. What would be the effects, for example, of an energy future dominated by carbon sequestration and biofuels, compared with heavily renewable electricity generation and electric cars?

This year, the Energyscape team developed a series of interlinked maps showing the location and size of energy demand, resources, infrastructure, and constraints on supply. This brings together disparate information, makes it consistent, and displays it clearly for non-specialists. The project runs till mid 2008. By then, the Energyscape framework and database relating all elements of the energy system will be complete.

Energyscape is the first major undertaking of a new alliance of five key energy research providers: NIWA, CRL Energy, Scion, GNS Science, and Industrial Research Ltd. It is funded by the Foundation for Research, Science & Technology.

National Centre for Climate–Energy Solutions

finding the energy to move New Zealand forward

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- renewable energy
- energy efficiency
- greenhouse gas reductions
- reducing the environmental effects of energy use
- energy for remote communities
- future energy options

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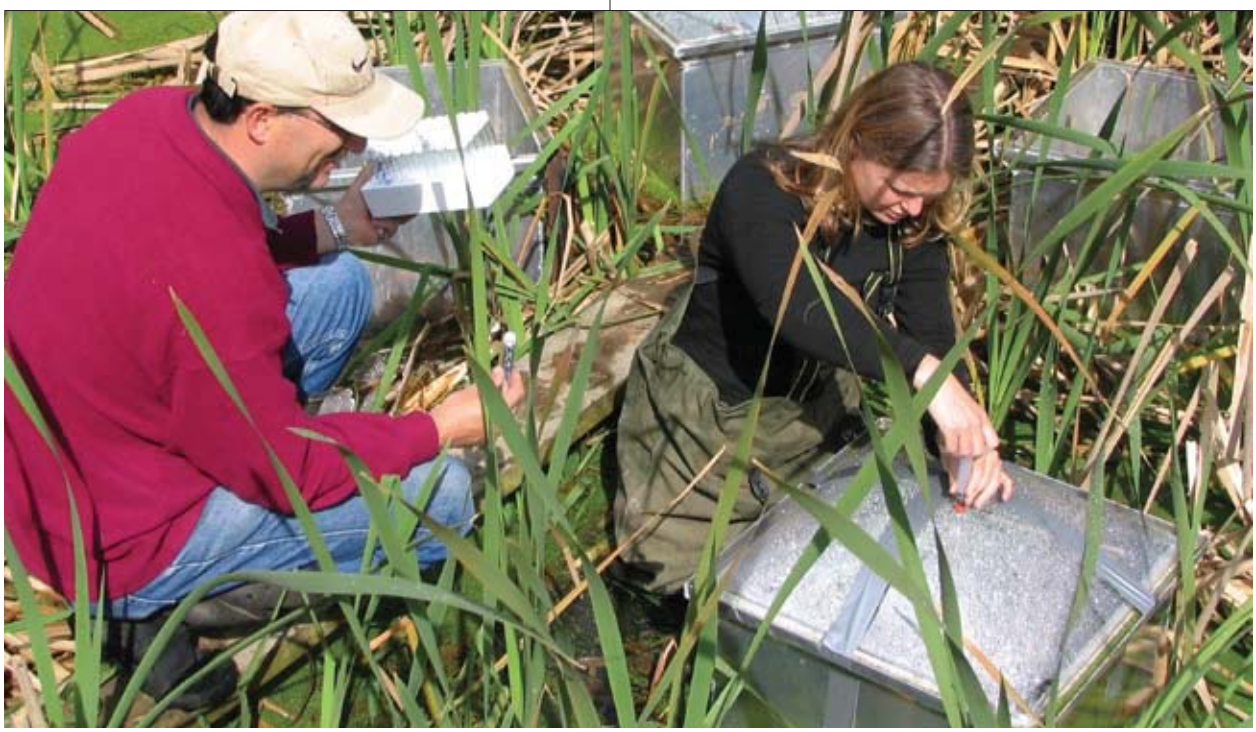

Chris Tanner, NIWA

Constructed wetlands: sustained research leads to practical advice

James Sukias and Dr Fleur Matheson take samples in NIWA's constructed wetland at Toenepi, Waikato. They are conducting stable isotope studies to identify the key ways the wetland removes nitrogen and to measure emissions of nitrous oxide and nitrogen gas.

By creating wetlands, farmers can reduce sediment and nitrogen in pasture runoff, reinforcing other best management practices.

NIWA operates five 'research' wetlands, from Titoki in Northland to Bog Burn in Southland, with funding from the Foundation for Research, Science & Technology and Dairy Insight. The wetlands are paddock-scale, except at Te Hoe, Waikato, where we use 16 experimental plots to conduct replicated studies on aspects of wetland design and performance.

Most of these wetlands are only now starting to mature, after 3–5 years. Wetland plants establish rapidly and play a key role in taking up nutrients early on, but over the long term wetlands primarily remove nitrates through bacteria feeding on rotting plant litter and converting nitrate to nitrogen gas.

Preliminary NIWA guidelines for the design and construction of wetlands, and general indications of the results farmers can expect, were incorporated into new Environmental Farm Management Guidelines published in 2006. The research to date suggests that a wetland comprising 1% of the drained catchment can remove 20–35% of annual nitrate and total nitrogen runoff. Different plant species have shown variable performance and woodchip filters show early promise.

www.dexcel.co.nz/data/usr/ACF790.pdf

Accounting for all the water

Elliot Tuck, NIWA

Scientific advances at NIWA are making a difference in the country's natural resource accounting. The ultimate goal of such accounts, being developed by Statistics New Zealand, is to examine links between economic activity and the state of our natural resources.

NIWA worked on the national water accounts, estimating ten components of the annual national and regional water balance. These covered inflows (e.g., rain, snow, sleet, and hail), storage changes (e.g., water held in soil, lakes, glaciers, and hydro dams), and outflows (e.g., river flows or evaporation).

As part of this, we developed a national streamflow model to estimate some components for which very few measurements are available. This takes advantage of significant redevelopment of NIWA's Topnet modelling system since the first edition of the accounts (2003). NIWA research on better methods for mapping rainfall also substantially improved the new accounts, especially for catchments draining the Southern Alps.

Residents of the South Island's west coast may not be surprised to learn that their region has by far the largest water resource per unit of area. There is more work to be done to improve the accuracy of the accounts, but already they provide detailed information on year-to-year variation.

The National Water Accounts are online at www.stats.govt.nz/environment

Hyporheic magic: how an ecosystem cleans Canterbury's water

Most Canterbury residents drink water which has not been treated at all. The water is drawn pure from aquifers below the central plains. It's pure largely because river water soaking through the river beds, and groundwater seeping to the surface, flows down, up, over, under, and around millions of grains of gravel. Here, in the 'hyporheic' zone, where surface water and groundwater mix, tiny animals and microbes purify the water.

NIWA's extensive research programme on the Selwyn River, however, has found that the hyporheic organisms here are not particularly effective at removing nitrate. Though the water remains safe to drink, it prompted us to explore possible causes of poor nitrate removal.

In an innovative series of field experiments, the research team created artificial gravel bars (in PVC pipes), ran unfiltered river water through them, and monitored the effects of adding more organic carbon and/or phosphorus. It appears that bacteria in the Selwyn hyporheic zone are starved of both nutrients. The next step is a long-term nutrient enrichment experiment in natural hyporheic ecosystems.

This research is funded by the Foundation for Research, Science & Technology.

Thibault Datry, CEMAGREF

Top right: Dr Scott Larned adds a non-toxic dye to the hyporheic zone of the Selwyn River to trace the water flow underground.

Lake Taupo: how much nitrogen?

Concentrations of nitrogen entering Lake Taupo have been rising for decades. Now we are seeing algal blooms and fluctuating water clarity.

NIWA, Lincoln Ventures, AgResearch, and GNS Science are collaborating to develop a catchment planning tool which will help predict the effects of land-use changes and mitigation measures on nitrogen delivery to the lake. It will also assist research on nutrient trading led by Motu. A moderately complex GIS-based model developed by NIWA for Rotorua is a prototype for the simpler tool and can be readily adapted to catchments elsewhere in New Zealand.

The model development is underpinned by extensive fieldwork. This year, NIWA established that about 30% of all streamflow in the Tutaeuaua catchment, on the lake's northwest side, passes through wetlands which take up nitrogen. This is a big step forward, putting us in a position to develop catchment budgets for water and nitrate and to quantify the effectiveness of such streambank bogs at catchment scale.

NIWA also collaborated with Dr Jennifer Tank of the University of Notre Dame to quantify the nitrate uptake in 13 streams feeding the lake.

The research is funded by the Foundation for Research, Science & Technology, with assistance from Environment Waikato and Environment Bay of Plenty.

Dirk Schroer (German student)

James Sukias and Kit Rutherford install a weir at Tutaeuaua, near Lake Taupo.

Case study: water resources (under fold)

National Centre for
Water Resources

making every drop count

providing tools & information for the sustainable use of water:

- water allocation
- water quality
- environmental monitoring & modelling
- pollution control & prediction
- lake, wetland, & river restoration
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Case study: water resources

We have enough water –
but not in the right place at the right time

Around the world, climate change is expected to dramatically alter water availability, pitting people against each other and the environment in regions short of water.

Even in water-rich New Zealand, debates and legal battles over water are intensifying, particularly in drier parts of the country, where increasing demands and predicted effects of climate change are creating complex and far-reaching water management issues.

"So far we have tapped the easy water," says NIWA's General Manager, Freshwater, Dr Clive Howard-Williams. "The financial and environmental cost of using water is already rising. Much of the debate is about where these costs should fall, and the best balance between uses."

In water allocation, decision-makers often face conflicting interests, incomplete knowledge, and patchy datasets. NIWA is contributing to a clearer understanding of patterns in water availability and use, associated environmental effects, and more effective planning and management processes.

How much water is available?

NIWA has built a hydrological model of all New Zealand river catchments, in a major step towards understanding the country's water resources.

Most previous methods for estimating how much water is available have been "disturbingly rough", says NIWA hydrologist Dr Ross Woods. "Where a flow recorder has been in a river for decades you get good information, but where there isn't a flow recorder or the record is very short, you get low accuracy and high uncertainty."

In essence, Ross and his colleagues have completely redeveloped NIWA's Topnet model for the hydrology of all New Zealand's rivers. Topnet is a good example of the integration of climate science and hydrology at NIWA, with better river flow estimation arising from improvements in rainfall forecasting and in estimating precipitation.

"We are using Topnet to investigate the impact of land-use changes, such as cutting down or planting forests, and to explore the likely effects of climate variability and change on hydroelectricity generation and water resource availability," says Ross.

Alan Blackbck, NIWA

For situations where less complex approaches than a Topnet model are appropriate, the same research team assembled simple methods to estimate the hydrological properties of ungauged catchments. This year, NIWA ran a training course for council hydrologists and consultants on these methods and highlighted new national datasets.

Irrigation modernisation

Once an irrigation scheme gets the go-ahead, there's increasing need to deliver the water in a way that closely matches on-farm needs. "Water users are introducing sophisticated water monitoring, control, and communications technology where they see it's cost-effective and brings real benefits," says NIWA's Dennis Jamieson. "We're working with irrigation scheme managers and consultants to provide water and climate monitoring, flow measurement and control equipment, data management, and advice on irrigation modernisation."

Injecting evidence: science in complex situations

Nowhere are claims and counter-claims about water louder than in Canterbury. Here the Selwyn River is the focus of multidisciplinary research. Like many gravel-bed rivers of the Canterbury Plains, flows in the Selwyn are a product of runoff from the hills and interactions with groundwater aquifers on the plains. NIWA scientists have reconstructed a long-term record of the day-to-day flow along 60 km of the river. "Now we are in a better position to predict the river's future under different conditions, such as climate change," says hydrologist Dr David Rupp. In related research, Drs Alistair McKerchar and Jochen Schmidt found climate variability cannot fully explain decreasing summer flows in the river, and concluded that increased take of groundwater for irrigation is a likely explanation.

The Selwyn provides a valuable illustration of the interactions between groundwater

and surface water. “The bottom line is that groundwater and surface water are a single resource and have to be managed as such”, says leader of the National Centre for Water Resources, Dr Mike Scarsbrook. “Many regional plans still portray surface and groundwater as separate entities.”

Dealing with dams

As well as working with irrigators, NIWA provides extensive expert advice on dams to the hydro-electricity sector, consenting authorities, and the Environment Court. Issues vary from project to project but include specifying minimum and maximum flows, estimating design floods, evaluating likely sediment and ecological effects, and recommending mitigation methods.

At the Opuha Dam in South Canterbury, NIWA is working with the dam operators, researching the effectiveness of releasing water to clear the riverbed downstream. Such ‘flushing flows’ cost money in lost power or irrigation potential; the key is to design them with the right water volume, duration, frequency, and timing to get the required ecological benefit at the lowest cost.

Tens of thousands of small dams ‘harvest’ floodwaters for irrigation or stockwater around New Zealand. Where water is in short supply, and as fears grow that climate change means less reliable rainfall, there’s increasing pressure to develop more water storage as insurance against dry spells.

Estimating the cumulative effect of many small dams is complex, and an on-going research area, but NIWA has already established that more than 25% of the annual runoff is intercepted in some streams, notably around Auckland, Moutere, and Central Otago. “Ultimately, we will develop tools to help decide how much water harvesting is sustainable before you irreversibly change a river,” says Dr Murray Hicks, an expert in sediment processes.

These processes, of course, don’t stop at the river mouth. NIWA is developing computer models to predict how reduced river sediment supply affects coastal erosion.

A national debate

In June 2007, NIWA’s national centres for water resources and for climate hosted a two day workshop for over 100 water resources stakeholders. “Too often stakeholders are pitted against each other in the media or adversarial legal proceedings”, says Clive Howard-Williams. “The workshop was an opportunity to discuss solutions in a more open, constructive forum.” NIWA plans to hold another workshop in the coming year.

Mike Scarsbrook says people naturally start with the low hanging fruit, the easy solutions to water resource issues. “Science is a ladder. We are providing knowledge, technologies, and tools to help people reach the more difficult fruit.”

In a world of heightened conflict over water, perhaps science can be not only a ladder but also a bridge to greater sustainability.

Nelson Boustead, NIWA

Biodiversity

Ocean Survey 20/20

NIWA's Deep Towed Imaging System captures a butterfly perch swimming above a coral-encrusted reef at about 200 m depth on the Chatham Rise.

Putting deep seafloor biodiversity on the map

Little is known about the biodiversity of New Zealand's offshore seafloor communities, particularly at productive depths where commercial fisheries occur. One of the objectives of the Government's Ocean Survey 20/20 programme is to better understand the role these communities play in the wider marine environment and in sustaining ocean resources.

The Chatham Rise and Challenger Plateau were chosen for initial investigation because they occur at similar depths, but support very different levels of productivity and fishing activity. In the past year, scientists have undertaken three voyages on *Tangaroa* to map, photograph, and sample seafloor habitats and communities at fishing depths in these two areas.

About 42 500 still images, 170 hours of video footage, and more than 5000 biological sample lots were collected. Taxonomists analysing the specimens are likely to identify species new to science.

The project will provide significant new information about seafloor biodiversity and, ultimately, aid decisions about resource management and offshore Marine Protected Areas. The Ocean Survey 20/20 Chatham-Challenger project is led by the Ministry of Fisheries in collaboration with NIWA, Land Information New Zealand, and the Department of Conservation.

The little things that hold wetlands together

Around 90% of New Zealand's wetlands have been drained or otherwise destroyed in the last 150 years. To protect the remaining 10%, we need to understand what makes our wetlands tick and, conversely, what damages them.

Algae and invertebrates are important components of wetland food chains, and algae act as indicators of environmental stress. But little is known about these small organisms that drive our wetland ecosystems. NIWA scientists are documenting the diversity of algae and invertebrates in New Zealand wetlands to assist the Department of Conservation in prioritising wetlands and wetland habitats for conservation.

Our initial study of four near-pristine wetlands on the west coast of the South Island has shown that each has its own unique assemblage of algae and invertebrates. Within a wetland, different habitats support different algae. This means that to protect wetland biodiversity you need to protect examples of each wetland type and habitat.

Further research is investigating biodiversity variation among wetlands on a wider scale, and the impacts of human activities on these endangered natural systems.

Alastair Suren, NIWA

NIWA's Dr Brian Sorrell surveys a fen in the upper Freshwater Valley, Stewart Island.

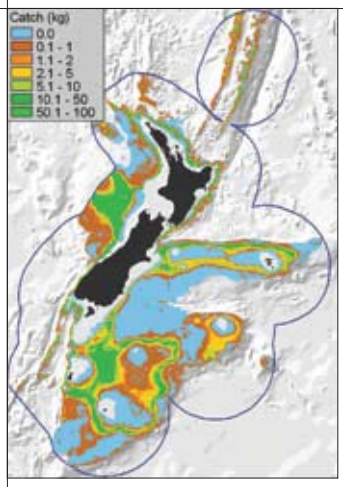
Novel approaches to marine protection

Under the New Zealand Biodiversity Strategy, the Government has set a target of protecting 10% of New Zealand's marine environments by 2010. NIWA's research is helping to design Marine Protected Areas (MPAs) that deliver the biggest conservation benefits with the least cost to fisheries, using the best available data and methods.

The team is using newly developed reserve-planning software to design and evaluate four MPA scenarios, based on the predicted distributions of 96 commonly-caught species of bottom-dwelling fish in trawlable parts of New Zealand's offshore Exclusive Economic Zone (EEZ).

Results show that MPAs selected to avoid prime fishing areas and protecting 10% of trawlable parts of the EEZ could protect an average of about 23% of each fish species' geographic range. This is nearly 2.5 times greater than the conservation benefits of proposed Benthic Protection Areas, with no extra cost in lost fishing opportunity.

This research is being undertaken with scientists from the universities of Helsinki, Melbourne, and Stanford, and the Department of Conservation (DOC), with funding from the Foundation for Research, Science & Technology, DOC, and the Ministry of Fisheries.



Predicted distribution of a typical bottom-dwelling fish species, ribaldo (Mora moro) *in trawlable depths of the EEZ (blue line). Fish distributions are predicted by statistical models relating 21 000 catch records to key environmental variables.*

Gas-fuelled ecosystems unveiled

An international team of scientists has observed, for the first time, the unusual creatures living around methane seeps off the North Island's east coast. Some of the species collected, which include tube worms and clams, are new to science.

The 21-member team onboard *Tangaroa* included scientists from NIWA, Woods Hole Oceanographic Institution, Scripps Institution of Oceanography, and the University of Hawaii as part of a larger study of marine 'chemosynthetic' ecosystems.

Chemosynthetic ecosystems are fuelled by chemicals, such as methane and sulphide, rather than sunlight. New Zealand is one of the few places where several chemosynthetic habitats occur in close proximity, allowing scientists to address key questions about their ecology.

The scientists used *Tangaroa*'s substantial mapping capabilities, our Deep Towed Imaging System, and seabed sampling equipment to characterise the geology and biota of these habitats. The team discovered an abundance of cold methane seep sites off the east coast, including one of the world's largest, dubbed 'The Builder's Pencil', covering an area of about 0.18 square kilometres.

The voyage was funded by the US National Oceanic and Atmospheric Administration and NIWA.

NIWA/NOAA

A previously unknown species of marine tube worm discovered at 'The Builder's Pencil' cold seep.

National Centre for
Aquatic Biodiversity & Biosecurity

protecting our natural heritage

providing advice on freshwater & marine biodiversity & biosecurity, including:

- biodiversity surveys – what lives in an area, including species new to science & species new to the area
- aquatic pests including toxic algae – detection, identification, prevention, spread, potential risks, control, eradication
- human impacts on biodiversity
- strategies for sustainable management, habitat & biodiversity restoration
- practical training, identification guides

www.niwascience.co.nz/ncabb

Chris Woods, NIWA

Nick Gust (left) leads the search for Styela clava *in Lyttelton Marina.*

Finding foreign species in our ports

Foreign marine species brought in by vessels pose a potential threat to New Zealand's aquaculture industry, fisheries, and marine ecosystem. The Ministry of Fisheries and MAF Biosecurity New Zealand have commissioned NIWA to find out what species are found in key ports and marinas.

Drawing on our considerable marine survey and taxonomy expertise, NIWA has this year reported on 23 port surveys involving dozens of NIWA staff. These recorded standardised baseline data on native and non-native species from 16 of our busiest ports and marinas – from Opua to Bluff – and repeat data from seven sites to estimate the arrival rate of new species.

We found 84 non-native species out of the 1000-odd marine species identified in these surveys, including 18 that were new records for New Zealand. Some of these, such as the clubbed tunicate *Styela clava*, are notorious invaders elsewhere in the world.

This research represents the first comprehensive field investigations of marine biodiversity within first-ports-of-entry in New Zealand. It has built a valuable national database of biodiversity information for both native and non-native species and a valuable collection of voucher specimens. Surveys are ongoing at seven additional ports and marinas.

Efficient service for marine species ID

NIWA continues to provide an efficient species identification service for MAF Biosecurity New Zealand (MAFBNZ) through its Marine Invasives Taxonomic Service (MITS), drawing on the expertise of taxonomists within NIWA and around the world.

Identifying the species is crucial to understanding a plant or animal's origins and, if non-native, their potential for invasion. Non-native species identified by MITS come from all around the world and cover a broad spectrum, from crabs to algae. New records are reported promptly to MAFBNZ.

In the last year, MITS has processed some 11 165 samples and identified 610 species from a range of MAFBNZ projects, including port surveys, hull fouling studies, and surveillance. Non-native species totalled 164, many of which were new records for New Zealand. A large number have only been found on visiting international vessels and are not known to be established here.

Importantly, this vast series of specimens is curated as a reference collection within NIWA's nationally-significant Invertebrate Collection, and Te Papa's herbarium collection.

Alan Blacklock, NIWA

Andrew Hosie.

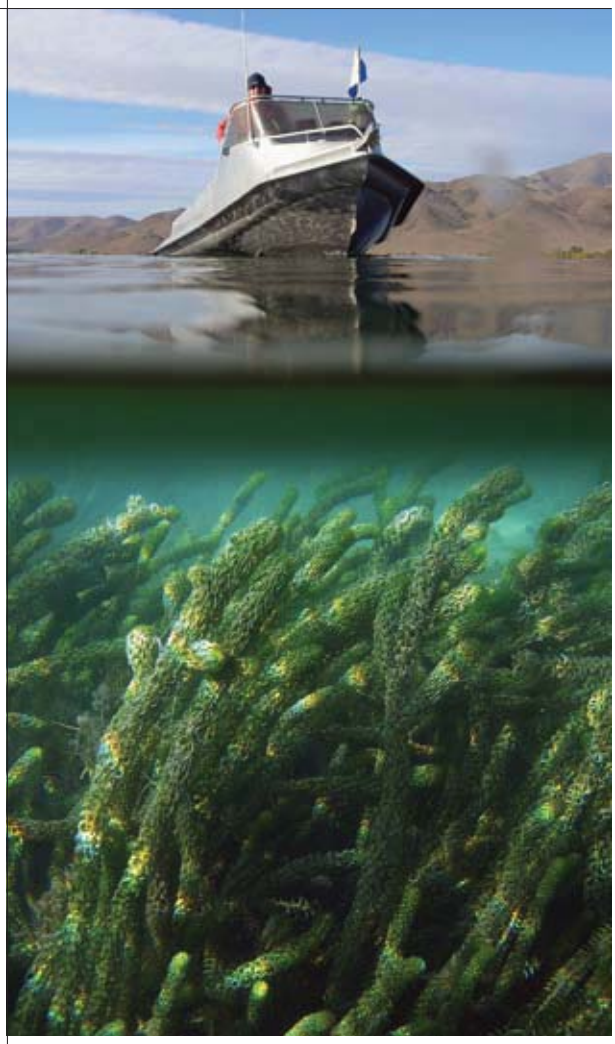
Front-line defence against freshwater weeds

Early detection of freshwater pests is crucial to contain or eradicate them effectively, but many are hidden beneath the waves. NIWA has designed underwater surveillance programmes, targeting at-risk water bodies and focusing on likely sites for introduction. Detection methods include manoeuvrable diver tows and sonar mapping.

This year, surveillance programmes undertaken by regional councils detected major new submerged weeds in four iconic lakes: Wakatipu, Rotomahana, Okataina, and Ototoa. NIWA advised on ways to delimit and contain the extent of the incursions, and assess if and how eradication might be achieved. Early detection and decisive action has led to realistic prospects of eradication at three of the above sites.

NIWA also advised on containment of lagarosiphon, a weed that threatens hydro-generation and amenity values in the Waitaki Valley system and Lake Wanaka. This included advising on weed control, inspecting weed control outcomes, and formulating strategies for future containment and reduction of the weed.

NIWA's generic guidelines for waterbody surveillance and incursion response will incorporate these experiences and provide agencies with stronger tools for early pest plant interception.



John Clayton, NIWA

Breakthrough in didymo control

NIWA research has identified a compound that could potentially control localised early stage didymo infestations with minimal impact on other aquatic life.

Intensive trials in laboratories and artificial stream channels identified a chelated copper formulation, now named Gemex™, as the best agent to kill didymo while having minimal non-target effects. After obtaining the necessary consents, we released Gemex™ into Princhester Creek, a tributary of the Mararoa River, at a prescribed rate over an hour on a single afternoon in February.

Gemex™ successfully eliminated didymo six weeks after treatment over the initial 0.3 km of waterway that was in the early stages of infestation, and it suppressed growth in 1–10 mm thick didymo mats for up to 4 km downstream. Overall, effects on non-target species, particularly invertebrates and native galaxiid fish, were minimal. Further investigation is needed of juvenile trout mortality at localised downstream sites, and the long-term effects of Gemex™.

This research, commissioned by MAF Biosecurity New Zealand, is attracting interest from other countries where didymo has become a nuisance, from North America to Scandinavia.

Bill Jarvie, Fish & Game New Zealand

Phil Jellyman sampling algae in Princhester Creek after Gemex™ trials.

Case study: didymo (under fold)

National Centre for
Aquatic Biodiversity & Biosecurity

protecting our natural heritage

See p. 25 for an outline of our capabilities & services

Targeting didymo

When NIWA scientist Cathy Kilroy identified a microscopic alga she collected from the lower Waiau River (Southland) in October 2004, the news was alarming. The alga was *Didymosphenia geminata*, aka didymo or rock snot, a single-celled diatom capable of smothering waterways with its prolific growth.

Extensive fleece-like mats of didymo now cover stretches of many rivers in the South Island. This unsightly alga clogs jetboat and water intakes and poses a significant threat to New Zealand's angling, tourism, and hydroelectricity industries.

NIWA is at the forefront of didymo surveillance and research, responding rapidly to changing research needs, building on new information as it comes to light, and always with careful consideration of practicalities and environmental protection. The research outlined here was commissioned by MAF Biosecurity New Zealand (MAFBNZ) to inform their decisions on didymo containment and control.

Defining didymo's limits

In September 2005, didymo was discovered in several more South Island rivers. MAFBNZ commissioned NIWA to help undertake a nationwide search for the pest. Within days field teams were in action, and within three weeks they had sampled 475 sites nationwide. NIWA has since led several nationwide delimitation surveys. Didymo has progressively spread to more areas – 14 major South Island river and lake systems as of July 2007 – but has not yet been detected in any North Island waterways. To prepare for that eventuality, we've developed plans to assist implementation of MAFBNZ's North Island didymo response strategy.

Early detection is crucial, but didymo cells aren't visible to the naked eye, and it's not feasible to search every part of every waterway. We've therefore helped to refine surveillance methods and identify high-risk sites. Initial analyses of habitat suitability, based on didymo's environmental preferences in other countries, showed that more than 50% of New Zealand's river area – mostly in the South Island – would be suitable for didymo. More recent analyses based on new survey data from 145 South Island sites show a similar broad pattern, with South Island rivers more susceptible to didymo incursions. Colour-coded maps showing predictions of percentage cover and thickness of didymo in river reaches will help managers to assess the risks of impacts from didymo in currently unaffected rivers, and to identify and manage high-risk sites.

Didymo ecology and impacts

To contain and control a pest, you first need to understand what makes it tick. MAFBNZ commissioned NIWA to study didymo's ecological requirements and impacts in Southland rivers in 2005 and again in 2006–07 – the latter with Fish & Game New Zealand, the Cawthron Institute, and the University of Otago.

The early studies showed that didymo can thrive in a broad range of water depths and speeds. Nutrients may stimulate cell growth, but thick mats can develop even if nutrient concentrations are very low. More recent research suggests floods are a major factor controlling didymo abundance.

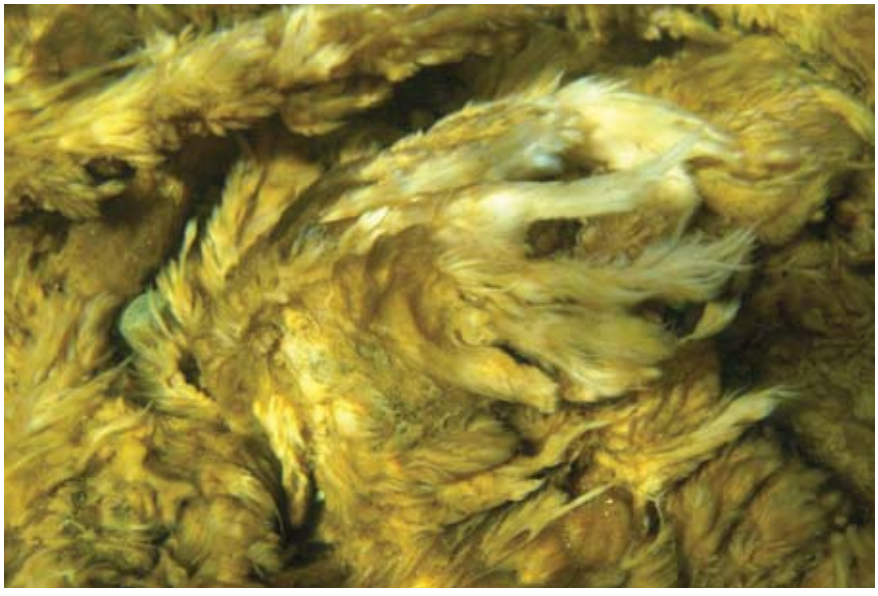
Understanding didymo's effects on river ecosystems may help to identify species and processes at high risk, and aid in prioritising conservation efforts. Quantitative studies of invertebrates in the Oreti, Mararoa, and Waiau Rivers showed that thick didymo growth is associated with overall increased invertebrate abundance and diversity. But species favoured by fish (mayflies, stoneflies, and caddisflies) decreased in proportional abundance. It is still too early to predict long-term effects on ecosystems.

Experiments in didymo survival

"Early on, the priority was to contain didymo within its original catchment, which required rapid development of methods for decontaminating materials and equipment that may have come into contact with didymo", explains Cathy Kilroy. NIWA made preliminary decontamination guidelines available within two months of the first didymo discovery, and quickly tested the effectiveness of various methods to kill didymo mats and cells on gear. Common household cleaners and desiccation were the most effective.

Once didymo was discovered in several rivers, priorities shifted to containing and slowing its spread within the entire South Island. This required an assessment of the risk of transporting didymo within New Zealand and decontamination of equipment on a massive scale.

Laboratory experiments showed didymo is capable of surviving outside its natural



Neil Blair, NIWA

environment for much longer than was previously thought – more than two months in optimum conditions of low temperature (about 9 ºC), and adequate moisture and light. Drying and extreme temperatures rapidly killed didymo, and these methods were incorporated into MAFBNZ's decontamination recommendations in the 'Check, Clean, Dry' campaign.

Tests of the effectiveness of 14 different decontamination products and protocols resulted in decontamination recommendations for a wide range of river users – from the casual angler, to jetboat operators and other high volume commercial users.

Further lab research confirmed felt-soled waders as a prime candidate for transferring didymo between rivers because of their ability to retain moisture and, therefore, live didymo cells. Trials of various decontamination methods suggested felt-soled waders should be frozen solid or soaked in hot water – preferably with detergent – for long periods, if used at all. As a result, MAFBNZ's 'Check, Clean, Dry' recommendations were updated to incorporate separate methods for absorbent and non-absorbent items.

Steps to identify a control agent

The search for a biocide that would control didymo, while having minimal environmental impacts, began in November 2005, building on earlier studies of its ecology and survivability in different conditions. Trying to entirely remove an established population of a microscopic organism from a waterway without serious impacts on other aquatic life is a huge challenge. "A more realistic goal was to focus on finding a tool to reduce the impacts of didymo blooms and control early infestations", says NIWA's Dr Sue Clearwater.

A wide-ranging scientific review of algal control chemicals identified ten compounds as possibilities, which were narrowed to four through a series of screening trials on cobbles covered in didymo mats. We tested these four for their effectiveness at different application rates and flow conditions in an artificial stream environment, built at Pioneer Energy's Monowai power station in early 2006, and concurrently tested their impact on freshwater fish and invertebrates in laboratory trials. The chelated copper product, Gemex™, emerged as the most promising. The next step was to test it in a natural waterway. After careful preliminary work and consultation, we trialled Gemex™ in Princhester Creek, a tributary of the Mararoa River, in February 2007 (see article on p. 27).

Alan Blacklock, NIWA

Cathy Kilroy with cultured didymo samples.

Results of the trial suggested Gemex™ has the potential to eliminate didymo from a waterway with minimal impact on non-target species if the infestation was detected and treated in the very early stages. Short-term Gemex™ treatment is likely to result in negligible accumulation of copper in the environment. However, heavy use of Gemex™ for repeated or long-term treatment is not viable due to the potential cumulative effect.

"NIWA has played a pivotal role in the Government's response to the didymo incursion in New Zealand," says MAFBNZ's Didymo Science Programme Leader, Dr Christina Vieglais. "NIWA's expertise has been instrumental in understanding didymo's ecology and potential distribution, and in quickly developing practical tools for cleaning freshwater gear. These tools empower everyone using New Zealand's awe-inspiring freshwaters to play their part to prevent spreading didymo."

Risk is all about facing consequences

What if a major stopbank failed at night during a 1-in-50 year flood? What if we had a magnitude 7.5 quake on a local fault at 2 p.m. on a weekday? What if that quake generated a tsunami?

Where are the likely injury hotspots, depending on day and time? How many people could be affected? What vital infrastructure is at risk and where? What might be the costs of repair or replacement?

RiskScape is a new tool, being developed jointly by NIWA and GNS Science, to answer such questions.

RiskScape can be applied in the aftermath of an event to help prioritise the response. But even more importantly, it's vital to ask those 'what if?' questions beforehand. Quantifying the consequences of credible scenarios helps long-term land-use planning (e.g., siting new subdivisions) and provides a realistic picture for emergency arrangements and exercises (e.g., evacuation maps). Consequently, RiskScape will be useful to land-use planners, design engineers, emergency managers, and the insurance sector.

NIWA and GNS Science are running a working prototype with councils covering Westport, central Hawke's Bay (Napier, Hastings, Havelock North), and Christchurch. RiskScape will be set up for five hazards in these three areas by mid 2008.

RiskScape is funded by the Foundation for Research, Science & Technology.

A screenshot from RiskScape showing estimated cost of damage to cars if the stopbank along the Ngaruroro River were to breach during a 1-in-50 year flood. The simulation was supplied by Hawkes Bay Regional Council. The lime green colour shows the extent of the area modelled; cars in these areas would not be damaged. The heaviest damage to cars would be in the red areas. In reality, for this scenario, there would be at least 12 hours' warning, allowing time to shift vehicles.

New Plymouth landslide hazard assessed

This year, NIWA assessed the landslide hazard for the New Plymouth district. The project required statistical and geotechnical modelling, analysis of soil moisture and rainfall data, field-work, and laboratory-based soil geotechnical work.

Reassuringly, the study concludes that only 9% of the district – mudstone country in the east and northeast – is likely to be affected by landslides. The estimated average return periods for heavy rainfall events which could trigger landslides in this area range from 1-in-70 years towards the end of summer (February) to 1-in-25 years in winter, especially in July and August when soils are very wet.

The landslide hazard assessment is part of a suite of reports commissioned by the New Plymouth District Council. The council has asked NIWA to take a comprehensive look at the climate hazards and extremes facing the district now and as a result of climate change. Using a mid-range projected climate change scenario, the landslide probability is likely to at least double during the 21st century, with more areas affected, though most of the district will still have stable soils.

Jochen Schmidt, NIWA

Shallow landslides under pasture near Tarata, southeast of New Plymouth.

Tsunami hazard

NIWA's tsunami specialists have had a busy year, conducting tsunami hazard assessments in the regions coloured yellow. The red circles show a representative sample of locations in NIWA's palaeotsunami database where physical evidence or oral tradition suggests past tsunamis.

All-hazards forecasting capability established

After several years of research, NIWA has the key elements of an integrated 'all natural hazards' forecasting capability.

This challenging project has already produced for the New Zealand region:

- the first high resolution weather forecast model that can incorporate satellite and conventional weather observations – the New Zealand Limited Area Model (NZLAM). NZLAM uses the UK Met Office Unified Model™;
- the first data-assimilating, spatially-distributed flood forecasting model;
- the first regional-scale high resolution wave forecasting models;
- the first regional-scale sea-level forecasting model.

The research is part-funded by the Foundation for Research, Science & Technology.

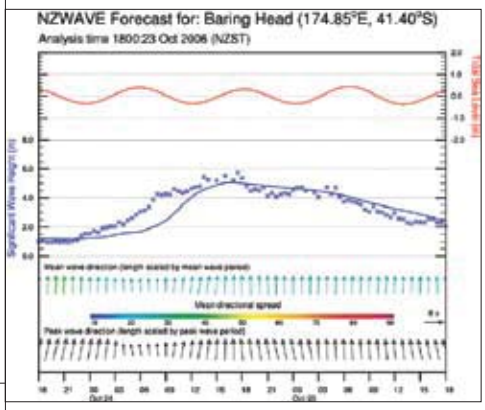
Alan Blacklock, NIWA

Towards a national flood forecasting service

Currently, some councils rely only on heavy rainfall warnings to forecast floods. Others predict downstream flows using river gauge data (0–6 hours warning for typical catchments), or rain gauge data (0–12 hours warning). In the past, NIWA has also produced experimental longer-range flood forecasts from a weather model on a best endeavours basis.

EcoConnect, NIWA's environmental forecasting and information service, can now provide up to 48 hours warning of flooding in five catchments: Rangitaiki, Manawatu, Wairau, Buller, and Clutha. EcoConnect runs operationally 24/7 and uses better models than past systems. We use NZLAM to produce our rainfall forecasts, and are one of only a few organisations worldwide to incorporate real-time measurements into our hydrological model, which improves accuracy.

Our next steps are to apply this science across every river basin in the country. We hope to produce a genuinely national flood forecasting service by mid 2008.



NZWAVE forecast as at 6 p.m. on 23 October 2006, predicting the severe storm in Cook Strait the following day.

Bumpy crossing

On 24 October 2006, the Interislander ferry *Kaitaki* took 10 hours to travel from Picton to Wellington, encountering 9 m swells en route. The vessel had to shelter in Cloudy Bay for several hours because of poor conditions at the entrance to Wellington Harbour.

NIWA's new wave forecasting system comprises a set of models, each providing more detail but shorter notice. Up to 123 hours (five days) beforehand, our global wave forecast model was signalling sizeable waves in Cook Strait for the 24th. By 6 p.m. on the 23rd, our regional wave forecast model was predicting significant wave heights greater than 5 m, meaning individual waves would be expected to reach up to 9 m when the ship was due to enter Wellington Harbour. Our system was running in test mode, not operationally, at the time.

Natural Hazards Centre

setting the foundation for a sater future

bringing together the expertise of NIWA & GNS Science:

- providing information for policy managers, planners, emergency managers
- helping people improve their resilience & better manage the risks
- covering the full range of natural hazards, including floods & droughts, extreme weather, coastal erosion, landslides, earthquakes, volcanoes, tsunamis

www.naturalhazards.net.nz

John Zeldis, NIWA

Peter Wilson (left) and Kay Vopel measure microprofiles of oxygen and pH in estuary sediments.

Diagnosing estuary health

NIWA is leading a study of the health of the Avon-Heathcote estuary before and after the installation of the Christchurch City wastewater outfall in late 2008.

The estuary has had heavy nitrogen loading from wastewater for the past 40 years, and the outfall will remove about 90% of it. We are using a range of tools to investigate the physical, chemical, and biological response of the estuary to this dramatic change. The resulting toolkit will be applicable to estuary remediation projects around the country.

The scientific team is separating sources of pollution using stable isotope analysis, and estimating the pollution load in the sediments through analysis of nutrient and oxygen levels.

They're also monitoring the abundance and, in some cases, physiology and population dynamics of key species. These include microalgae which support the base of the estuary food chain, sea lettuce (the source of nuisance smells in summer), and abundant animal populations.

This research is in collaboration with the universities of Canterbury, Otago, and Birmingham (UK), Environment Canterbury, Christchurch City Council, and the Ihutai Trust, with direct financial support from the Department of Conservation and the Foundation for Research, Science & Technology.

What drives coastal productivity?

Barb Hayden, NIWA

Nutrients in coastal waters come from the ocean and land via mechanisms such as upwelling, tidal mixing, and river flows. Understanding these mechanisms has applications for the aquaculture and fishing industries and regional councils.

NIWA research has shown that nutrients in Pelorus Sound – New Zealand's largest aquaculture area – come both from Cook Strait and the Pelorus River, and that climate has important effects on this input. Southeast winds during La Niña summers suppress upwelling and nutrient delivery from Cook Strait to the outer Sound. In winter, southerly winds are associated with decreased river flow and less nutrient input to the inner Sound.

Our research has shown that a large downturn in mussel meat yield between 1999 and 2002 occurred when climatic conditions favoured decreased nutrient input to the Sound. This suggests that climatic conditions, rather than resource over-use, drove the downturn.

These findings were based on climatic, oceanographic, and mussel industry historical data. To understand the underlying mechanisms of nutrient supply to coasts, NIWA is developing coastal ocean models, and validating them with data from ships, satellite sensing, and telemetered buoys.

The vital role of coastal ecosystems

Worldwide, there is growing recognition of the services nature provides that effectively sustain life and business on our planet. NIWA research is highlighting the vital services provided by estuarine ecosystems and the threats they face.

A key service is the cycling of nutrients from seafloor sediments to the overlying water. Seafloor habitats can supply up to half the nutrients for primary production in coastal waters, supporting fisheries, shellfish production, and shorebirds.

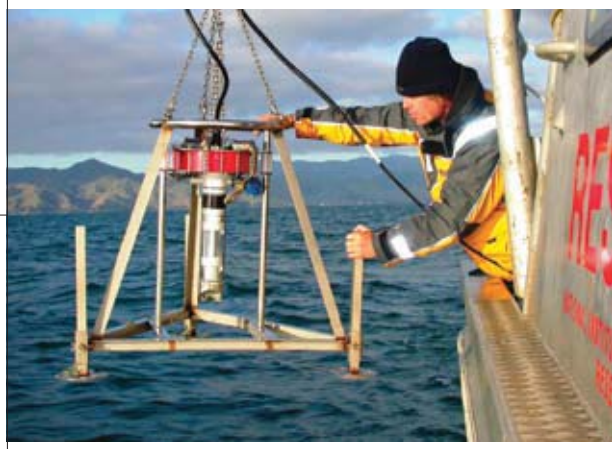
Estuaries function like a liver or kidney in the coastal zone, processing nutrients, contaminants, and sediments that are washed off the land. We are researching the role key seafloor species play in this processing these inputs, and what happens when they become overloaded.

Species like horse mussels, heart urchins, and cockles help release nutrients from the seafloor and create habitats for other species. Seagrass and large shellfish also provide nurseries for juvenile fish. Because of feedback mechanisms, small changes in the abundance of key species can rapidly alter an estuary's ability to process nutrients and contaminants.

This Foundation for Research, Science & Technology funded research will help coastal managers devise policies and strategies that avoid damage to estuaries and maintain the important ecological services estuaries provide.

Top right: Drew Lohrer setting up benthic chambers on Waitemata Harbour sandflats to measure changing levels of oxygen and nutrients associated with the activity of sediment-dwelling organisms.

Luca Chiaroni, NIWA



Kay Vopel, NIWA

Cliff Hart deploying the sediment profile imaging device in Wilson Bay, Firth of Thames, to investigate the effects of longline mussel farming on seafloor function.

New advances in sediment biogeochemistry

Coastal sediment acts as a biogeochemical reactor, breaking down organic matter through microbial activity and chemical processes and releasing nutrients. Understanding the functioning of this reactor is key to predicting the effects of human activities, such as wastewater discharge, on coastal ecosystems.

NIWA has developed a new method to assess sediment functioning using a combination of two high resolution measuring techniques and a numerical model of the processes involved in organic matter breakdown.

We use a scanner to capture vertical sediment colour profiles which result from a sequence of 'redox' (reduction-oxidation) reactions and the mineral composition of the sediment. The interpretation of these profiles is aided by millimetre-scale profiling measurements of key pore-water solutes and the numerical model. The pore-water solute measurements also help to fine-tune the model, which not only characterises the status quo of the sediment reactor, but also predicts its function under future scenarios of human activities.

This three-pronged tool has many applications, including assessing the environmental effects of fish and mussel farming, urban development, and dredging on coastal regions.

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guiding exploration, management, & protection of coastal & marine resources, including:

- mapping seafloor resources
- environmental assessments & surveys – sedimentation, pollution, erosion, restoration
- forecasting for the marine environment
- oceanography & ocean productivity
- coastal ecology
- environmental monitoring & modelling

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Aquaculture & biotechnology

Developing high performance broodstock

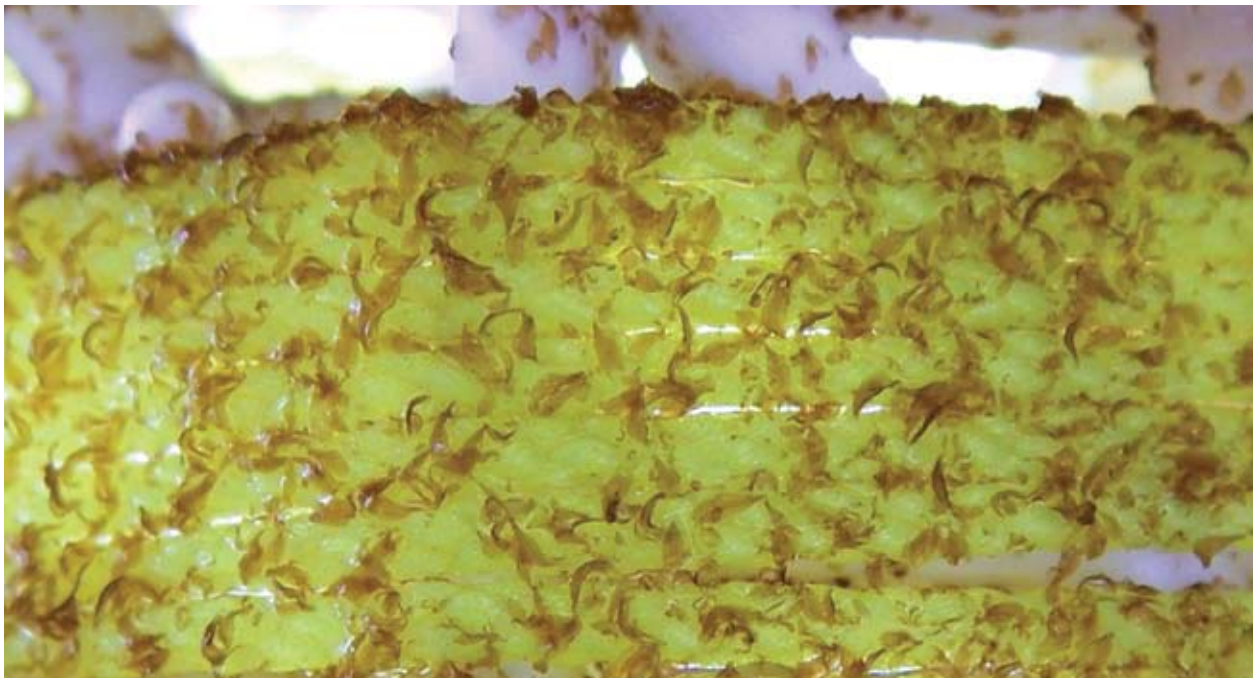
The New Zealand aquaculture industry's aim to become a billion dollar industry by 2025 requires the use of new high-value species. NIWA continues to have significant success in developing rearing methodologies for new aquaculture species such as kingfish, hapuka (groper), and paua. Having established that these species are feasible options for aquaculture, our world-class research team is now undertaking to turn these into high return export industries.

To provide the foundation for future development, we have expanded and successfully bred from our wild kingfish and hapuka broodstock. Hapuka bred and reared in captivity – a world first – form part of this broodstock.

We are now developing elite broodstock through selective breeding to produce superior seed for the developing industries. Our first endeavour has established a series of paua families at Mahanga Bay; their performance will be evaluated over the next three to four years. We'll also develop similar programmes for other key species. The research is supported by the industry and the Foundation for Research, Science & Technology.

NIWA

The product of a world first: 4 month old juvenile hapuka in the breeding facility at Bream Bay.



Kate Neil, NIWA

Seaweed cultivation.

Seaweed: a versatile product

Seaweeds provide an ideal diversification activity for mussel farmers, as they are low maintenance and use similar culture technologies to mussel farming. Seaweed is in great demand, with uses ranging from foodstuffs to cosmetics. But regulations surrounding wild seaweed harvesting mean that aquaculture is currently the only way to boost supply of this versatile product.

NIWA has successfully developed techniques to culture a number of seaweed species on ropes as part of a Foundation for Research, Science & Technology-funded project Industrial Research Ltd is undertaking. Seaweed spores settled onto strings at our Mahanga Bay facility are ongrown at mussel farms. We are now achieving excellent growth rates and repeated harvests of a red seaweed that is valued for its unique chemical extracts.

NIWA's biotechnology team has identified extracts with anti-viral and anti-bacterial properties from a range of New Zealand seaweeds. These offer potential to develop new high value, natural products unique to New Zealand.

We are also exploring the use of seaweeds in both onshore and offshore co-culture systems as a means of contributing to sustainable aquaculture.

Co-culture for sustainability and profit

Growing ecologically complementary species together can yield more value from existing aquaculture space while reducing environmental impacts. Complementary species can be grown using the waste from mainstream aquaculture species. This reduces environmental impact and provides additional revenue to farmers – a win:win situation.

For instance, mussels and seaweeds grown on lines around salmon farms remove suspended waste and nutrients, while sea cucumbers ranched below either salmon or mussel farms remove solid waste that falls on the seafloor.

With industry collaborators Marlborough Mussels Ltd and The New Zealand King Salmon Company Ltd, we are trialling various combinations of salmon, mussels, seaweeds, and sea cucumbers in Pelorus Sound. At each site, water currents and temperature, levels of nutrient and suspended waste, sediment deposition, and growth rates of the co-culture species are monitored. Matching the species to the environment is crucial to success.

NIWA also successfully trialled a land-based recirculation system that uses the red seaweed karengo to remove nitrogenous waste from paua tanks. Funded by the Foundation for Research, Science & Technology, this is being piloted near Wellington by collaborators Hongoeka Development Ltd.

Alan Blacklock, NIWA

Graeme Moss (NIWA) and Wally Turvey (Hongoeka Development Ltd) monitoring the polyculture system at Hongoeka Bay, Plimmerton.

Improving treatments for fish diseases

NIWA is working on more efficient and environmentally-friendly ways of tackling aquatic diseases in order to enhance aquaculture productivity and sustainability.

We've adopted some principals from human pharmacology (the study of how drugs interact with the body over time) to better predict the outcome of a dosing regimen. Compared with traditional trial-and-error methods of selecting dosing regimens, this approach can improve the effectiveness of the drug, reduce costs, minimise waste and environmental impact, and identify where disease therapies are likely to fail.

Using an established drug for the treatment of parasitic worms in kingfish, we have modelled the link between drug performance and the biological processes of drug absorption, distribution, metabolism, and excretion in fish, all of which affect treatment outcome.

This provides a mechanism to predict and develop treatments for emerging diseases of new aquaculture species, such as hapuka. It's also a cost-effective and powerful tool to assess the performance and viability of alternative disease therapies. In the future, we hope to examine the effectiveness of natural marine extracts, identified by our biotechnology team, in treating aquaculture diseases.

This research was funded by the Foundation for Research, Science & Technology.

Larry Hammell, Atlantic Veterinary College, Canada

Lincoln Tubbs conducting a post-mortem on hapuka at Bream Bay.

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working with industry to increase the value & sustainability of seafood & aquaculture

- fish abundance & productivity
- population modelling & risk analysis
- estimation of sustainable harvest levels
- fish biology & ecology
- fish & shellfish culture, health management, nutrition & feed development
- environmental impacts & mitigation strategies
- research & development with commercial application

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Working with stakeholders

NIWA is working with the fishing industry, Ministry of Fisheries (MFish) and other stakeholders on a number of fronts, including the development of Fisheries Plans. We have recently provided scientific advice for three proof-of-concept Fisheries Plans: for Bluff oysters, Coromandel scallops, and southern blue whiting.

We are helping the Bluff Oyster Management Company (BOMC), MFish, and a broad range of community stakeholders to better manage the iconic Bluff oyster fishery. Our research has shown that the disease bonamia is the main driver of oyster population changes. Future research will focus on what triggers these devastating outbreaks and why they persist.

With BOMC, we've made great progress in trialling the return of oyster shell to enhance seabed habitat and settling surfaces for oyster larvae, which we've found settle mostly on live oysters and oyster shell. Purpose-built still and video camera systems reveal that areas enhanced with shell show some regeneration within 20 months. As part of the Fisheries Plan, NIWA will assist BOMC with developing new dredge designs, and test them to further improve their efficiency and minimise impacts. We'll also further investigate drivers of oyster production.

Alan Blacklock, NIWA

Keith Michael, NIWA

Regeneration of seabed communities on returned oyster shell in Foveaux Strait.

Crispin Middleton, NIWA

Estimating the recreational share of fisheries

More than a quarter of New Zealanders take part in some form of marine recreational fishing. This recreational harvest needs to be quantified to improve the accuracy of inshore fishery stock assessments and for the Ministry of Fisheries (MFish) to allocate shared fisheries resources equitably and sustainably. Past estimates proved unreliable, so MFish commissioned NIWA to gather direct observations of recreational fisheries, providing catch estimates where possible.

Since 2003, we have surveyed recreational fisheries around the country, employing a range of methodologies to suit their disparate nature. For example, aerial boat counts and boatramp interviews with fishers were used to estimate snapper, kahawai, and kingfish catches from North Cape to East Cape. This area supports New Zealand's largest snapper fishery. We estimated that in 2004–05, the recreational snapper harvest was about 2500 tonnes, about a third of the combined recreational and commercial catch. We are now using webcam images of traffic at boatramps to monitor how levels of fishing effort change from year to year in this area.

Advice on eels

Freshwater eels support important commercial, recreational, and Māori customary fisheries throughout New Zealand. NIWA is the leading provider of scientific research and advice on eels to the Ministry of Fisheries.

Endemic longfin eels are particularly vulnerable to over-fishing, being long-lived single spawners. Our analysis of commercial fishery data shows that longfin stocks have declined since the 1990s and mature females are now very scarce in commercially fished rivers.

New techniques and knowledge of eel habitat preferences have enabled us to predict the extent of longfin eel habitat and abundance in all New Zealand's waterways, using spatial models of river characteristics and water flow. We've also used these techniques to assess the value of national parks as eel reserves.

We recently piloted the world's first integrated population model for eels, applying our CASAL model to the Southland longfin fishery. A key input was knowledge of longfin spatial distribution. NIWA's models are now being considered as a means of assessing management options for habitat protection and alternative harvest strategies.

Advances made by NIWA in improving passage for eels at barriers, such as dams and floodgates, will ultimately benefit eel stocks.

Greg Kelly, NIWA

Marty Bonnett and Don Jellyman comparing size and species composition in Lake Ellesmere.

Neil Bagley, NIWA

Insight into hoki stocks

Hoki support New Zealand's biggest fishery. NIWA works with the Ministry of Fisheries (MFish) and the fishing industry to develop a better understanding of hoki stocks in order to sustain them into the future.

We provide annual assessments of both the western and eastern hoki stocks for MFish based on data collected from NIWA research surveys and the commercial fishery. This year we completed the tenth summer survey of the western stock and sixteenth summer survey of the eastern stock. These assessments allow catch limits to be altered each year according to the most current information. Our assessments show that the median biomass of the western stock has been falling since the mid 1990s and now sits at 15–24% of its 'unfished' biomass.

Poor recruitment of young fish into the western hoki stock remains a key question for the fishery. One possibility is that many more young fish may die than we realise, by getting damaged as they escape through trawl nets. We recently carried out a collaborative experiment with the Deepwater Group Ltd to find out how many fish of each length class escape during commercial fishing operations so that possible impacts can be modelled. We're also investigating possible links between recruitment and changes in oceanic and climatic conditions within each spawning season.

Neil Bagley, NIWA

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See p. 33 for an outline of our capabilities & services

Evaluating the ocean as a carbon sink

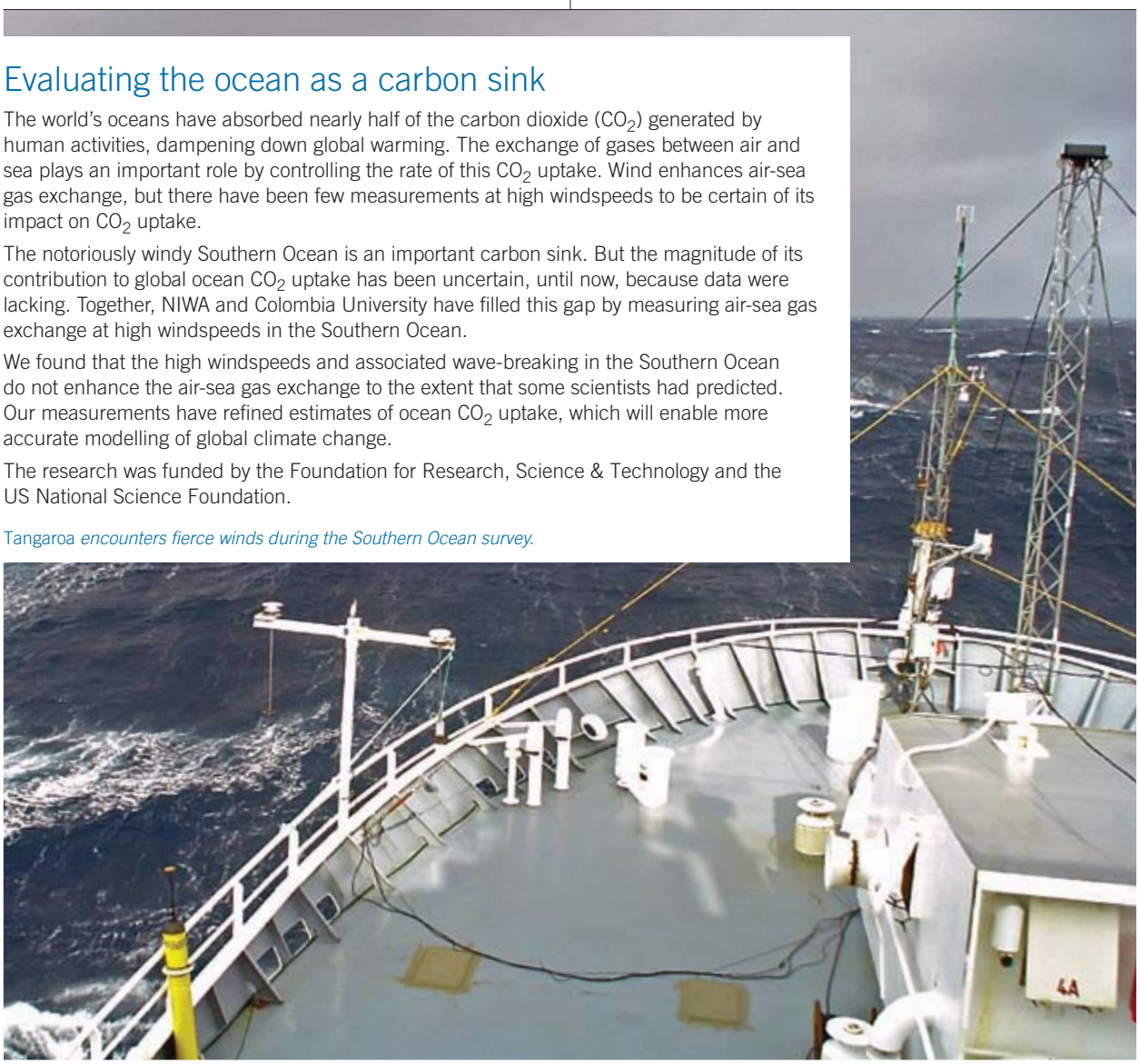
The world's oceans have absorbed nearly half of the carbon dioxide (CO_2) generated by human activities, dampening down global warming. The exchange of gases between air and sea plays an important role by controlling the rate of this CO_2 uptake. Wind enhances air-sea gas exchange, but there have been few measurements at high windspeeds to be certain of its impact on CO_2 uptake.

The notoriously windy Southern Ocean is an important carbon sink. But the magnitude of its contribution to global ocean CO_2 uptake has been uncertain, until now, because data were lacking. Together, NIWA and Colombia University have filled this gap by measuring air-sea gas exchange at high windspeeds in the Southern Ocean.

We found that the high windspeeds and associated wave-breaking in the Southern Ocean do not enhance the air-sea gas exchange to the extent that some scientists had predicted. Our measurements have refined estimates of ocean CO_2 uptake, which will enable more accurate modelling of global climate change.

The research was funded by the Foundation for Research, Science & Technology and the US National Science Foundation.

Tangaroa *encounters fierce winds during the Southern Ocean survey.*



Péter Minnett, University of Miami

Origins of coastal nutrients

Nutrients in coastal waters sustain important fisheries, aquaculture, and ecosystems. NIWA is using nutrient budgets to help understand the origins and processing of these nutrients in coastal ecosystems.

We have used nutrient budgets to evaluate the balance of terrestrial and oceanic nutrient inputs in the Firth of Thames and Golden and Tasman bays. The Firth of Thames supports New Zealand's largest snapper nursery and biggest mussel farm. We found that about 75% of its nitrogen loading comes from rivers, underlining the importance of runoff water quality and catchment management for the Firth ecosystem.

By contrast, Golden and Tasman bays get 90% of their nitrogen loading from offshore waters in Cook Strait. Understanding the oceanography of Cook Strait is, therefore, key to understanding and predicting nutrient levels in the bays, with implications for scallop fisheries and mussel farms.

Nutrient budgets are also useful in evaluating aquaculture impacts in coastal ecosystems. For instance, we found that very little nitrogen and primary production is lost due to mussel harvest in the Firth of Thames, at both present and projected harvest levels.

Antarctic sea ice and global climate

Sea ice plays a major role in climate through its influence on gas exchange, solar radiation, atmospheric temperature, and ocean salinity. The extent of sea ice in the Southern Ocean varies annually from about 3 million to 20 million square kilometres, effectively doubling the size of Antarctica. This has a major influence on New Zealand's climate.

Average annual sea ice volume in the Southern Ocean is predicted to drop by about 34% over the next century due to global warming. What impact will this have on regional and global climate and on ocean circulation? What oceanic and atmospheric factors influence the formation and break-up of sea ice?

NIWA is undertaking research on these questions in collaboration with Industrial Research Ltd, Victoria University of Wellington, and the universities of Auckland and Otago. We are using McMurdo Sound in the Ross Sea as a natural laboratory to understand the processes controlling sea ice thickness and their impact on local oceanic and atmospheric conditions. This research will then be used in global climate change models.

The 13-year research programme is funded by the Foundation for Research, Science & Technology.

Craig Stevens, NIWA

NIWA's Dr Mike Williams retrieves a current meter from below the McMurdo Sound sea ice.

Exploring the potential of deepsea methane

NIWA has collaborated with several New Zealand and overseas institutions to investigate the unique biology and geology associated with deepsea methane seeps, and their potential as a source of energy and greenhouse gas.

Cold seeps occur where methane-charged fluids percolate through the seafloor from large stores deep below. A 2-year study of a methane seep off the Wairarapa coast by NIWA suggests that insufficient methane reaches the sea surface to be a significant source of greenhouse gas.

Late last year, scientists on *Tangaroa* discovered several new cold seep sites off the east coast of the North Island. They characterised the unique gas-fuelled biota associated with the seeps and their unusual carbonate formations, which include 'donuts' and 'chimneys'. Sediment and water samples were collected to track the fate of the expelled methane. This voyage was led by NIWA and Woods Hole Oceanographic Institution, with funding from the US National Oceanographic and Atmospheric Administration and NIWA.

Following on from this study, a 3-month survey on the German research vessel *Sonne* identified the geological structures and processes which enable transport of methane from beneath the earth's crust. This research was led by IFM-Geomar (Germany), NIWA, and GNS Science.

Craig Stevens, NIWA

Marine tube worms, Calyptogena (clam) shells, and carbonate rocks captured at a cold seep by NIWA's Deep Towed Imaging System.

National Centre for
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guiding sustainable development

See p. 31 for an outline of our capabilities & services

Environmental information

Nelson Boustead, NIWA

250 million data records and rising

Hourly and 10-minute climate data are collected every day from many of 2820 monitoring stations around New Zealand, the Pacific, and Antarctica, and added to NIWA's National Climate Database.

The database already contains over 250 million individual data points, and features information on rainfall, earth and air temperature, wind, soil moisture, evaporation, solar radiation, sunshine, pressure, and humidity.

Records for two stations go back to before 1855, by 1900 climate records were being kept in over 200 sites, and the database contains information from over 7470 locations, many of which are no longer taking measurements. The longest running site, which opened in 1864, is in Christchurch Gardens and data is still being collected there 143 years later.

Until this year, access to the database was limited and charged for, with fewer than 150 regular users. In July this year, much of it became available free and two months later user numbers had increased to over 900, and are rising every day. In the first two months more than 40 million rows of data had been downloaded, six times more than in the same period last year.

How fresh are things in Doubtful Sound?

Continuing monitoring of the impact of freshwater into the Doubtful-Thompson-Bradshaw Sound system from Meridian's Manapouri power scheme is carried out by NIWA and the Cawthron Institute. Monitoring is required to ensure the Fiordland ecosystem is not being stressed or altered by the freshwater input.

NIWA's Ian Maze said the ecosystem is used to dealing with sudden increases in freshwater layers, produced by the region's big annual rainfall and huge natural runoff, but the Manapouri power scheme outflows subtly change the situation through a more continuous input of freshwater. To date the extensive monitoring has not identified any ecological effects following the operation of the second tailrace tunnel.

When the Manapouri scheme began back in 1969, it was recognised that an initial impact might occur. New baselines have been established with the recent re-consenting of the scheme in the mid 1990s for use in future scheme management. Hourly salinity and temperature measurements at 10 depths are made at some locations, while hourly rainfall, air temperature, and wind speed and direction are recorded at others. The second Manapouri tailrace means up to 510 cumecs can now be discharged at times as opposed to the previous 465 cumec normal limit with the single tailrace.

Ian Maze, NIWA

River gauging gets smart

Acoustic Doppler current profilers (ADCPs) are transforming the way we gauge the flow of rivers, and a nifty device developed by NIWA is making the job even easier.

ADCPs are sophisticated echo-sounders which can measure water depth and velocity across a full cross-section of a river. Older methods typically involve an operator gauging the river at selected points while wading, standing on a bridge, or even suspended in a cable car.

By using a large ADCP mounted on a jet boat, we can much more accurately gauge big rivers like the Waikato, but we also use ADCPs mounted on a 'float' to gauge smaller streams.

The manufacturer's recommended method for deploying a float-mounted ADCP involves an operator dragging the float back and forth along a line strung across the stream. This is tedious and difficult because each traverse of the stream must be smooth, constant, and slow.

Andrew Willsman of NIWA's Dunedin branch office invented a remote-controlled 'traveller' which moves the float at very slow, steady speed, ensuring high quality flow measurements. At one site where we were getting 10% or more variation in flow measurements between traverses, we get just 2% variation using the traveller.

The traveller has been further developed by NIWA Instrument Systems and is now available for sale.

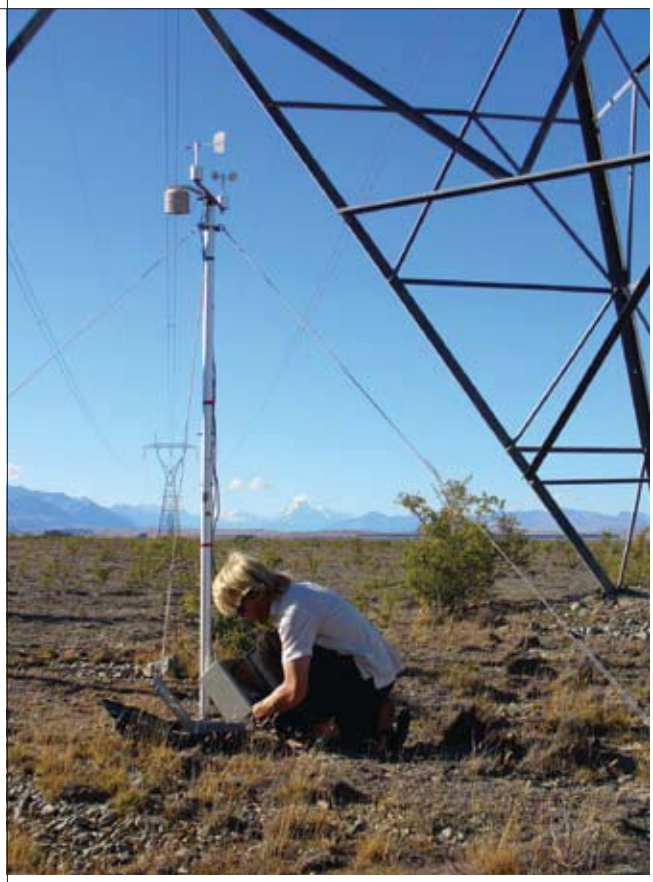
Andrew Willsman, NIWA

Power lines surveyed

NIWA staff recently covered thousands of kilometres in the backblocks helping to survey a number of power transmission lines which form part of the national grid.

The survey information will enable the grid owner/operator, Transpower, to better understand and manage the effects of temperature on existing transmission lines. Lines expand and sag as they get warmer. Their temperature depends on the heating effect of the electrical current flowing through the line and on prevailing weather conditions (sunlight contributes to heating; wind contributes to cooling).

Surveying was carried out using a helicopter-mounted laser ranging instrument (LIDAR), operated by a Russian company, Opten, working through their NZ agent, Power Systems Consultants. The LIDAR accurately locates the lines, and 'line sag' can be calculated under known conditions. NIWA's involvement was to provide, deploy, and redeploy more than twenty portable meteorological monitoring stations along the transmission line as it was being surveyed, recording wind, solar radiation, and air temperature. Between 100 and 200 km of line were covered most days. NIWA also used a small balloon-borne weather station to get a vertical profile of conditions around transmission line heights. In combination, these data enable a complex meteorological model to derive the line temperature and performance characteristics for each of several hundred spans each day.



Steve Le Gal, NIWA

NIWA's Shane Rodwell downloads data from a portable meteorological monitoring station near Twizel during the power transmission line survey. Aoraki Mt Cook is in the distance.

Educating the public on coastal hazards

As a coastal researcher at NIWA, Darcel Rickard spends a fair amount of time looking at the beach. Darcel has been analysing Cam-Era images from Pāuanui and Tairua beach, looking at rip current frequency, location, and persistence. "We looked at the images from the camera, noted the rips, and then compared what we saw happening with concurrent wave data. Some of this work has ended up in educational posters on rip currents in both English and Māori."

Another aspect of our coastal work could prove to be one of New Zealand's most popular summer websites. That is the development of NZCoast – a GIS-based coastal classification and database on different coastal areas. NZCoast holds a range of information, such as erosion rates, tidal range, wave conditions, or whether the shoreline is sandy, rocky, or a sheer cliff. By identifying various environments we can help manage coastal hazards and risk and also educate the public on coastal processes and hazards.

Art Trembanis, University of Delaware

Darcel Rickard explaining the beach morphology at Ngarunui Beach, Raglan, to students from the University of Delaware, in New Zealand on a summer programme.

Kaitiakitangi blends with NIWA mission

The Waitao Stream restoration project has become a nursery for information sharing and the development of process for future projects. Ngā Pōtiki iwi wanted to restore the Rangataū arm of Tauranga Harbour, but NIWA stressed the catchment needed to be restored first.

Restoration programme leader Dr John Quinn said it was quickly realised that NIWA knowledge and systems were not easily accessed by iwi groups. That has been addressed, and NIWA has in return learned from traditional knowledge on restoration and even medicinal native plants. Tom Cooper of Ngā Pōtiki has been trained in stream monitoring and electric fishing and the project is producing regular community reports and field-days, with assistance from NZ Landcare Trust.

There have been some exciting findings, like the rediscovery of lamprey in the catchment, tools have been tested and refined, and a new catchment-scale fish diversity index developed.

"There is a mixture of Māori and Pākehā ownership, landuse, and habitat in the catchment, which includes Kaiate Falls, but gradually kaitiakitanga and Pākehā needs are coming together," John says. "Several initiatives are taking hold, and a greater feel for the environment is emerging within the demands of small-lot and commercial farming."

Other iwi are learning from the project and kaitiakitanga is seen as a very powerful vehicle that happily coincides with NIWA's mission.

John Quinn, NIWA

Tom Cooper (kaitiaki of Waitao Stream) and Dave Rowe (NIWA) demonstrating electric fishing in the lower Waitao Stream at a catchment field day.

Using Māori environmental knowledge in natural hazard management

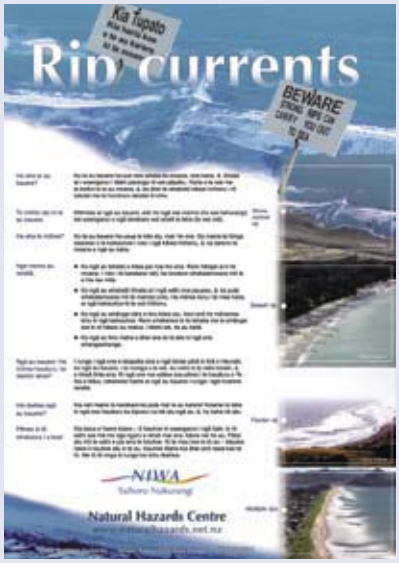
A group of Ngāi Tara went out fishing from Wai-iti, north of New Plymouth. A violent storm drove them south to Rangitoto (D'Urville) Island, where they eventually settled at Moawhitu (Greville Harbour). One version says this migration occurred in the 14th century, and that a 'wave' drowned everyone some time in the 16th century. Another version names this event Tapu-arero-utuutu – said to have drowned nearly everyone, piling the bodies into the sand dunes.

NIWA scientists have been looking at how Māori environmental knowledge can contribute to natural hazards management and mitigation. In the case of the oral recording of Ngāi Tara, there is physical evidence pointing to a tsunami at Greville sand bar. Such accounts can suggest past events warranting further investigation, help ground-truth scientific predictions, and provide supporting evidence for broad-scale models.

Oral recordings, such as histories and traditions, pose many challenges. Te Kūwaha has considerable expertise in the complementary use of Māori environmental knowledge and Western science.

This work was conducted in partnership with GNS Science and funded by the Foundation for Research, Science & Technology.

Reyn Naylor, NIWA



I whakanaotia e NIWA e rua ngā pānui i roto i te reo Māori. Ko tētehi e whakaatu ana i ētehi o ngā tohu huarere me ngā tohu āhuarangi a te Māori (nā Te Whānau-ā-Apanui rāua ko Ngāti Pare te nuinga o ngā kōrero) huri noa i te motu. Ko tērā atu he mea hei whakatūpato i te tangata e kauhoe ana i ngā tai kukume tē kitea, ā, i tukuna whānuitia atu ki ngā marae me ngā karapu whakaora kauhoe. Mena e hiahia ana koe ki te hoko tētehi kape, tuku imera mai koa ki; xxxxxxx@xxxx.xx.xx.

NIWA – working around the world

PERSGA

NIWA's Dr Graeme Inglis (centre) with biosecurity workshop delegates in Hurghada, Egypt.

Building biosecurity capacity in the Middle East

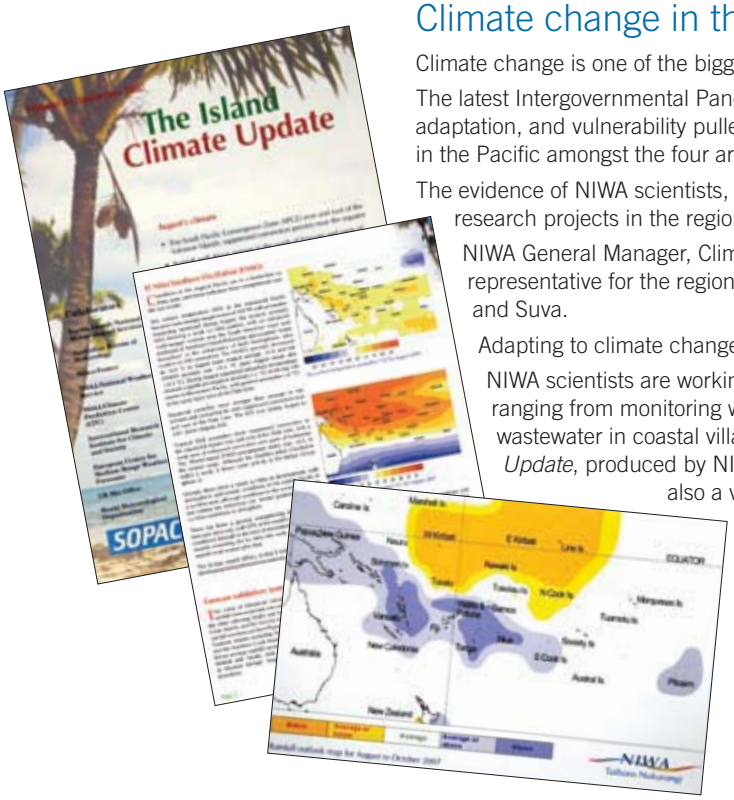
NIWA has assisted with biosecurity capacity-building in far-flung places, including Vietnam, the Seychelles, and Egypt.

Most recently, NIWA scientist Dr Graeme Inglis was invited to give a training workshop on port surveys and marine pest surveillance for Middle Eastern scientists and government representatives.

The 3-day workshop was hosted by the Red Sea Marine Emergency Mutual Aid Centre in Hurghada, Egypt, in May and was attended by 16 delegates from Egypt, Jordan, Saudi Arabia, Yemen, Sudan, and Djibouti.

Bordered by the Suez Canal and several of the world's major oil producers, the Red Sea and Gulf of Aden contain one of the busiest shipping routes in the world, amid some of its most spectacular and unique marine environments. The workshop raised awareness in the region of the spread of unwanted marine organisms by shipping, and provided theory and practical hands-on training in marine pest surveys.

Dr Inglis was invited by the International Maritime Organisation's Global Ballast Water Management Programme and the Regional Organisation for the Conservation of the Environment of the Red Sea and Gulf of Aden.



Climate change in the Pacific

Climate change is one of the biggest challenges facing Pacific Island nations.

The latest Intergovernmental Panel on Climate Change (IPCC) report on impact, adaptation, and vulnerability pulled no punches when it positioned small islands in the Pacific amongst the four areas most vulnerable to climate change.

The evidence of NIWA scientists, who have carried out various climate-related research projects in the region, contributed to the report.

NIWA General Manager, Climate Change, Dr David Wratt (IPCC bureau representative for the region) discussed the findings at forums in Rarotonga and Suva.

Adapting to climate change is a challenge for many small islands.

NIWA scientists are working with Pacific Island communities on projects ranging from monitoring water quality in the Cook Islands to treating wastewater in coastal villages in Fiji. The monthly *The Island Climate Update*, produced by NIWA in collaboration with others in the Pacific, is also a valued resource in the region.

From Mauritius to the mid Pacific

It's been described as 'a revolution in ocean observing'. The international Argo programme is creating a network of high tech floats monitoring conditions in the world's oceans.

Argo floats measure ocean currents, and profile upper ocean temperature and salinity, transmitting data via satellite for public access within hours of collection. The unprecedented level of information is starting to bring results. Argo recently helped Australian scientists discover a 'super-gyre' connecting southern hemisphere oceans, with implications for the climate and marine ecosystems.

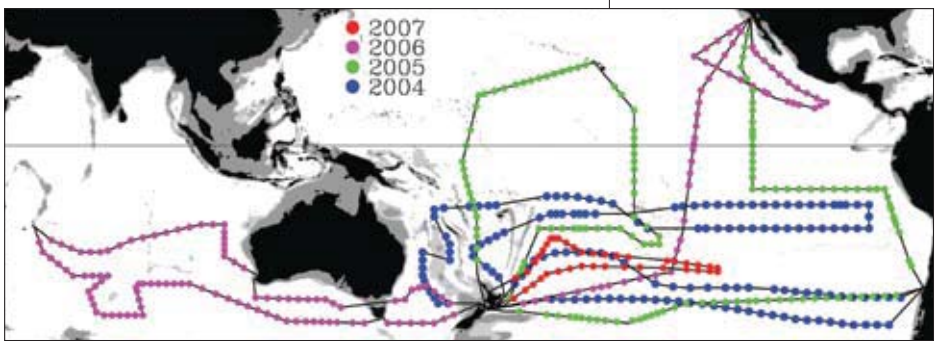
With 23 countries involved, Argo is a cumulative, global effort, but NIWA's contribution is singularly impressive. Our 28 metre research vessel *Kaharoa* holds the world record for the largest number of Argo deployments, filling in gaps in remote parts of the oceans.

This year, *Kaharoa* completed two Argo voyages. The first went south of Australia to Mauritius; the second to the mid Pacific in prolonged bad weather. Said the Second Mate: "I was just glad I wasn't the cook!"

Funding of *Kaharoa's* Argo voyages is shared between NIWA and US Argo (University of Washington and Scripps Institution of Oceanography, funded by the National Oceanic and Atmospheric Administration through the National Ocean Partnership Program).

Craig Macaulay, CSIRO

Australian Argo project leader Dr Susan Wijffels presents Captain Evan Solly with a plaque recognising Kaharoa *'s contribution to 'seeding' the oceans with more than 400 Argo floats (below).*



Managing wastewater in the Pacific

The health of Fijian villagers, and the coral reef ecosystems they depend on, is being promoted in a NIWA-led wastewater management project being carried out for NZAID in collaboration with ESR, ecoEng, and the University of the South Pacific.

Rising coastal populations, the use of flush toilets and modern water-demanding appliances, and small-scale piggeries have altered the effectiveness of traditional waste management approaches. Using ongoing research to develop sustainable natural treatment systems, overburdened septic tanks are being upgraded and effluents channelled through a communal gravel-bed wetland treatment system. Household greywaters are being treated on-site using recycled plastic drums filled with coconut husks that are buried in coarse rock seepage beds.

The NIWA workshops have merged into village life, involving residents personally in the project as they need to be able to understand and maintain the new systems. "Once proven, we hope such systems will be able to be replicated in similar situations around the Pacific," says project leader Dr Chris Tanner.

Chris Tanner, NIWA

Research vessels

Future-proofing *Tangaroa*

After 15 years of being pounded by extreme weather and sea conditions, *Tangaroa* spent over four weeks undergoing essential maintenance this year. Although repairing the damaged gearbox wasn't scheduled, it provided a timeslot for other planned work.

In mid 2005, we started a 3-year electronics replacement programme, equipping the vessel with state-of-the-art technology. This included a worldwide alarm system to be activated in event of a pirate attack, satellite receivers for weather monitoring through thick cloud cover, special heated windows on the bridge to prevent icing in Antarctica, satellite communications systems, and an Ethernet system throughout the vessel allowing worldwide web access from every cabin. Seabed sounding gear was upgraded, and new electronic bridge equipment was purchased, including an 'intelligent' radar to identify other vessels, their speed and sailing direction, to help avoid potential collisions. A new crane was installed, and electrical wiring upgraded. New audiovisual systems were installed in the conference room and lounges.

Upgraded computer software now enables data recorded onboard to be accessed by any NIWA staff member, and extends the range of onboard data collected: these include wind speed and direction, air and water temperatures, salinity of the sea surface, scientific measurements, and detailed day-to-day operating data. Onboard video coverage of critical operations is also available on the computer network.

All these upgrades are designed to future-proof the vessel and ensure it continues to provide accurate, real-time data at all times.

Alan Blacklock, NIWA

Skipper Roger Goodison (top) and Stephen Robbins (centre).

Mike Naidanovici, NIWA

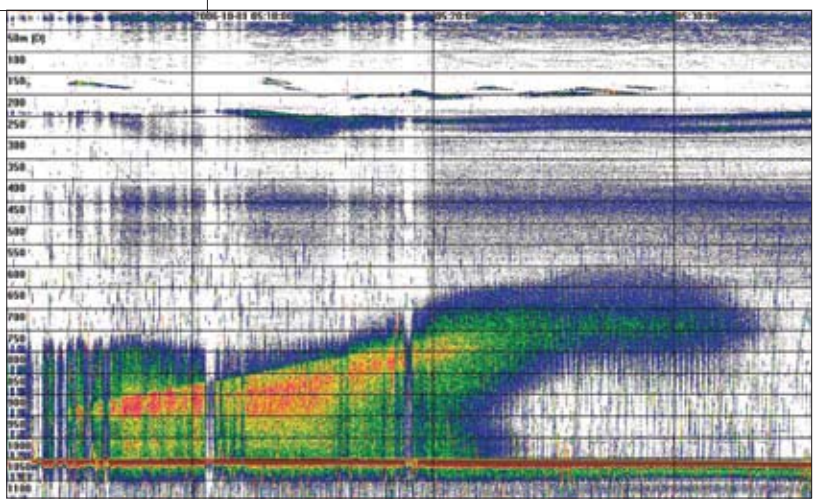
Pirates add to *Kaharoa*'s legend

Kaharoa's Argo 6 voyage to Mauritius, which left Wellington in August 2006, proved to be just a little too eventful.

The crew is used to big seas, gale-force winds, and getting by in a variety of foreign climes, but they did not expect to be boarded by pirates inside a high security naval port. The crew was bedded down for the night in Mauritius when pirates forced the doors to several external rooms, but failed to gain entry to the ship proper. A permanent guard was promptly supplied for *Kaharoa*.

Around all this, *Kaharoa* continued its work as part of the international Argo float fleet. The floats are deployed around the world and work on a 10-day cycle of descending to 1000 metres, drifting at that depth, sinking down to as much as 2000 metres, then ascending to report via satellite. On the way up they take the 'pulse of the ocean', recording salinity and water temperature.

Methane plumes arouse international interest



Tangaroa's advanced hydroacoustic sounders allowed us to record plumes of methane rising 350 metres above the seafloor off the Wairarapa coast to evaluate their effect on local chemistry and biology. "Of particular interest," says voyage leader Dr Cliff Law, "is whether the methane is diluted or oxidised in deep water, or whether it migrates to the surface in sufficient quantity to contribute to New Zealand's greenhouse gas emissions".

Methane hydrates are basically methane molecules encased in an 'ice cage', and are found deep within continental slopes all over the world. They release methane, which rises to the seafloor, bringing with it material that supports geological formations, such as carbonate chimneys, and localised ecosystems with unique life forms.

Methane hydrates are of interest for their potential as a fuel source and for their role in continental slope stability. In addition to NIWA's 2-year monitoring programme, funded by the Foundation for Research, Science & Technology, NZ EEZ seeps have also attracted international interest, forming the basis for collaborative voyages with American and German researchers.

NIWA Research Vessels

RV *Tangaroa*

Tangaroa is New Zealand's premiere research and survey vessel, equipped for hydrographic, bathymetric, oceanographic, and biological surveys, and both trawl and acoustic fisheries surveys. *Tangaroa* has an ice-strengthened hull, enabling it to operate in Antarctic waters.

RV *Kaharoa*

Kaharoa is primarily a coastal and inshore vessel with hydrographic, bathymetric, oceanographic, biological, and fisheries survey capacities, but over recent years has deployed Argo floats across the Pacific to North and South America, South Africa, and Hawaii.

Pelorus

Pelorus is a purpose-built rugged science support and hydrographic survey launch, which has been fitted out to operate in Antarctic conditions. It can be carried on and launched from *Tangaroa*.

Type:	Deepwater research vessel	Coastal research vessel	Survey launch
Year built:	1991 (Mjellem & Karlsen Verf, Norway)	1981	1977 (fully refitted 2000)
Owner:	NIWA Vessel Management	NIWA Vessel Management	NIWA Vessel Management
Length:	70.0 m	28.0 m	10.5 m
Beam:	13.8 m	8.2 m	3.0 m
Draft:	7.2 m	3.2 m	1.0 m
Hull:	Ice-strengthened		
Cruising speed:	10.5 knots	9.5 knots	9.0 knots
Endurance:	60 days	30 days	
Crew:	14	5	
Accommodation:	30 scientific staff	6 scientific staff	
Miles steamed:	c. 980 000 nautical miles	c. 530 000 nautical miles	

Capability funding

Capability funding is provided to Crown Research Institutes (CRIs) through the Ministry of Research, Science & Technology to support and enhance long-term research capability. Each CRI's capability funding is based on its proportion of the total government research investment. In 2006–07, NIWA received $9.09 million (excluding GST) in capability funding and used it to support over 147 scientific projects.

	$'000 (excl GST)	Percentage
Support core skill bases that are at or below critical mass	352	4
Advance new areas of science and innovation	3,745	41
Increase the transfer of science to end-users	1,141	13
Build future research capacity in areas of high national need	2,045	22
Bridge the gap between research and commercialisation of new products	1,811	20

Better paua culture

Paua is one of the new high value New Zealand aquaculture species NIWA is developing to help build a billion dollar industry. We have used capability funding to investigate a range of key water quality and husbandry issues and improve the performance of paua culture systems.

Carbon dioxide build-up in recirculation systems is a problem because it makes the water more acid, eroding paua shells. We measured and modelled various degassing techniques in order to design systems that will meet the very high water quality demands of paua.

Plentiful supplies of cheap seed are essential to support the paua industry. To maximise production of seed, NIWA scientists isolated a range of naturally-occurring algae to provide a settlement surface and first feed for paua. The new algae provided higher settlement and growth rates of paua larvae than algae previously used by the industry. We've also made significant improvements in growth and feed consumption of young paua by defining and applying appropriate rearing regimes.

Selective breeding offers significant potential for improving growth rates and product quality in paua. We have developed a selective breeding strategy for paua that will provide industry with a higher performing stock.

Alan Blacklock, NIWA

Jordy Hendrikx, NIWA

The NIWA snow model

Capability funding is helping NIWA develop the first physically realistic snow model for New Zealand.

The model will improve our predictions of stream flow in snowmelt-dominated basins – especially important for irrigation and hydro-power. It will also provide more detail on how climate change could affect water resources.

New Zealand has unusual snow conditions, with a maritime rather than continental climate. So, for example, a typical overseas snow model works adequately by assuming that temperature drives snowmelt, but here weather patterns like northwest storms are also important. This year we used capability funding to bring snow expert Dr Andrew Slater of the University of Colarado to New Zealand. Dr Slater worked with NIWA to develop an 'energy balance' approach which simulates the snowmelt processes in New Zealand.

The NIWA snow model is now being tested for two New Zealand basins (Camp Stream in the Craigieburn Range, and the Jollie Basin near Aoraki Mt Cook).

Additional funding came from the Foundation for Research, Science & Technology, NOAA, and NASA.

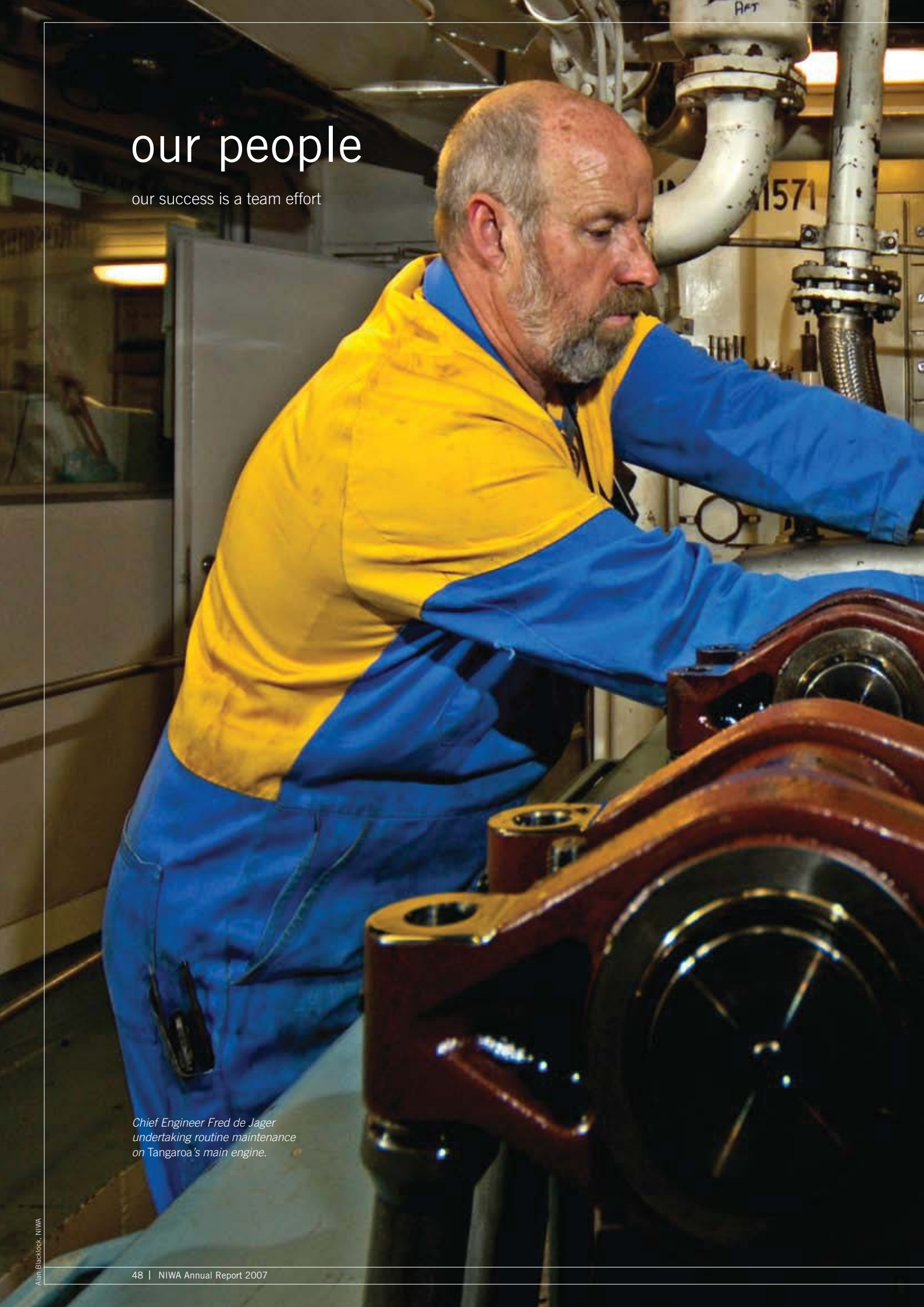
Hayden McDermott and Martyn Clark making snow measurements in Pinnacle Stream in the Upper Jollie River basin.

Capabilities maintained, enhanced, or developed with Capability Fund in 2006–07 include:

Areas of nationally recognised expertise	Forecast	Achievements
Sustainability of freshwater environments & resources	■ maintain national capabilities in lake and wastewater sciences ■ support seven postdoctoral fellows in key areas of increasing stakeholder need (water allocation, water-borne pathogens, contaminant modelling) ■ further develop freshwater modelling capabilities and user-friendly decision support systems ■ develop new tools for real-time environmental data capture, transfer, and forecasting systems	■ research on development of lake processes models and faecal contamination of streams ■ postdoctoral fellows supported to study catchment modelling, nutrient processing, snow and ice dynamics, effects of irrigation, aquatic communities of river floodplains, freshwater fisheries, and water extraction ■ research on development of next generation sediment and solute transport models ■ projects initiated to develop new flow metering and environmental monitoring instrumentation
Sustainability of nearshore marine environments & resources	■ maintain critical mass in key areas of coastal hydrodynamics and nearshore ecology through support of two postdoctoral staff ■ strengthen understanding of interactions between coastal aquaculture and land-derived contamination ■ develop shellfish rehabilitation techniques	■ postdoctoral fellows supported to improve coastal hydrodynamic models and study human impacts on rocky reef communities ■ researched microbial contamination of shellfish in relation to water quality for harvest criteria ■ determined the effectiveness of estuarine remediation measures
Sustainability of oceanic environments & resources	■ support cross-agency initiative for Ocean Survey 20/20 to proceed and inform ocean policy ■ maintain national capability in ocean geology ■ maintain strong links with international science programmes in ocean ecosystem and biogeochemical research	■ co-funded with government agencies Ocean Survey 20/20 voyage to the Challenger Plateau ■ identified earthquake sources in submarine fault zones, and quantified geomorphic processes along the active continental margin ■ supported the IMBER (Integrated Marine Biogeochemistry & Ecosystems Research) programme
Fisheries	■ strengthen capability in key areas of demand, especially fisheries population modelling and ecological impacts modelling ■ re-develop our software systems for gathering, storing, and interrogating our fisheries data ■ develop training courses to enable stakeholders to better participate in fishery management and research planning	■ analysed population dynamics of toheroa and reviewed techniques for studying fish behaviour ■ software enhanced for catch/effort and trawl survey age/length data acquisition, storage, and processing, including CASAL model modules ■ held industry workshops and participated in research planning meetings of the Ministry of Fisheries
Māori development	■ promote value of new web-based tools for resource management and new species aquaculture opportunities relevant to Māori ■ strengthen capability of staff to interact effectively with Māori ■ enhance capability of Māori staff by supporting visiting experts in the use of traditional knowledge ■ enhance capability in assessing customary fisheries resources and kaimoana	■ promoted web-based eel support tool for customary fisheries management ■ staff participated in four noho marae ■ hosted management experts from the Hawaiian Papahānaumokuākea Marine National Monument ■ reviewed the utility of a kaimoana monitoring kit and ran a national customary fisheries workshop
Mitigating human impacts on the atmosphere	■ develop novel technologies to quantify and source greenhouse gas emissions ■ support a postdoctoral fellow to attain critical mass in atmospheric chemistry and modelling ■ re-build capability in air quality modelling and real-time display	■ evaluated new technologies for validating farm-scale greenhouse gas emissions ■ supported postdoctoral fellow to model the role of atmospheric chemistry in climate change ■ mobile vehicle-mounted particulate monitors evaluated
Natural hazards	■ strengthen capabilities in coastal hazard modelling and risk assessment ■ strengthen capability in the use of satellite remote sensed data and the supply of near real-time products	■ enhanced the RiCOM model for real-time sea state forecasting ■ new X-band reception facility implemented for receiving satellite remote sensed data for atmospheric and marine environments
Climate variability & change	■ enhance capability in assessing climate extremes ■ build short-term climate outlooks and create new products with strong user orientation ■ produce monthly climate summaries and outlooks and disseminate via television, radio, internet, public presentations, and *The Climate Update*	■ recruited expertise to research extreme climate events and quantify extreme occurrences in regional climate model outputs ■ new Climate Explorer products developed and promoted ■ monthly climate summaries and outlooks disseminated in over 100 media interactions, publications, and presentations
Aquaculture & natural products	■ develop commercial-scale trials on a new species with partners ■ recruit new staff to enhance capability in added-value product development ■ conduct proof-of-concept studies on an added-value product opportunity	■ improved the efficiency and volume of large-scale kingfish fingerling rearing from eggs ■ recruited postdoctoral fellow to research aqua-feed additives and feed products ■ proof-of-concept study conducted for a novel probiotic for finfish disease control
Aquatic biodiversity & biosecurity	■ maintain core skills in marine and freshwater taxonomy and freshwater biosecurity ■ increase staff skills in taxonomy through training courses ■ build capability associated with predicting future biodiversity and bio-incursion spread	■ completed studies on freshwater fish biosystematics and biogeography ■ four staff trained offshore in invertebrate parataxonomy (amphipods, echinoids, algae, asteroids) ■ study initiated on ecological methods for the control of *Didymosphenia geminata*

our people

our success is a team effort



Chief Engineer Fred de Jager undertaking routine maintenance on Tangaroa*'s main engine.*

Alan Blacklock, NIWA

in the following pages we celebrate some of the achievements a few of our staff made during 2006–07

Executive Management Team

leading our NIWA-wide strategy and performance

Sasha Blair, Rob Murdoch, Geoff Baird, Kate Thomson, Mark James, John Morgan, Arian de Wit, Bryce Cooper.

John Morgan
Chief Executive Officer
John took up his position as CEO of NIWA on 1 May 2007. He had been CEO of AgriQuality for seven years, presiding over a sustained period of profitability for the company, and guiding it to the position of a world leader in the provision of science-based food safety and biosecurity services. Before that, John was Executive Director and General Manager of ICI Chemicals in New Zealand for ten years, and led that organisation to number one in its market.

Bryce Cooper
Director, Strategic Development
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 is currently responsible for overseeing NIWA's strategic initiatives, including commercialisation of research and building partnerships with central and local government and industry.

Mark James
Director, Operations
Mark completed his PhD in aquatic ecology at the University of Otago, and spent more than 20 years as a scientist specialising in lake and coastal ecology research and consulting. In 2000 he moved from Christchurch to Hamilton to take up the position of Regional Manager, NIWA, Hamilton, and he was appointed as NIWA's Director of Operations in September 2002.

Rob Murdoch
Director, Research
Rob has a PhD in marine science from the University of Otago and has specialist interests in oceanography and marine ecology. He is responsible for managing NIWA's relationship with the Foundation for Research, Science & Technology, and has overseen the planning and direction of NIWA's science and NIWA Vessel Management Ltd since 1999.

Kate Thomson
Chief Financial Officer & Company Secretary
Kate is a chartered accountant with a BCom from the University of Canterbury. An experienced Chief Financial Officer, she held similar roles with Learning Media and in the private sector before joining NIWA in 2006. Kate was previously a policy analyst with the Treasury.

Geoff Baird
General Manager, Communications & Marketing
Geoff has a BSc (Hons) in ecology from Victoria University of Wellington. He has more than 20 years' experience in science publishing and communication, initially with the Ministry of Agriculture & Fisheries and later with NIWA. He managed the science communication team in NIWA before taking on the role of Communications Manager in 2003 and being appointed General Manager, Communications & Marketing in July 2007.

Sasha Blair
General Manager, Human Resources
Sasha has an MSc in Earth Science from the University of Waikato and a Graduate Diploma of Business in Human Resource Management. She joined NIWA in 2002 as an HR Advisor, and was appointed as HR Manager in 2006 and as General Manager, Human Resources in July 2007.

Arian de Wit
General Manager, Information Systems
Arian has an MSc in software engineering from the University of Waikato and holds a number of IT industry certifications. With a background in system and network design as well as technical writing, Arian works to ensure that our strategy for development of IT infrastructure, software, websites, and databases aligns with NIWA's overall strategic direction.

Science Executive Team

leading our science

Barry Biggs, John McKoy, Research Director Rob Murdoch, Murray Poulter, Strategic Development Director Bryce Cooper, Don Robertson, Andrew Forsythe, Nick Bain, Clive Howard-Williams, Charlotte Severne, David Wratt, inset Fred Smits.

Nicholas Bain
General Manager, Commercialisation
Nicholas holds an LLB from the University of Auckland and is enrolled as a barrister and solicitor of the High Court of New Zealand. He had an 8 year commercial law career with Bell Gully and a London law firm before turning to investment banking in the early 1990s, specialising in structured finance. He returned to New Zealand in 1997 after 11 years away and has run his own video production company as well as a 3-year stint in the Department of Prime Minister and Cabinet as an industry advisor. He joined NIWA in 2004 to establish and manage its commercialisation activities.

Barry Biggs
General Manager, Environmental Information & International
Barry is an environmental scientist with a PhD from the University of Canterbury. He worked in environmental science management with the Ministry of Works & Development in Wellington and the DSIR in Christchurch before joining NIWA in 1992, specialising in the effects of hydropower development on river ecosystems, water allocation, stream periphyton, and bioinvasions.

Andrew Forsythe
General Manager, Aquaculture & Biotechnology
Andrew Forsythe is a veterinarian with a BSc in marine biology from the University of New Brunswick and a DVM from the University of Prince Edward Island. Andrew came to NIWA in 2005 as Regional Manager Aquaculture Facilities with more than 20 years of aquaculture industry experience from North America and Europe.

Clive Howard-Williams
General Manager, Freshwater & Coasts
Clive is an aquatic ecologist with a PhD from the University of London. He was a research scientist at the Max Planck Institute for Limnology, has specialised in research on water quality, water plants, and wetlands, and has a wide interest in freshwater degradation and change and in Antarctica. 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.

John McKoy
General Manager, Fisheries
John is a marine zoologist with a PhD from Victoria University of Wellington. He has contributed in a range of roles to fisheries research in New Zealand since 1973, in MAF, MAF Fisheries, and, since 1995, NIWA. He has worked in crustacean and molluscan aquaculture, fisheries biology, and resource management in New Zealand, Australia, the Middle East, and the Pacific.

Murray Poulter
General Manager, Atmosphere, Natural Hazards, & Energy
Murray has a PhD from the University of Canterbury and worked in England and Germany on wave propagation in the atmosphere and space. He returned to New Zealand where he applied radar methods to determine the role of ocean waves in coastal and air-sea interaction processes, working in New Zealand, Canada, the USA, and Antarctica, before taking on a management role in NIWA.

Don Robertson
General Manager, Aquatic Biodiversity & Biosecurity
Don holds a PhD in marine biology from the University of Otago and has a background in marine biological research, including deepwater fisheries around New Zealand, and Antarctic marine resource management. He has had roles in marine science leadership, NIWA regional management, and information services in MAF Fisheries and NIWA. More recently, Don took on the lead role for NIWA's marine and freshwater biodiversity and biosecurity research and services. He also has a role as New Zealand's representative on the Governing Board of the Global Biodiversity Information Facility.

Charlotte Severne
General Manager, Māori Development & Oceans
Tēnei te mihi mahana o NIWA ki ngā iwi huri noa i te motu. Ko Charlotte Severne tōku ingoa. Ko ahau tētahi o ngā uri o Tūwharetoa me Tūhoe Pōtiki. Heoi anō he Tumu Whakarae ahau mō ngā tūranga e rua, arā, tētahi mō te roopu rangahau Māori, e kiia nei ko Te Kū waha, ā, ko tētahi atu mō te takutai me te moana. Ko te tino kaupapa o Te Kūwaha he mahi rangahau pūtaiao hei tautoko i ngā tūmanako, wawata o te iwi Māori. I whiwhingia e au tōku Tohu Kairangi mai i Te Wānanga-o-Tāmaki Makaurau. Ko taku kaupapa matua te rangahau i ngā tātaitanga mō ngā puia o Tokaanu me Waihī. I mua i taku taenga mai ki NIWA i te MfE ahau e mahi ana.

Fred Smits
General Manager, Operations, NIWA Vessel Management Ltd
Fred is a geotechnical engineer with an ME from the University of Auckland as well as two engineering degrees from his home country Holland. Before moving to New Zealand in 1985 he worked in many countries as a contracts' manager for major onshore and offshore civil engineering projects. Fred joined NIWA in 1994 as marine business development manager, and has been in charge of NIWA's research vessels *Tangaroa* and *Kaharoa* since 2004.

David Wratt
General Manager, Climate Change
David has a PhD in Atmospheric Physics from the University of Canterbury. He has worked in the USA and New Zealand on a range of applied topics in meteorology and climate, including air quality, mountain meteorology, and climate change. He is a Companion of the Royal Society of New Zealand, Chair of the Royal Society's New Zealand Climate Committee, and a member of the Bureau of the Intergovernmental Panel on Climate Change.

Regional Management Team

leading our operations

David Roper, Graham Fenwick, Charles Pearson, Terry Hume, Rosie Hurst, Ken Becker, Ken Grange, Andrew Laing, Operations Director Mark James.

Auckland: Ken Becker
Ken is a marine biologist with a BSc (Hons) from the University of Liverpool and a postgraduate diploma in professional ethics from the University of Auckland. He spent 24 years as a scientist and project manager with Auckland Regional Council, working on marine ecology, water quality, wastewater treatment and disposal, stormwater management, and water resource management.

Christchurch & Lauder: Charles Pearson
Charles is a hydrologist with an MSc (Hons) from the National University of Ireland. He specialises in the analysis of hydrological and other geophysical and climate data for purposes such as estimating flood risks. He is an executive member of NZ's Hydrological and Meteorological Societies and is the World Meteorological Organization's Hydrological Advisor for its Asia-Pacific region.

Christchurch: Graham Fenwick
Assistant RM
Graham is an ecologist and crustacean systematist with 30 years' research and consulting experience on the biodiversity and ecologies of shallow coastal and groundwater ecosystems. He has a PhD and Dip. BA from the University of Canterbury, and joined the Regional Management Team in 2006.

Hamilton: David Roper
David has a PhD in marine science from the University of Otago. He has worked as an environmental scientist for the past 28 years, specialising in environmental impact assessment and resource management with NIWA and then ECNZ (later Mighty River Power), before returning to NIWA as Regional Manager in 2002.

Hamilton: Terry Hume
Assistant RM
Terry is a marine geologist/coastal oceanographer with a PhD in earth sciences from the University of Waikato. He holds an Honorary Associate Professorship at the University of Auckland and an Honorary Lectureship at the University of Waikato. He has more than 30 years' experience in environmental research and consulting for government departments, local authorities, and private companies.

Nelson: Ken Grange
Ken is a marine ecologist with a PhD in marine ecology from Florida International University. He initially researched the marine environment in NZ fiords, particularly the ecology of black corals, with the Oceanographic Institute, DSIR, in Wellington, before moving to Nelson as Regional Manager in 1994.

Wellington: Andrew Laing
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 Meteorological Service of New Zealand, in the UK, and at NIWA, before becoming a Regional Manager in 2000.

Wellington: Rosemary Hurst
Rosie is a fisheries scientist with a PhD from Victoria University of Wellington. She worked for MAF Fisheries from 1979 before joining NIWA in 1995, becoming a Regional Manager in 2000. She is also the science leader for hoki and middle depth fisheries research.

Staff highlights

Helping control didymo

Finding a potential control tool for didymo has been an exciting and satisfying challenge for **Dr Sue Clearwater**, project leader for the control study. The team has found a copper-based compound that can control early stage infestations of didymo.

"The cooperation between NIWA staff and other organisations has been immensely satisfying. And the depth and breadth knowledge in this organisation is amazing," she says.

Didymo became a high profile invasive pest because it forms extensive and ugly algal mats, and many interest groups are pushing hard for a solution to its invasion. Sue says New Zealand is now a world leader in didymo control.

Talk about the weather

Climatologist **Stuart Burgess** has a wealth of climate information at his fingertips, in the form of NIWA's national climate database.

Each month, Stuart uses the data to produce the national climate report (a hit with the media), detailing the recent climate (wetter, drier, sunnier, colder than normal) and major weather events.

With years in the job, Stuart is adept at analysing climate information, producing client reports on potential hazards, such as floods and tornadoes, and appearing as an expert witness in court cases.

One of the biggest challenges? "Keeping up with the weather – hardly a month goes by without heavy rain or damaging winds."

The best of both worlds

Marty Flanagan has the best of both worlds – maintaining near real-time telemetry networks from the office and getting out into the backblocks, with the Christchurch field team, servicing hydrometric equipment from Rakaia to Kaikoura and Craigieburn to the Chathams. The team also run large commercial hydrometric networks for the Christchurch City Council and irrigation companies.

"You have to be good at a lot of things, not just the science. You need practical abilities and technical knowledge to work in marine, freshwater, and alpine environments with the various technologies we use." And he can now add the Pacific to that list because he'll be part of a team installing a flood warning system in Fiji over the next few months.

"I just love the variety," he says.

Breaking the ice

The year's highlight for NIWA's dive training and safety officer, **Steve Mercer**, was a 10-day polar diving workshop at a Norwegian research station (next stop, the North Pole).

The ice was broken with a few dives and a review of safety and training standards. Despite diving's high-risk reputation, the biggest concern was the local polar bear, who pitched up on the first evening (and fortunately left without mishap).

NIWA has about 70 diving staff. Safety standards are high, and despite an average of 3000 freshwater and marine dives a year (from Antarctica to the Spirit Islands, Northland), the incident rate is very low.

Steve also dives with the paua assessment team off Fiordland and Stewart Island.

Managing the payroll

As the payroll manager for NIWA, **Shareen Sharma-Prasad**, is responsible for ensuring 730 scientists, technicians, crew members, and other staff are paid accurately and on time.

The biggest challenge is working with staff who spend as much time in the field or at sea as at their desks. This means taking account of things like seagoing rates and overtime allowances as well as being on top of the terms and conditions of the various unions covered at NIWA.

"It's a very demanding role, with non-flexible deadlines, which keeps me very busy, but it does have a lot of variety," says Shareen.

Staff highlights

Hydrology for hydroelectricity

Barry Waugh's expertise in hydroelectricity industry hydrology is being used in three new hydro development projects in the Philippines. A foundation member of NIWA, he provides hydrology services for several hydroelectricity companies in the central North Island.

"Having worked in hydrology in New Zealand for 37 years, now helping to shape the future of hydrology in the Philippines is very rewarding," says Barry. The Philippines has many small schemes, as opposed to New Zealand's fewer larger schemes, and presents very different challenges in terms of the need to provide not only energy, but also water supply and irrigation systems.

So, what do you *really* mean?

"It's fascinating the way the world works", says NIWA science journalist **Michele Hollis**. "In this job I can tap into answers to questions like 'why does that happen?' 'how do you know that?', or 'what if?', and I can pass that knowledge on."

Her day is spent writing and distributing media releases, newsletters, and reports about what's happening at NIWA, as well as organising media interviews with scientists. "I tell them we're striving for clarity and humanity, not excess simplicity."

Michele's highlight of the year: "publicising the Intergovernmental Panel on Climate Change reports."

Blending science with commerce

Hydrodynamic modellers **Drs Emily Lane** and **David Plew** are blending science and commerce using the RiCOM model to work on a wide range of scenarios that have the potential to save a lot of money and lives.

A specialist modeller, Emily is working with local bodies on predicting tsunami inundation, which will help with forecasting economic effects as well as potentially saving lives. David is looking at offshore tidal power generation possibilities for New Zealand power companies. He is also working on assessing the impacts of aquaculture structures on tidal flows, and on a range of more experimentally-based research projects.

"Our work uses science to solve practical problems," says David.

Sashimi, with a little soy

Dr Peter Lee's job ranges from ironing out hatchery problems facing groper to judging the best entries in the latest NIWA science and technology fair.

As science leader at NIWA's Bream Bay Aquaculture Park, Peter works with the aquaculture team developing strategic research and commercial plans, new research programmes, and supervising postgraduate students. He also works closely with Te Kūwaha to bring aquaculture to Māori.

His biggest project aims to commercialise new aquaculture species. Kingfish have thrived, while groper, kina, lobsters, and eels are still poised to grow. "The potential for aquaculture in New Zealand is huge", says Peter, "with a great coastline, climate, and water conditions."

His recommendation for kingfish: "Serve as sashimi, with a little soy and wasabi. Fantastic."

Modelling in Antarctica

"The best science enables fisheries managers to make well-informed decisions", says fisheries modeller, **Alistair Dunn**. His work on the Ross Sea Antarctic toothfish, which has become a popular target for fishers in recent years, is a case in point.

Using observations from catch, effort, and tagging, Alistair developed a new integrated population model for the toothfish.

The model has been so successful that the Commission for the Conservation of Marine Antarctic Living Resources has adopted it to set sustainable catch levels for both the Antarctic toothfish and its neighbour, the Patagonian toothfish.

When not working on toothfish, Alistair puts his modelling skills to use on species such as hake, Bluff oysters, and longfin eels.

Forecasting floods

Dr Martyn Clark regards his key innovative contribution to NIWA as the development of the flood forecasting methods used in NIWA's EcoConnect environmental forecasting system.

"Our flood forecasting methods are among the most advanced worldwide, but we're dreaming if we expect to get the forecast exactly right all of the time. We must be honest about our uncertainties, and provide forecasts of the probability (or chance) that a river will rise above critical levels, providing early warning for emergency managers and opportunities to protect lives and property."

Martyn is one of the key scientists involved in an international effort to quantify and reduce uncertainties in hydrological predictions.

Working with industry

Keith Michael's expertise is in shellfish, from the iconic Bluff oyster to the latest delicacy, the surf clam.

As a fisheries scientist with 30 years' experience, Keith says that these times are exciting. Scientists are working across disciplines to build holistic views of the marine world and are engaging more successfully with industry about science and its value.

The 140-year old oyster and fledgling surf clam fisheries are good examples of collaboration, with NIWA scientists and industry working on research projects designed to ensure the ongoing sustainability of the shellfish stocks and minimise damage to their environment.

For Keith, it's meant a lot of meetings and time on the oyster boats working with the fishers.

Illustrating science

For graphic designer **Erika Mackay** it's all in a day's work, but the range of her output is astounding.

Erika produces conference posters, flyers, report figures, banners, and presentations for NIWA scientists in the Wellington region.

There's a strong science bent to her career; she spent five years at Te Papa (where she produced 450 hand-drawings of fish) before joining NIWA in 2001. These days, Erika is extending her skills by moving into multimedia and animation. We hope she'll keep producing those beautiful Antarctic posters as well.

Using cameras instead of observers

George Payne has found a way around thousands of hours of often cold and damp field observation. To achieve his innovative Cam-Era system for monitoring beach environments, George has adapted high speed, high resolution digital cameras to a form of time-lapse photography that reports electronically.

This allows evaluation of the effect of normal and storm waves on any beach, determination of what is happening to the neighbouring sea floor, and construction of a relief map of the tidal area by averaging wave movement at set periods.

To date, Cam-Era has been installed at Lowestoft, UK, and near Bordeaux in France, as well as several New Zealand locations. Environmental monitoring is the main application at present.

From snowmelt to stormwater

Innovative stormwater management in urban environments is already having an impact on reducing stormwater flows, and modeller **Dr Annette Semadeni-Davies** is keen to ensure this work is taken into account when she is assessing the potential impact of future climate change.

Traditional underground urban stormwater systems may not cope with the predicted increased rainfall. But trends here and overseas are towards open-water systems, such as plantings, ponds, and wetlands, which may reduce flood risk while improving water quality.

She is currently working on a GIS urban sediment and containment load model with colleagues in Auckland and Hamilton.

She returned to New Zealand after 12 years in Sweden, where her work on urban snowmelt was internationally recognised.

Staff highlights

Helping save lives

Dr Michael Uddstrom leads a team of more than 25 scientists, IT staff, and international collaborators who are creating an integrated, all-hazards forecasting system which can predict where serious hazards – such as high waves, coastal inundation, river floods, and tornadoes – are expected, up to 48 hours in advance.

The unique system uses NIWA's supercomputer to process a vast array of real-time data from sources including satellites, weather balloons, and ships.

The seven-year project has been absorbing, says Michael, with collaborators often sharing information well into the late hours.

Making a difference

Bruce Hartill has spent a lot of time in small planes in recent years, estimating the nature and extent of the recreational fishing harvest and its consequent impact on the marine environment. It's an extensive and under-researched issue, but one which is central to the sustainable management of inshore fisheries.

There is wide interest in the work; partly because of ongoing debate about the allocation of inshore fisheries between commercial and non-commercial interests, and partly because it is hard to assess the state of these resources when a large part of the harvest is unknown.

Bruce gets much satisfaction from tackling such an important question and from the fact that NIWA's work does really make a difference.

Keeping staff safe

Keeping NIWA's staff safe at all times, given their huge variety of activities, locations, sites, and occupations, is **Jenny White**'s challenge – in offices, tramping on the mountains in snow, driving over very rugged terrain, collecting samples from fast-flowing rivers.

Jenny takes an active interest in safety by working to ensure all staff have the right training and skills to work efficiently and safely, according to NIWA's established guidelines, and that everyone's safety is monitored through procedures such as set reporting times for field staff when they are in the field. Jenny is justifiably proud of her role in ensuring that NIWA maintains an outstanding safety record.

From mudflats to seamounts

Swapping intertidal mudflats in Scotland for the marine life on seamounts in some of the world's deepest waters doesn't phase NIWA scientist **Dr Mireille Consalvey**.

She moved to Wellington from St Andrews two years ago, to coordinate the research of 16 scientists from 11 countries for the Census of Marine Life seamounts project, CenSeam.

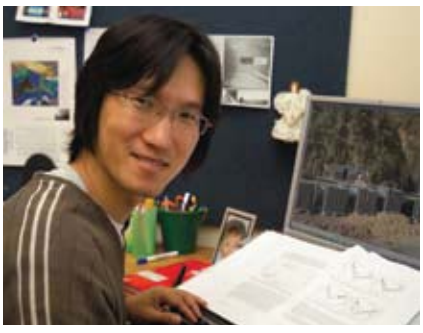
One of the highlights is going to sea. "It's a real privilege. Amazing to see parts of the seafloor which have never been seen by humans before."

Although apolitical, the CenSeam reports are already feeding into international negotiations on issues such as bottom trawling on the high seas.

Potential solution to rural effluent

The continuing debate over dairy effluent may be defused by environmental engineering being carried out by **Jason Park** and colleagues here and in his homeland, Korea. A joint project on high grade wastewater systems for urban areas will hopefully be able to be scaled down and the technology used at farm level.

GNS Science, the University of Auckland, NIWA, and their Korean counterparts are working on optimising and converting a high tech Korean wastewater treatment system to New Zealand conditions. The up-flow multilayer bioreactor is about 25% more efficient than traditional systems.



Using scents to lure fish

Being a fish pheromone expert might cause sideways looks at a barbecue, but **Dr Cindy Baker**'s work is essential for the preservation of endangered species and the control of exotics. Establishing the right scent to lure exotic freshwater pests to a kill zone will hopefully help control the predatory European perch which is decimating native populations of several species.

Cindy is also establishing, through water samples, which streams have signature migration cues, and hopes to use the same pheromones to attract rare native species to other suitable breeding waters.

It's practical, satisfying, and quantifiable science, she says, with the potential to make a significant difference to New Zealand's environment.

How long will it take for that reservoir to fill ... with sediment?

The geomorphic behaviour of rivers and coastlines sounds a bit abstract, but it has direct impact on society and commerce. **Dr Murray Hicks** predicts the long-term effects of dams and water-storage schemes, addressing questions such as "How long will it take a reservoir to fill with sediment?" and "How much erosion will occur in the riverbed and along the coast downstream of a dam?"

His current big project is the $1 billion North Bank Tunnel for the Lower Waitaki, Meridian's next big hydrogeneration proposal. The demand for river water to irrigate dry areas like Canterbury will have Murray forecasting effects for many years to come.

Ka pūwaha te tai nei, hoea tahi tātou

Helping NIWA develop and maintain successful collaborative partnerships with iwi, hapū, and Māori organisations is a core responsibility of Te Kūwaha, NIWA's Māori research and development team. Group manager, **Erica Williams** (Te Arawa, Ngāti Whakaue, Ngāti Pikiao, Te Whānau a Apanui) says it's all about delivering science excellence for the benefit of Māori.

"One of our key focuses is to improve the communication of NIWA science to Māori, as well as increasing the capability of the wider NIWA staff to interact effectively with our Māori partners, but top of my list this year has been finishing my PhD on the effects of polycyclic aromatic hydrocarbons on hanikura (*Macomona liliana*)*", says Erica.*

Taking stock to determine the future

Marine scientist **Dr Alison MacDiarmid** is leading a team of 25 scientists from 11 institutions in a bid to track 1000 years of climatic change and human impact on New Zealand's marine ecosystem.

"The 3-year 'Taking Stock' project, launched last year, aims to put a historic perspective on where our marine ecosystem is now so we can better plan its future," says Alison.

The team is gleaning information from archaeological, historical, biological, climatic, and geological records. These clues will be pieced together into five snapshots (computer models) depicting the marine ecosystem in 1000AD (before human intervention), 1450, 1790, 1945, and the present day.

Calling on Mr Supercomputer

Chris Edsall's supercomputer skills can help transform reams of data into top class weather and environmental forecasts, as well as projections for climate change.

Chris oversees the running of NIWA's Cray T3E supercomputer. It's unique in New Zealand, takes up a small room and has the computing power of 500 personal computers cabled together. "It's the interconnections rather than the megahertz which count", says Chris.

The supercomputer takes less than one hour to transform high-resolution satellite, radar, aircraft, and other data into a 36-hour forecast.

"But its size and uniqueness has its challenges; you can't practise on your computer at home, and it sure generates a lot of heat," says Chris.

Special congratulations to emeritus NIWA scientist **Dr Janet Grieve**, who was appointed an Officer of the New Zealand Order of Merit in this year's Queen's Birthday Honours for services to marine science. Janet is New Zealand's foremost authority on marine copepods (small crustaceans). She has devoted her career to studying copepod diversity, ecology, and life history, and investigating the biological and physical processes that drive ocean productivity.

Education & training

NIWA contributes significantly to the promotion of science in our schools, universities, and with the public.

Alan Blacklock, NIWA

Sir Peter Blake Trust Executive Director Mark Orams with Papatoetoe High School students on Kaharoa.

In 2006–07 we relaunched the **Sea & Learn** programme, in collaboration with the Sir Peter Blake Trust. Sea & Learn is a 'hands-on' shipboard education programme for senior high school students. In March 2007 we had more than 150 students and 15 teachers from Taihape to the Bay of Islands involved in the programme on *Kaharoa*.

We also continued with our substantial sponsorship of the **Regional Science & Technology Fairs** to promote science in intermediate and secondary schools. We are major sponsors of the Auckland City, Waikato, Bay of Plenty, Wellington, and Nelson regional fairs, and we provide prizes for five other regional science fairs.

Alan Blacklock, NIWA

Prize Winner Jessica Bird of Tawa College with NIWA Regional Manager Andrew Laing.

For younger students, we sponsor the **NIWA Interactive Room** at Kelly Tarlton's Underwater World, which provides hands-on activities for primary school students. We also provide scientific information and display material for special exhibits at Kelly Tarlton's.

We also contribute to the scientific knowledge and skills of teachers by hosting recipients of the **New Zealand Science, Mathematics, & Technology Fellowships**. This year we hosted three fellows investigating stream ecology, shark genetics, and the impacts of increasing atmospheric carbon dioxide on the ocean.

Our strong relationship with universities continues, particularly through the joint postgraduate **Centres of Excellence** with Otago (Chemical Oceanography), Canterbury (Aquaculture and Marine Ecology), and Auckland (Aquatic and Atmospheric Sciences) universities. NIWA staff are actively involved in the supervision of 62 postgraduate students (52 at PhD level) at 13 universities, here and overseas. We also provide infrastructure and operational support for jointly supervised students funded by the Foundation for Research, Science & Technology's Enterprise Fellowships, Tūāpapa Pūtaiao Māori Fellowships, and Bright Futures Fellowships.

Postdoctoral fellowships are a very important stepping stone for recent PhD graduates. We funded 22 fellowships in areas where we need to develop a new skills base or to ensure that there are fully trained staff to meet future skills shortages. These areas include coastal processes, water resources, bioactive chemicals, simulation modelling, and biodiversity. We also provide supervision and operational support for 4 postdoctoral fellows who are supported by the Foundation for Research, Science & Technology.

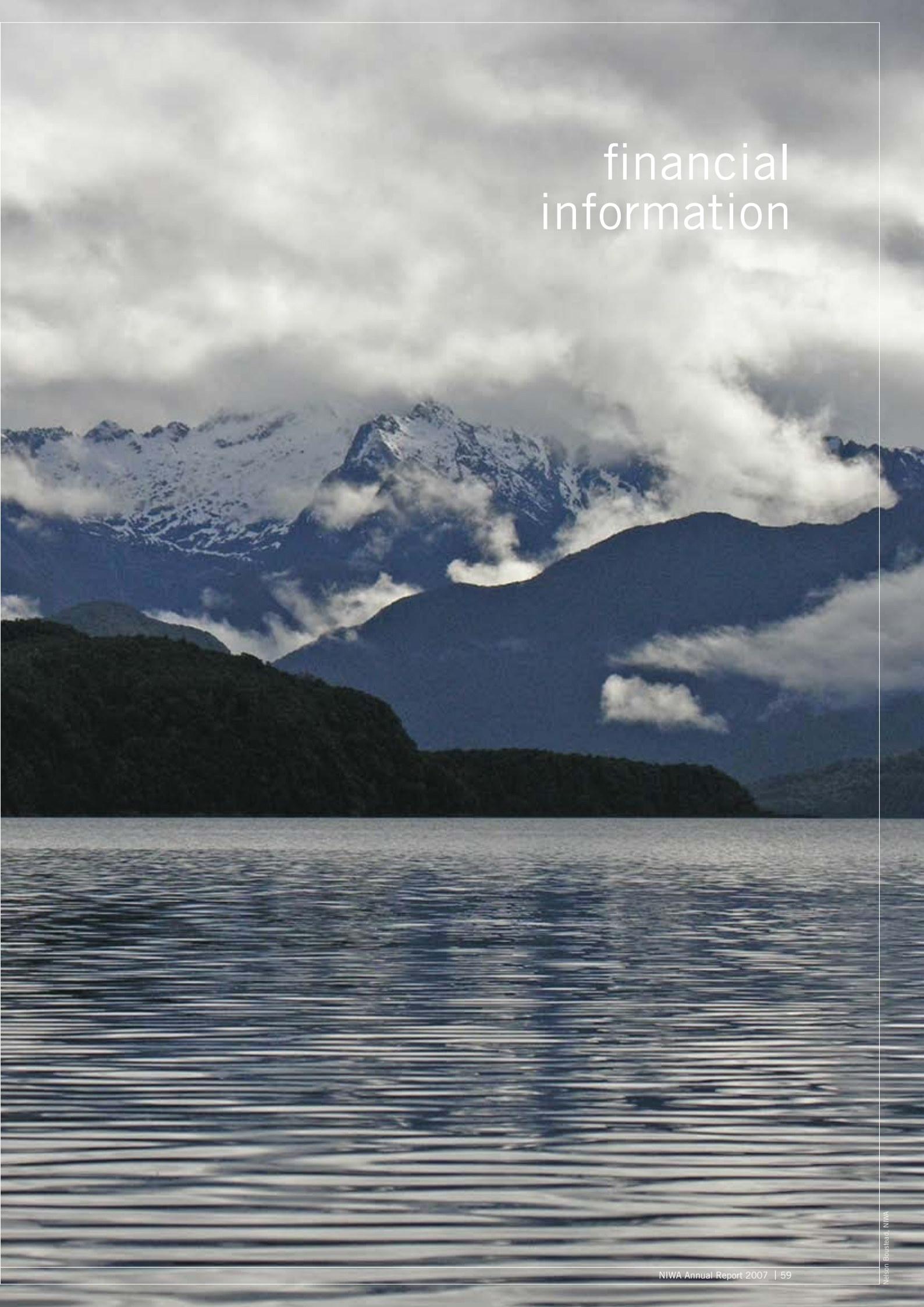
Fleur Matheson, NIWA

Staff from regional councils, DOC, and independant consultants at the Riparian Management Training course held in November 2006 at Mangaotama Stream, Whatawhata.

In **public education** we offered 10 training courses this year to assist in the professional development of staff in regional councils, government departments, and consultancy companies, as well as our own staff. There were 135 participants this year in courses ranging from managing coastal hazards, to electric fishing, identification of native fish, and data quality for environmental management. We also ran 7 workshops which attracted more than 500 participants.

Internally, we also provided educational opportunities for capacity-building in NIWA, with awards for 8 staff through our overseas technical training programme.

financial information



Nelson Boustead, NIWA

Board of Directors

Sue Suckling, John Spencer, John Hercus, Ed Johnson, Graham Hill, Wendy Lawson, Craig Ellison, Troy Newton.

Sue Suckling (*Chair*), OBE, BTech (Hons), MTech, is a Christchurch-based director and strategic business consultant. She is Chair of The New Zealand Qualifications Authority and a number private companies. She is a Director of Restaurant Brands and a member of the Takeovers' Panel. Previously, she was Chair of AgriQuality Ltd and Deputy Chair of the Institute of Geological and Nuclear Sciences Ltd. Sue was appointed NIWA Chair in July 2001.

John Spencer (*Deputy Chair*) is Chairman of Tainui Group Holdings Ltd and Telfer Young Ltd. He is Deputy Chairman of Solid Energy and a Director of Tower Ltd, Waikato Regional Airport Ltd, and WEL Networks Ltd. He was the Chief Executive of New Zealand Dairy Group prior to the formation of Fonterra, and has held a number of senior management positions in New Zealand and overseas. A Fellow of the Institute of Chartered Accountants, he is Deputy Chairman of the Accounting Standards Review Board.

John Hercus has an MSc in physics from Victoria University of Wellington and has been a leading figure in polytechnic, technology, and science education, serving as Director of the Christchurch Polytechnic from 1974 to 1993. He has worked for the UN Development Programme in higher education and training, and on projects with UNESCO and the Asian Development Bank. He has held directorates with several companies involved in international education and technology development.

Dr Graham Hill is an astronomer and astrophysicist currently lecturing in astronomy at the University of Auckland. From 1967 to 1996 he was a research scientist at the National Research Council of Canada – Dominion Astrophysical Observatory in Victoria, BC. He is a scientific computer software consultant and collaborator with colleagues at several overseas universities. He is an invited member of the International Astronomical Union and holds a PhD in astronomy from the University of Texas. He is a director of the Meteorological Service of New Zealand, and a council member of Unitec.

Ed Johnson, BA (Hons) Finance and Accounting, MBA (Hons), is a Marlborough-based company director and advisor. He is currently Chair of Fulton Hogan Ltd and Goldpine Industries Ltd, and a director of several entities, including the Bank of New Zealand, Port Otago Ltd, MDC Holdings Ltd, and Marlborough Airport Ltd. He retired as Chairman and Chief Financial Officer of Shell New Zealand in 2002 after having senior management roles in New Zealand, the US, and the UK. In 2001 Ed was appointed the inaugural Honorary Fellow of Massey University's Centre for Business and Sustainable Development. In 2003 he was made a Fellow of the Institute of Directors in New Zealand.

Troy Newton is a director of KPMG Corporate Finance, where he advises clients on mergers and acquisitions, valuation, regulatory reform, and financing matters in New Zealand, Australia, and the Pacific Rim. He is a chartered accountant and was a director of Industrial Research Ltd from 1997 until September 2002. He has particular industry experience in telecommunications, information technology, and energy and transport operations.

Wendy Lawson, BSc (Hons), PhD, is a glaciologist and academic, with a particular interest in the impacts of climate change on earth systems at IPCC time scales. She has more than 25 years of remote field science experience in Arctic, Antarctic, and alpine regions, on expeditions from universities in the UK and US, as well as New Zealand. She is Head of the Department of Geography at the University of Canterbury, Chair of the Advisory Board of Gateway Antarctica, and serves on the Board of the Antarctic Research Centre at Victoria University. She previously served on the Board of Antarctica New Zealand.

Craig Ellison (appointed 1 July 2007) has an MSc in zoology from Otago University, and is a director on several boards, including Airways Corporation of New Zealand, Aotearoa Fisheries Ltd, New Zealand Trade & Enterprise, and Prepared Foods Processing Ltd, as well as chairing the New Zealand Seafood Standards Council. He was a Commissioner on the Treaty of Waitangi Fisheries Commission until 2004. Craig has a strong interest in improving NZ business management capability, Māori governance structures, and resource management.

Statement of management responsibility

The following statement is made in accordance with section 42 of the Public Finance Act (1989).

1. The management of the company is responsible for the preparation of these Financial Statements and the judgements used therein.
2. The management of the company is responsible for establishing and maintaining internal control procedures designed to provide reasonable assurance as to the integrity and reliability of financial reporting.
3. In the opinion of management, these Financial Statements fairly reflect the financial performance, movements in equity, financial position, and cash flows of the National Institute of Water & Atmospheric Research Ltd and Group for the year ended 30 June 2007.

Sue Suckling
Chair

John Morgan
Chief Executive

24 August 2007

Report of the Directors to the Shareholders

The Directors take pleasure in presenting the National Institute of Water & Atmospheric Research Ltd (NIWA) and Group Annual Report for the financial year ended 30 June 2007.

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 Foundation for Research, Science & Technology, the Ministry of Fisheries, 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 has exceeded its Business Plan objectives, as set out in the Statement of Corporate Intent (SCI), with a net surplus of $10.5 million (2006: $10.3 million) against a budgeted net surplus of $5.6 million. This was achieved on a turnover of $113.9 million (2006: $106.4 million), against budgeted revenue of $102.6 million.

Average shareholders' equity at 30 June 2007 totalled $46.4 million (2006: $42.5 million). Total average assets were $73.4 million at 30 June 2007 (2006: $67.8 million).

Donations

No donations were made during the year.

Dividends

Dividend payments of $101,000 were made to the Government of New Zealand (the Crown), as the sole shareholder.

Group actual performance versus Statement of Corporate Intent (SCI)

Years ended 30 June	Actual 2007 $'000	SCI 2007 $'000	Actual 2006 $'000
Revenue	113,911	102,627	106,414
Operating expenses and depreciation	94,850	93,306	90,348
Operating surplus before tax	15,843	8,339	15,706
Net surplus	10,461	5,550	10,342
Average total assets	73,394	63,706	67,804
Average shareholders' funds	46,354	40,570	42,461
Profitability			
EBIT margin (%) (EBIT/revenue)	13.7	8.5	14.5
Return on average equity after tax (%) (net surplus/average equity)	22.6	13.7	24.4
Return on assets (%) (EBIT/average total assets)	21.2	13.5	22.7
Liquidity and efficiency			
Current ratio	1.3	1.0	0.9
Quick ratio	1.9	1.3	1.2
Financial leverage			
Debt to average equity (%)	57	68	65
Gearing (%)	1	1	2
Proprietorship (%) (shareholders' funds/total assets)	63	64	63

Directors

The retirement of Miranda Cassidy on 30 September 2006 and David Sharp on 30 June 2007 were the only changes to the Board of Directors for the year ended 30 June 2007. Craig Ellison was appointed to the Board of Directors from 1 July 2007.

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 4 of the 'Notes to the Financial Statements'.

Interests Register

The following are transactions 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.

Directors' remuneration

Details of the Directors' remuneration are provided in the Remuneration of Directors section of the governance statement.

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 or disposed of any equity securities of the NIWA Group.

Directors' loans

There were no 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:

Sue Suckling
Chair

Troy Newton
Director

24 August 2007

Corporate governance statement

Approach to corporate governance

The NIWA Group's corporate governance deals with how the company is directed and controlled to ensure good ethical behaviour and promote shareholders' interests in a sustainable way. In particular, corporate governance applies to the role of the Board of Directors ('the Board') and the need to ensure a framework of effective accountability and transparency.

A key element of governance is designing a governance model that reflects the values of the NIWA Group and its participants and then evaluates the model's effectiveness. Ethical behaviour is a vital element; the governance model in place will be ineffective unless the Board, Directors, and management are committed to ethical standards and behaviours. Ultimately the Board is responsible for ethical behaviour within the NIWA Group.

We promote a Code of Conduct to all staff (including the Board and management) which promotes standards of integrity, discretion, and ethical conduct. The NIWA Group encourages staff to:

1. perform to the best of their ability, and be committed to a high quality of work performed in a safe manner;
2. take the initiative and be creative in resolving problems, seeking improved productivity, and responding to opportunities within areas of responsibility;
3. make decisions and be responsible for those decisions and the actions that flow from them;
4. be supportive of their work teams;
5. treat staff and equipment with care and respect.

It is expected that managers will guide staff in accordance with management's philosophy, policies, and standards.

Corporate governance values adopted by the NIWA Group include honesty, openness, trust and integrity, mutual respect, performance orientation, accountability, and commitment to the NIWA Group.

The NIWA Group is a Crown Research Institute, established under the terms of the Crown Research Institutes Act 1992 and the Public Finance Act 1989, with all its shares held by the Minister of Finance and the Minister for Crown Research Institutes on behalf of the Crown.

The Board's authority and accountability is based on the two Acts noted above and the Statement of Corporate Intent (SCI). The SCI is produced annually, and sets out the Board's strategic objectives, specific goals, and performance targets. The SCI is submitted to the shareholding Ministers for acceptance.

The NIWA Group reports annually to Parliament on its performance in its annual report. A half-yearly report and quarterly progress reports are also prepared for shareholding Ministers and performance is measured against the objectives in the SCI.

In addition to the above Statutes and the SCI, the Board also operates under a number of other governance instruments, which include:

- periodic letter of expectation from the Shareholder;
- Directors' undertakings at the time of appointment;
- Directors' interests register;
- policy on Directors' expenses.

The Board and management of the NIWA Group is committed to ensuring that it adheres to best practice governance principles and maintains the highest ethical standards.

This governance statement outlines the main corporate governance practices as at 30 June 2007. Unless otherwise stated, they reflect the practices in place throughout the financial year ending on that date.

Principles for corporate governance

Nine principles and guidelines established by the Securities Commission of New Zealand are contained in the corporate governance of the NIWA Group. These principles apply to entities that have an economic impact in New Zealand and/or are accountable to the public in various ways.

The NIWA Group is a Crown Research Institute, owned by the government, which is held accountable by the public.

Our direct customers are those who fund our science and research. The Crown is our largest customer, but we also conduct research for, and provide advice and information to, many others, ranging from international conglomerates to local commercial fishers and schools. We consider the New Zealand public as our most important customer, although they do not directly contract us.

Most of our research is aimed at addressing issues of relevance to the general public – the sustainability of our society and civilisation.

Not all of the principles apply to the NIWA Group, but are observed to the fullest extent to which they apply, for example, Directors are appointed by the shareholding Ministers rather than the Board.

Responsibilities of the Board and management

The Board of Directors of the National Institute of Water & Atmospheric Research Ltd (NIWA) is appointed by the shareholding Ministers to guide and monitor the business of NIWA and its subsidiaries NIWA Vessel Management Ltd, NIWA Environmental Research Institute, NIWA (USA), Incorporated, NIWA Australia Pty Ltd, NIWA Natural Solutions Ltd, EcoConnect Ltd, and Unidata Pty Ltd, which constitute the NIWA Group.

The functions of the Board include:

- establishing objectives;
- reviewing and approving major strategies for achieving objectives;
- managing risks;
- reviewing and approving capital investments;
- ensuring compliance with statutory requirements;
- providing leadership in the relationship with key stakeholders;
- determining the overall policy framework within which the business is conducted;
- establishing appropriate governance structures;
- monitoring management's performance with respect to these matters.

The Board delegates management of the day-to-day affairs and management responsibilities of the NIWA Group to the executive team under the leadership of the Chief Executive Officer to deliver the strategic direction and goals determined by the Board. A formal delegations authority framework establishes the operational and expenditure delegations within which the Chief Executive Officer must operate.

Board composition and activity

Shareholding Ministers appoint board members under the Crown Entities Act 2004 and are required to meet the same obligations as directors of private sector companies.

Board Directors are selected and appointed on the basis of their skills and experience. Additionally, the balance of these skills and experience is required to match the strategic direction and needs of the NIWA Group.

Some basic competencies that all Directors must have:

- an ability to add value;
- an ability to communicate clearly;
- the ability to take a wide perspective on issues;
- common sense, integrity, and a strong sense of ethics;
- organisational and strategic awareness;
- financial literacy;
- a knowledge of the responsibilities of a Director and an ability to distinguish corporate governance from management.

Before a new Director is appointed, candidates are put through a due diligence process to determine whether the candidate can add value to the Board, the degree of risk entailed in the appointment, and whether there are known or potential conflicts of interest. Once a Director has been appointed, they receive guidelines on the government's expectations, above those contained in the Companies Act 1993.

Appointment of Directors is for a term of up to 3 years. Directors may be reappointed for a second term of up to 3 years, although this is not automatic, with Ministers basing their decision on the needs of the company. Both the Chair and the Deputy Chair are appointed by the shareholding Ministers.

During the financial year ended 30 June 2007 the Board comprised seven independent non-executive Directors (including the Chair). The Directors' profiles are presented on page 60. Board meetings are held monthly. The Board formally met twelve times during the year.

Achieved	Principle	Reference
✓	Directors should observe and foster high ethical standards.	p. 62
✓	There should be a balance of independence, skills, knowledge, experience, and perspectives among Directors so that the Board works effectively.	p. 63
✓	The Board should use committees where this would enhance its effectiveness in key areas while retaining Board responsibility.	p. 64
✓	The Board should demand integrity both in financial reporting and in the timeliness and balance of disclosures on affairs of entities.	p. 62
✓	The remuneration of Directors and executives should be transparent, fair, and reasonable.	p. 64, 65
✓	The Board should regularly verify that the entity has appropriate processes that identify and manage potential and relevant risks.	p. 65
✓	The Board should ensure the quality and independence of the external audit process.	p. 65
✓	The Board should foster constructive relationships with shareholders that encourage them to engage with the entity.	p. 65
✓	The Board should respect the interests of stakeholders within the context of the entity's ownership type and its fundamental purpose.	p. 65

Director development

A sector-specific induction programme is conducted for all new Directors by the Crown Company Monitoring Advisory Unit (CCMAU). A formal induction into all aspects of the NIWA Group is provided by the Chair.

All Directors are responsible for maintaining up-to-date knowledge of the legal and professional duties of board members.

Ongoing professional development is agreed between the Directors and the Chair as part of the annual review process.

Wendy Lawson undertook a Director's training programme during the year.

Remuneration

Directors' remuneration is annually reviewed and approved by the shareholding Ministers. Remuneration is set at levels that are fair and reasonable in a competitive market for the skills, knowledge, and experience required by the NIWA Group.

The annual review is primarily a tool to help the Boards analyse its performance and identify any areas where performance could be improved. The review assists to provide input into the Chair's succession planning and identification of Director training needs.

The Board is additionally reviewed as a whole through a set of performance measures on an on-going basis.

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

Parent	2007 $'000	2006 $'000
Directors of the National Institute of Water & Atmospheric Research Ltd		
Sue Suckling (Chair)	52	52
Carolyn Burns (resigned 30 June 2006)	–	26
Miranda Cassidy (resigned 30 September 2006)	7	26
John Hercus	26	26
Graham Hill	26	26
Ed Johnson	26	26
Wendy Lawson (appointed 1 July 2006)	25	–
Troy Newton	26	26
David Sharp (resigned 30 June 2007)	26	26
John Spencer	33	33
Group		
Directors of NIWA Natural Solutions Ltd		
John Baird (resigned 4 August 2006)	2	16

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

Board committees

Audit and Legislative Compliance Committee

The Audit and Legislative Compliance Committee is a sub-committee of the Board. During the financial year, the Audit and Legislative Compliance Committee comprised three members of the Board and met formally four times with the NIWA Chair as an ex-officio member.

The function of the Audit and Legislative Compliance Committee is to assist the Board in carrying out its responsibilities under 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 in respect of the Group financial accounting practices, policies, and controls, and to review and make appropriate enquiry into the audits of the Group Financial Statements by both internal and external auditors.

The committee has a defined process for dealing with complaints from auditors that may arise in the audit-client relationship or other audit aspects.

Employees or others who believe auditor independence and objectivity is or may be compromised can refer these concerns to the committee and should expect these to be received in an open manner.

Remuneration Committee

The Remuneration Committee is a sub-committee of the Board and comprised two members, the NIWA Chair and Deputy Chair.

The Remuneration Committee reviews the remuneration policies applicable to the Chief Executive Officer on an annual basis and makes recommendations on remuneration packages and terms of employment to the Board. The Remuneration Committee also ratifies the remuneration packages of the direct reports to the Chief Executive Officer.

Remuneration packages are reviewed with due regard to performance and other relevant factors.

Directors' insurance

The NIWA Group has arranged policies for Director's 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.

Remuneration of employees

Adequate remuneration is necessary to attract, retain, and motivate employees.

Additional to salary, other employee benefits include:

- death and disability insurance
- superannuation
- training leave
- profit share
- Employee Assistance Programme
- annual practising and professional membership fees

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

Group $	2007	2006
100,000–109,999	24	21
110,000–119,999	10	7
120,000–129,999	6	5
130,000–139,999	3	2
140,000–149,999	2	2
150,000–159,999	–	4
160,000–169,999	4	–
170,000–179,999	1	1
180,000–189,999	1	–
190,000–199,999	1	1
200,000–209,999	1	1
280,000–299,999**	1	–
330,000–339,000*	1	–
350,000–359,000*	–	1

* Chief Executive Officer's remuneration band.

** Acting Chief Executive Officer's remuneration band.

Risk management

Risk management has been incorporated into the normal business processes of the NIWA Group, with practices such as business planning and budgeting, operational management, and project management. Appropriate processes are regularly verified by the Board to identify and manage potential and relevant risks.

The Board reviews the delegations authority framework. The delegations authority framework sets authorities for operational and expenditure delegations, including authority for undertaking treasury activities of the NIWA Group.

The Audit and Legislative Compliance Committee receives reports on internal risk management reviews, and also meets with the external auditors to discuss findings from the annual audit.

Auditor independence

The appointment of auditors to conduct statutory work, and the annual audit fees, are approved annually by the Auditor-General.

The Board and the auditors are jointly responsible for ensuring that the audit is conducted with independence, integrity, and objectivity.

Rotation of audit partners promotes independence and objectivity. Audit partners are rotated every six years.

To ensure the independence of the external auditors, NIWA does not consult the external auditor for tax or management-related services and takes care not to make use of the external auditors for any work which they may need to evaluate as part of the external audit.

Shareholder and Stakeholder relations

The Crown is the ultimate shareholder of the NIWA Group, with the shareholding Ministers holding the shares.

Formally outlined in an owner's expectation manual, shareholding Ministers relate their expectations of the Board. This document entails the expectations and responsibilities of the Board, including Board duties, reporting requirements, financial governance, and how to deal with strategic issues.

Each year an operating framework is issued to Crown Research Institutes and is the cornerstone document which shareholding Ministers communicate their yearly expectations.

From the operating framework the Board develop a Statement of Corporate Intent (SCI) which shareholding Ministers need to approve before it is tabled in Parliament and becomes a public document. Shareholding Ministers are then accountable for the performance against the Statement of Corporate Intent by Parliament.

The NIWA Group reports quarterly against its SCI to the Crown Company Monitoring Advisory Unit, yearly to Treasury, half-yearly and annual reports are generated for shareholders and stakeholders.

Stakeholders include, but are not limited to, creditors, employees, the Crown, and the public.

The yearly Sustainability Report informs stakeholders by both financial and non-financial measures about the NIWA Group's actions and performance over the past year and the future challenges.

As a responsible and accountable corporate citizen, the NIWA Group is committed to maintaining the health of our environmental systems through the provision of sustainability advice and services, and operating in a socially, culturally and environmentally responsible manner. We firmly believe that socially and environmentally sound behaviour contributes to sustained economic growth and value creation.

Membership and attendance

Director	Date of appointment	Appointment term expires	Board	Audit Committee	Remuneration Committee
Miranda Cassidy	28 June 2001	30 September 2006	3		
David Sharp	4 July 2001	30 June 2007	10		
Sue Suckling (Chair)	1 March 2001	30 June 2008	12	4*	1
John Hercus	27 October 2000	30 June 2008	7		
Graham Hill	27 May 2002	30 June 2008	9		
Ed Johnson	9 June 2005	30 June 2008	9	2	
Troy Newton (Audit Committee Chair)	18 June 2002	30 June 2008	10	3	
John Spencer (Deputy Chair)	16 June 2003	30 June 2009	12	4	1
Wendy Lawson	1 July 2006	30 June 2009	11		

* The Chair is an ex-officio member of the Audit Committee.

Membership of subsidiary Boards

Director	NIWA Vessel Management Ltd	NIWA Natural Solutions Ltd	NIWA Australia Pty Ltd	NIWA (USA), Inc. & NIWA Environmental Research Institute	Unidata Pty Ltd
Sue Suckling	✓*	✓*	✓*	✓*	
John Baird [1]		✓			
Carolyn Burns	✓	✓	✓	✓	
Miranda Cassidy	✓	✓	✓	✓	
John Hercus	✓	✓	✓	✓	
Graham Hill	✓	✓	✓	✓	
Ed Johnson	✓	✓	✓	✓	
Wendy Lawson	✓	✓	✓	✓	
Troy Newton	✓	✓	✓	✓	
David Saunders[2]					✓
David Sharp	✓	✓	✓	✓	
John Spencer	✓	✓	✓	✓	
Kate Thomson[3]					✓*
Bryce Cooper[3]					✓
Matt Saunders[4]					✓

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

National Institute of Water & Atmospheric Research Ltd and Group

Statement of Financial Performance

for the year ended 30 June 2007

	Note	Group 2007 Actual $'000	Group 2007 Budget $'000	Group 2006 Actual $'000	Parent 2007 Actual $'000	Parent 2006 Actual $'000
Revenue	3	113,911	101,645	106,414	114,847	108,512
Operating surplus before taxation	4	**15,843**	**8,339**	**15,706**	**17,300**	**19,874**
Taxation expense	6a	5,382	2,789	5,364	3,693	4,121
Net surplus		**10,461**	**5,550**	**10,342**	**13,607**	**15,753**
Net surplus comprises:						
Parent interest		10,453	5,505	10,422		
Minority interest	9	8	45	(80)		
		10,461	**5,550**	**10,342**		

The accompanying 'Notes to the Financial Statements' are an integral part of, and should be read in conjunction with, this 'Statement of Financial Performance'.

National Institute of Water & Atmospheric Research Ltd and Group

Statement of Movements in Equity

for the year ended 30 June 2007

	Note	Group 2007 Actual $'000	Group 2007 Budget $'000	Group 2006 Actual $'000	Parent 2007 Actual $'000	Parent 2006 Actual $'000
Net surplus for the year						
Parent	7b	10,453	5,505	10,422	13,607	15,753
Minority interests	9	8	45	(80)	–	–
Foreign currency translation reserve movement	7b	(117)	–	200	–	–
Total recognised revenues and expenses		**10,344**	**5,550**	**10,542**	**13,607**	**15,753**
Distributions to owners						
Dividends	8	(101)	(165)	(13,000)	(101)	(13,000)
Movements in equity for the year		**10,243**	**5,385**	**(2,458)**	**13,506**	**2,753**
Equity at the beginning of the year		**41,232**	**37,878**	**43,690**	**31,531**	**28,778**
Equity at the end of the year		**51,475**	**43,263**	**41,232**	**45,037**	**31,531**

The accompanying 'Notes to the Financial Statements' are an integral part of, and should be read in conjunction with, this 'Statement of Movements in Equity'.

National Institute of Water & Atmospheric Research Ltd and Group

Statement of Financial Position

as at 30 June 2007

	Note	Group 2007 Actual $'000	Group 2007 Budget $'000	Group 2006 Actual $'000	Parent 2007 Actual $'000	Parent 2006 Actual $'000
Equity						
Share capital	7a	24,799	24,799	24,799	24,799	24,799
Equity reserves	7b	26,687	18,467	16,452	20,238	6,732
Shareholders' interest		51,486	43,266	41,251	45,037	31,531
Minority shareholders' interest	9	(11)	(3)	(19)	–	–
Total equity		**51,475**	**43,263**	**41,232**	**45,037**	**31,531**
Non-current liabilities						
Unsecured loans	10	409	409	452	–	–
Employee entitlements	11	1,474	1,632	1,551	1,388	1,468
Intercompany	24	–	–	–	9,587	12,119
Total non-current liabilities		**1,883**	**2,041**	**2,003**	**10,975**	**13,587**
Current liabilities						
Payables and accruals	12	16,421	13,225	17,192	15,451	15,847
Short-term advance facility	13	–	–	600	–	600
Employee entitlements	11	8,252	5,483	7,705	7,651	7,115
Taxation payable		–	555	26	–	–
Total current liabilities		**24,673**	**19,263**	**25,523**	**23,102**	**23,562**
Total equity and liabilities		**78,031**	**64,567**	**68,758**	**79,114**	**68,680**
Non-current assets						
Property, plant, & equipment	14	43,201	42,799	42,740	32,133	30,770
Identifiable intangibles	16	69	109	117	–	–
Investments	20	559	555	491	13,209	13,246
Future income taxation benefit	6b	898	1,446	1,816	2,453	3,476
Receivables and prepayments	17	688	–	765	688	765
Loans to associates	23	–	139	106	–	26
Total non-current assets		**45,415**	**45,048**	**46,035**	**48,483**	**48,283**
Current assets						
Cash and short-term deposits		4,138	1,636	1,143	3,619	488
Receivables and prepayments	17	19,803	13,190	17,539	19,148	16,777
Taxation receivable		1,575	–	–	1,935	138
Uninvoiced receivables		4,829	2,565	2,217	4,699	2,203
Inventories	18	2,271	2,128	1,824	1,230	791
Total current assets		**32,616**	**19,519**	**22,723**	**30,631**	**20,397**
Total assets		**78,031**	**64,567**	**68,758**	**79,114**	**68,680**

For and on behalf of the Board:

Sue Suckling
Chair
24 August 2007

Troy Newton
Director

The accompanying 'Notes to the Financial Statements' are an integral part of, and should be read in conjunction with, this 'Statement of Financial Position'.

National Institute of Water & Atmospheric Research Ltd and Group

Statement of Cash Flows

for the year ended 30 June 2007

	Note	**Group 2007 Actual $'000**	Group 2007 Budget $'000	Group 2006 Actual $'000	**Parent 2007 Actual $'000**	Parent 2006 Actual $'000
Cash flows from operating activities						
Cash was provided from:						
Receipts from customers		110,619	101,574	105,215	111,372	105,543
Interest received		364	27	386	354	373
		110,983	101,601	105,601	111,726	105,916
Cash was disbursed to:						
Payments to employees and suppliers		(92,124)	(85,292)	(76,925)	(92,316)	(77,226)
Interest paid		(86)	(304)	(50)	(86)	(50)
Taxation paid		(6,063)	(1,850)	(5,606)	(4,467)	(4,290)
		(98,273)	(87,446)	(82,581)	(96,869)	(81,566)
Net cash inflow from operating activities	19	**12,710**	**14,155**	**23,020**	**14,857**	**24,350**
Cash flows from investing activities						
Cash was provided from:						
Sale of property, plant, & equipment		93	–	76	93	75
Loans advanced from subsidiary company		–	–	–	–	–
Cash was applied to:						
Purchase of property, plant, & equipment		(9,107)	(9,570)	(8,480)	(8,613)	(7,485)
Purchase of intangible assets		–	–	(95)	–	–
Investment in associates	22	–	–	(535)	–	(500)
Net cash outflow in investing activities		**(9,014)**	**(9,570)**	**(9,034)**	**(8,520)**	**(7,910)**
Cash flows from financing activities						
Cash was applied to:						
Dividends paid to shareholders	8	(101)	(166)	(13,000)	(101)	(13,000)
Short-term advance facility received	13	–	–	600	–	600
Short-term advance facility (repaid)	13	(600)	(3,500)	(1,700)	(600)	(1,700)
Associate loan (payment)		–	(5)	(100)	–	–
Subsidiary loan proceeds		–	–	–	23,512	14,892
Subsidiary loan (repaid)		–	–	–	(26,017)	(17,667)
Net cash outflow from financing activities		**(701)**	**(3,671)**	**(14,200)**	**(3,206)**	**(16,875)**
Net increase/(decrease) in cash held		**2,995**	**914**	**(214)**	**3,131**	**(435)**
Add opening cash balance		1,143	722	1,357	488	923
Closing cash balance		**4,138**	**1,636**	**1,143**	**3,619**	**488**
Made up of:						
Cash		4,138	1,636	1,135	3,619	488
Short-term deposits		–	–	8	–	–
Closing cash balance		**4,138**	**1,636**	**1,143**	**3,619**	**488**

The accompanying 'Notes to the Financial Statements' are an integral part of, and should be read in conjunction with, this 'Statement of Cash Flows'.

Notes to the Financial Statements

for the year ended 30 June 2007

1 Nature of activities

The National Institute of Water & Atmospheric Research Ltd (NIWA) and Group conducts research in water and atmospheric sciences in New Zealand and internationally.

2 Statement of accounting policies

The NIWA Financial Statements and Group Financial Statements 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. The consolidated (or 'Group') Financial Statements comprise NIWA (the 'Parent Company'), its subsidiaries and the Group's interest in associates and joint ventures.

Measurement base

The Financial Statements have been prepared in accordance with Generally Accepted Accounting Practice (GAAP) in New Zealand. The measurement and reporting of financial performance, movements in equity, financial position, and cash flows is based on historical cost. The reporting currency used in the preparation of these Financial Statements is New Zealand dollars.

Specific accounting policies

The following specific accounting policies, which materially affect the measurement of financial performance, movements in equity, financial position, and cash flows, have been established and consistently applied.

(a) Basis of consolidation

i) Consolidation of subsidiaries

Subsidiaries are those entities controlled by NIWA. The Group Financial Statements have been prepared using the purchase method of consolidation. This involves adding corresponding assets, liabilities, revenues, and expenses on a line-by-line basis. All intercompany transactions, balances, and unrealised profits are eliminated on consolidation. The results of any subsidiaries that become or cease to be part of the Group during the year are consolidated from the date that control commenced or until the date that control ceased.

The interest of minority shareholders is stated at the minority's proportion of the fair values of the identifiable assets and liabilities recognised on acquisition together with the minority interests' share of post acquisition surpluses.

ii) Accounting for associates

An associate is an investee, not being a subsidiary or joint venture arrangement, over which the Group has the capacity to exercise significant influence, but not control, through participation in the financial and operating policy decisions of the investee.

The Group Financial Statements incorporate the Group's interest in associates, using the equity method, as from the date that significant influence commenced or until the date the significant influence ceased. The investments are recorded at the lower of carrying value and recoverable amount.

The Group recognises its share of the associates' net surplus or deficit for the year as operating revenue in its Statement of Financial Performance. The Group recognises its share of other post-acquisition movements in reserves in its Statement of Movements in Equity. Dividends received from associates are recognised directly against the carrying value of the investment. In the Statement of Financial Position the investment and the reserves are increased by the Group's share of the post-acquisition retained surplus and other post-acquisition reserves of the associates. In assessing the Group's share of earnings of associates, the Group's share of any unrealised profits between group companies and associates is eliminated.

iii) Accounting for joint ventures

Joint ventures are joint arrangements between NIWA and another party in which there is a contractual agreement to undertake a specific business project in which the venturers share joint and several liabilities in respect of the costs and liabilities of the project and share in any resulting output. NIWA's share of the assets, liabilities, revenues, and expenses of the joint ventures is incorporated into the Parent Company and Group Financial Statements on a line-by-line basis using the proportionate consolidation method.

(b) Revenue recognition

Contract revenue is recognised based on the lower of the stage of completion of the contract or the value of work done. The amount of revenue unbilled is represented by 'Uninvoiced Receivables', which is stated at percentage complete in the Statement of Financial Position. Revenue received but not earned is recognised as revenue in advance in 'Payables and Accruals' in the Statement of Financial Position. Other revenue is recognised when the obligation to receive funds is incurred.

(c) 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.

(d) Taxation

Taxation expense is charged in the Statement of Financial Performance in respect of the current year's operating surplus after allowing for permanent differences. The provision for taxation for the year includes both current and deferred tax on income after taking into account all available deductions.

Deferred tax arising from timing differences in recognition of income and expenditure for tax purposes has been accounted for using the liability method on a comprehensive basis. A debit balance in the deferred tax account (hereafter called 'future income taxation benefit'), arising from timing differences or taxation benefits from taxation losses, is recognised only if there is virtual certainty of realisation.

(e) Identifiable intangible assets

Purchased identifiable intangible assets, comprising copyrights and trademarks, are recognised at cost and amortised in the Statement of Financial Performance on a straight-line basis over their estimated useful lives. When the carrying amount of an identifiable intangible asset exceeds its recoverable amount, it is written down to its recoverable amount.

The estimated useful lives for the copyrights and trademarks are 5 years.

(f) Development costs

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 technical feasibility of the product or process can be demonstrated;
- 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;
- 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 further related costs, is likely to be recovered from related future economic benefits.

When the criteria above no longer apply, the unamortised balance of development costs is written off and recognised immediately as an expense.

Development costs recognised as an asset are amortised in the Statement of Financial Performance on a straight-line basis over the period of expected benefits.

When the unamortised balance of development costs exceeds the probable amount of future recovery from related future economic benefits less related future costs, the excess is written down and recognised immediately as an expense.

All other development and research costs are expensed as incurred.

The estimated useful lives are between 1 and 5 years.

(g) Investments

Non-current investments are valued at cost. Where the carrying amount of an investment exceeds its recoverable amount, it is written down to its recoverable amount.

(h) Property, plant, and equipment

Property, plant and equipment, except land, are valued at historical cost less accumulated depreciation to date. Provision is made for any impairment. Land is valued at cost. Property, plant and equipment purchased from the Crown at 1 July 1992 and 1 July 1995 are stated at the transfer price at those dates, adjusted for subsequent disposals and depreciation.

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.

Notes to the Financial Statements

for the year ended 30 June 2007

(i) Depreciation

Property, plant, and equipment, except for freehold land, are depreciated on a straight-line basis at rates estimated to write off the cost (or transfer price) of the property, plant and equipment over their estimated useful lives. Useful lives used are:

Buildings & Leasehold improvements	
Buildings	40 years
Leasehold improvements, freehold property	10 years
Leasehold improvements, rented property	5 years
Vessels	
RV *Tangaroa* hull	26 years
RV *Kaharoa* hull	16 years
Plant & equipment	
Plant & equipment	10 years
Scientific equipment	4 years
Electronic data processing equipment	
Supercomputer	5 years
Electronic data processing equipment	3 years
Office equipment	5 years
Furniture & fittings	10 years
Motor vehicles	4 years
Small boats	5 years

(j) Receivables

Receivables are stated at their estimated realisable value after providing for doubtful and uncollectable debts.

(k) 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.

(l) Foreign currencies

i) Transactions

Transactions in foreign currencies are converted at the New Zealand rate of exchange ruling on the date of the transaction. Monetary assets and liabilities are converted to the New Zealand rate of exchange ruling at balance date, and any exchange gains or losses are taken to the Statement of Financial Performance.

ii) Translation of independent foreign operations

Revenues and expenses of independent foreign operations are translated to New Zealand dollars at the exchange rates in effect at the time of the transactions, or at rates approximating them. 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 independent foreign operations are recognised in the foreign currency translation reserve.

(m) 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.

(n) 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 Financial Performance. Operating activities comprise the provision of research services, consultancy, and manufacture of scientific instruments. Investing activities comprise the purchase and disposal of property, plant and equipment 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 includes cash and short-term deposits.

(o) Provision for dividends

Dividends are recognised in the year that they are authorised and approved.

(p) Financial instruments

Forward exchange contracts entered into as hedges of foreign exchange assets or liabilities are valued at the exchange rate prevailing at year end. Any unrealised gains or losses are offset against forward exchange gains or losses on the related asset or liability. Unrealised gains or losses on forward exchange contracts entered into as future sales or purchasing are deferred and included in the measurement of the purchase or sale.

(q) Changes in accounting policies

There have been no changes in accounting policies this year.

(r) Implementation of New Zealand equivalents to International Financial Reporting Standards

New Zealand reporting entities are required to comply with the New Zealand equivalents of International Financial Reporting Standards ('NZ IFRS') for reporting periods commencing on or after 1 January 2007, with optional adoption for reporting periods commencing on or after 1 January 2005.

NIWA is to adopt NZ IFRS for the year ending 30 June 2008, and accordingly the first report using NZ IFRS will be for the half year ended 31 December 2007. The transitional rules for the first time adoption of NZ IFRS require NIWA to restate its comparative financial statements using NZ IFRS. The majority of the adjustments required on transition will be made to opening retained earnings in the opening NZ IFRS balance sheet as at 1 July 2006.

NIWA recognises that it will be required to restate the Statement of Financial Position of the comparative period financial statements in accordance with the version of NZ IFRS applicable at the first NZ IFRS reporting date. It should therefore be noted that the actual impact of adopting NZ IFRS may vary from the information presented, and this variation may be material.

NIWA has compiled an opening balance sheet based on the current version of NZ IFRS as at 1 July 2006. Based on the results of the information gathered in this process and the review of policies, NIWA does not expect its financial results or financial position to be materially different under NZ IFRS from that currently reported, other than in the format and level of disclosure as presented in this report.

Set out below are the key areas where accounting policies may change and have an impact on the financial reports of NIWA.

(i) Income taxes

A 'balance sheet' approach will be adopted, replacing the 'income statement' approach under NZ GAAP. This method recognises deferred tax on most temporary differences between the carrying value of an asset or liability and its tax base.

Adoption of NZ IFRS is not expected to impact significantly on the tax expense reported.

(ii) Carrying value of land and other assets

On first time adoption of NZ IFRS, entities are permitted to adjust the carrying value of selected property, plant, and equipment to the current fair value without creating a need for ongoing revaluations. This fair value would be the assets deemed cost.

NIWA has elected to revalue Land and Buildings as at 1 July 2006. This is a result of reflecting the true and fair value of these items rather than the adoption of NZ IFRS.

The impact of this fair value adjustment will go through Retained Earnings net of Deferred Taxation.

Land will increase from $2.2 million to $10.2 million.

Buildings & Improvements will increase from $14.9 million to $35.6 million.

The movement of $28.7 million will be reflected within a revaluation account.

(iii) Impairment of assets

An asset is impaired if its carrying value exceeds its recoverable amount, being the higher of the asset's fair value less costs to sell or 'value in use' to NIWA. Non-current assets must be reviewed each year to determine whether there are any indications that they may be impaired. Any impairment identified should be recognised immediately in the Statement of Financial Performance.

Adoption of NZ IFRS will require annual impairment testing to be performed, but is not expected to impact significantly on the carrying values currently reported.

(iv) Financial instruments: recognition and measurement

NZ IFRS requires NIWA to recognise the derivatives held by the Group to hedge exposures to foreign currencies and interest rates on the balance sheet at fair value. Gains or losses on such contracts, even if unrealised on unsettled transactions, will be reported in the Statement of Financial Performance.

NIWA has elected not to hedge account. Therefore, any derivatives held will be recognised at fair value in each period. Given the current level of hedging and short-term nature of most hedges, no significant impact is anticipated. Higher volatility of earnings from period to period may result as the reported impact of a hedging instrument may now fall in a different reporting period to the impact of the underlying risk.

(v) Intangible assets

NZ IFRS requires computer software that is not an integral part of the related computer hardware to be treated as an intangible asset, provided certain criteria are met.

On conversion to NZ IFRS, such items will be reclassified from tangible to intangible assets. There will be no net impact on equity.

(vi) Foreign currency translation reserve

On translation of a foreign operation, certain exchange differences are recognised as a separate component of equity, in the foreign currency translation reserve. A first-time adopter may elect to reset these cumulative translation differences to zero.

On transition to NZ IFRS, these cumulative translation differences will be transferred to opening retained earnings. There will be no net impact on opening equity or earnings as a result of this adjustment.

Translation differences in operating activities are currently recognised in the currency translation reserve.

3 Revenue

	Group 2007 Actual $'000	Group 2007 Budget $'000	Group 2006 Actual $'000	Parent 2007 Actual $'000	Parent 2006 Actual $'000
Public Good Science and Technology					
Contract funding	44,324	41,642	42,895	44,324	42,845
Capability Fund	9,094	9,094	7,479	9,094	7,479
Ministry of Fisheries	17,183	16,500	16,060	17,183	16,060
Commercial	42,886	34,336	39,685	36,892	33,755
Share of associate's net gain/(deficit)	60	45	(91)	–	–
Dividends from subsidiaries	–	–	–	7,000	8,000
Interest income	364	28	386	354	373
All revenue was derived from continuing activities.	**113,911**	**101,645**	**106,414**	**114,847**	**108,512**

4 Operating surplus before taxation

	Note	Group 2007 Actual $'000	Group 2006 Actual $'000	Parent 2007 Actual $'000	Parent 2006 Actual $'000
The operating surplus before taxation is stated after charging/(crediting):					
Depreciation	5	8,570	8,743	7,184	7,189
Amortisation of identifiable intangible assets		38	39	–	–
Rental and operating lease costs		1,232	973	1,215	883
Remuneration of Directors		259	284	254	268
Net (gain)/loss on sale of property, plant, & equipment		161	310	10	32
Net (gain)/loss on sale of associates		(93)	–	–	–
Bad debts written off		–	3	–	3
Movement within doubtful debt provision		18	(59)	18	(59)
Net realised foreign currency (gain)/loss		67	15	52	(35)
Interest expense		86	50	86	50
Remuneration of the auditors of these Financial Statements:					
Audit fees		103	109	101	93
Other services		–	–	–	–
Provision for intercompany advances		–	–	–	584
Partial defeasance of intercompany advances		–	–	240	–

5 Depreciation

	Group 2007 Actual $'000	Group 2006 Actual $'000	Parent 2007 Actual $'000	Parent 2006 Actual $'000
Buildings & improvements	1,229	1,225	1,170	1,203
Vessels	739	756	–	–
Plant & equipment	3,890	3,816	3,571	3,503
Electronic data processing equipment	1,769	1,796	1,543	1,398
Office equipment	357	459	332	438
Furniture & fittings	39	43	39	43
Motor vehicles	476	545	474	532
Small boats	71	103	55	72
Total	**8,570**	**8,743**	**7,184**	**7,189**

6 Taxation

6a Taxation expense

	Group 2007 Actual $'000	Group 2006 Actual $'000	Parent 2007 Actual $'000	Parent 2006 Actual $'000
Operating surplus before taxation	**15,843**	**15,706**	**17,300**	**19,874**
Prima facie tax @ 33%	5,228	5,183	5,709	6,558
Add/(less) tax effect of permanent differences	10	8	(2,209)	(2,440)
Share of associate's net deficit	20	30	–	–
Tax losses (recognised)/carried forward	(117)	117	–	–
Deferred tax adjustment for tax rate decrease	403	–	245	–
Under/(over) provision in previous year	(162)	26	(52)	3
Income taxation expense	**5,382**	**5,364**	**3,693**	**4,121**
The income taxation expense is represented by:				
Current taxation	4,464	5,720	2,670	4,259
Deferred taxation/(future income taxation benefit)	918	(356)	1,023	(138)
	5,382	**5,364**	**3,693**	**4,121**

The 2007 budget introduced the reduction in the company tax rate from 33% to 30% from 1 April 2008. The rate reduction impacts the deferred tax calculation this year and the taxation expense next year. The change recognised from the reduction of the rate on deferred tax is recognised in the taxation expense in the income statement.

6 Taxation (continued)

		Group 2007 Actual $'000	Group 2006 Actual $'000	Parent 2007 Actual $'000	Parent 2006 Actual $'000
6b	**Future income taxation benefit**				
	Balance at the beginning of the year	1,816	1,460	3,476	3,338
	Prior period adjustment	(146)	85	37	(22)
	Current year movement	(772)	271	(1,060)	160
	Balance at the end of the year	**898**	**1,816**	**2,453**	**3,476**
6c	**Tax losses carried forward**				
	Balance at the beginning of the year	117	117	–	–
	Current year movement	(117)	117	–	–
	Balance at the end of the year	**–**	**117**	**–**	**–**

All tax losses available to be carried forward and offset against future taxable income are held in Unidata Pty Ltd and were recognised this year.

6d Imputation Credits

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 (2004) confirms this requirement.

7 Equity

7a Share capital

Issued and fully-paid capital				
24 798 700 ordinary shares	**24,799**	**24,799**	**24,799**	**24,799**

All shares carry equal voting and distribution rights.

7b Equity reserves

Equity reserves include:				
Retained earnings	26,540	16,188	20,238	6,732
Foreign currency translation reserve	147	264	–	–
Total equity reserves	**26,687**	**16,452**	**20,238**	**6,732**
Movements in reserves during the year were:				
Retained earnings				
Balance at the beginning of the year	16,188	18,766	6,732	3,979
Add net surplus	10,453	10,422	13,607	15,753
Less dividend paid	(101)	(13,000)	(101)	(13,000)
Balance at the end of the year	**26,540**	**16,188**	**20,238**	**6,732**
Foreign currency translation reserve				
Balance at the beginning of the year	264	64	–	–
Add foreign exchange gain (loss) on translation of independent foreign operations	(117)	200	–	–
Balance at the end of the year	**147**	**264**	**–**	**–**

Foreign currency translation occurs as a result of the incorporation of the net assets of the international subsidiaries into the Group Financial Statements. The international subsidiaries are NIWA (USA), Incorporated, NIWA Environmental Research Institute, NIWA Australia Pty Ltd, and Unidata Pty Ltd (note 20).

8 Dividend payments

Payments were made on:				
9 January 2006	–	(6,500)	–	(6,500)
30 June 2006	–	(6,500)	–	(6,500)
31 January 2007	(101)	–	(101)	–
	(101)	**(13,000)**	**(101)**	**(13,000)**

These dividend payments were made to the Government of New Zealand (the Crown) as the sole shareholder.

9 Minority shareholders' interest

Balance at the beginning of the year	(19)	61	–	–
Share of surplus/(deficit) for the year	8	(80)	–	–
Balance at the end of the year	**(11)**	**(19)**	**–**	**–**

10 Unsecured loan

	Group 2007 Actual $'000	Group 2006 Actual $'000	Parent 2007 Actual $'000	Parent 2006 Actual $'000
Shareholder loan	**409**	**452**	**–**	**–**

The loan is unsecured and relates to a vendor finance agreement 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 change in the value of the loan from the previous year is a result only of foreign currency translation.

11 Provision for employee entitlements

Balance at the beginning of the year	9,256	7,876	8,583	7,020
Additional provision recognised	4,115	5,134	3,618	4,250
Amount utilised	(3,645)	(3,754)	(3,162)	(2,687)
Balance at the end of the year	**9,726**	**9,256**	**9,039**	**8,583**
Classified as:				
Non-current	**1,474**	**1,551**	**1,388**	**1,468**
Current	**8,252**	**7,705**	**7,651**	**7,115**

The provision for employee entitlements relates to employee benefits such as accrued wages, holiday pay, long service leave, cash-up portion of training leave and retirement leave. The provision is affected by a number of estimates, including the expected employment period of employees, current remuneration, and the timing of employees using the benefits.

12 Payables and accruals

Trade payables	9,341	9,125	8,476	7,900
Revenue in advance	7,080	8,067	6,975	7,947
Total	**16,421**	**17,192**	**15,451**	**15,847**

13 Short-term advance facility

A short-term advance facility is available from Westpac Banking Corporation.

Advance facility	**–**	**600**	**–**	**600**

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 with a limit available to borrow of $7.5 million. The relevant interest rate for the 2006 and 2007 period was 7.45%.

14 Property, plant, and equipment

	2007 Cost $'000	2007 Accum depn $'000	2007 Net book value $'000	2006 Cost $'000	2006 Accum depn $'000	2006 Net book value $'000
Group						
Land	2,206	–	2,206	2,206	–	2,206
Buildings & leasehold improvements	25,280	10,234	15,046	24,120	9,070	15,050
Vessels	18,424	8,781	9,643	18,423	8,042	10,381
Plant & equipment	54,026	41,147	12,879	50,312	38,349	11,963
Electronic data processing equipment	20,809	19,416	1,393	20,859	19,281	1,578
Office equipment	6,770	6,331	439	6,626	6,317	309
Furniture & fittings	1,961	1,860	101	1,971	1,826	145
Motor vehicles	3,416	2,478	938	3,252	2,302	950
Small boats	1,701	1,145	556	1,283	1,125	158
Total	**134,593**	**91,392**	**43,201**	**129,052**	**86,312**	**42,740**
Parent						
Land	2,206	–	2,206	2,206	–	2,206
Buildings & leasehold improvements	25,101	10,112	14,989	23,925	8,949	14,976
Plant & equipment	47,468	35,627	11,841	43,963	33,151	10,812
Electronic data processing equipment	19,381	18,127	1,254	19,551	18,234	1,317
Office equipment	6,479	6,163	316	6,456	6,172	284
Furniture & fittings	1,534	1,458	76	1,540	1,428	112
Motor vehicles	3,298	2,375	923	3,134	2,204	930
Small boats	1,453	925	528	1,053	920	133
Total	**106,920**	**74,787**	**32,133**	**101,828**	**71,058**	**30,770**

14 Property, plant, and equipment (continued)

14a Property, plant, and equipment valuation

Independent valuers, DTZ New Zealand Limited, undertook a valuation of Land and Buildings in June 2007. This valuation totalled $48.6 million, and, while the Directors consider this value to be relevant, they have elected not to revalue for reporting purposes.

14b Vessels

As agreed with the shareholders, an amount has been identified within the Group for any shortfall between the current insured value of $40 million and the estimated replacement cost of RV *Tangaroa*, in the event of the loss of that vessel. This has not been provided for in the Statement of Financial Position.

15 Heritage assets

NIWA has one collection and three databases that have been defined as heritage assets. Heritage assets are those assets held for the duration of their physical lives because of their unique scientific importance.

NIWA has the following heritage assets:

Type	Description
Marine Benthic Biology Collection	A national reference collection for 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 value of these heritage assets cannot be assessed with any reliability, and accordingly these assets have not been valued for reporting purposes.

16 Identifiable intangibles

	Group 2007 Actual $'000	Group 2006 Actual $'000	Parent 2007 Actual $'000	Parent 2006 Actual $'000
Copyrights and trademarks				
At cost	165	165	–	–
Accumulated amortisation	(96)	(48)	–	–
Net book value	**69**	**117**	**–**	**–**

Identifiable intangibles such as copyrights and trademarks are amortised over their estimated useful lives.

17 Receivables and prepayments

Trade receivables	19,787	17,783	19,209	17,044
Provision for doubtful debts	(58)	(41)	(58)	(41)
Prepayments	762	562	685	539
Total	**20,491**	**18,304**	**19,836**	**17,542**
Classified as:				
Non-current	**688**	**765**	**688**	**765**
Current	**19,803**	**17,539**	**19,148**	**16,777**

The non-current component of receivables relates to the long-term portion of contract retentions included in trade receivables.

18 Inventories

Consumables	389	269	16	–
Finished goods	1,325	1,420	1,103	731
Work in progress	557	135	111	60
Total	**2,271**	**1,824**	**1,230**	**791**

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

19 Reconciliation of net surplus after taxation to net cash inflow from operating activities

	Note	Group 2007 Actual $'000	Group 2006 Actual $'000	Parent 2007 Actual $'000	Parent 2006 Actual $'000
Net surplus		**10,461**	**10,342**	**13,607**	**15,753**
Add/(less) items classified as investing activities					
Net loss/(gain) on disposal of property, plant, & equipment		161	310	10	32
Net loss/(gain) on disposal of associate		(93)	–	–	–
		68	**310**	**10**	**32**
Add/(less) non-cash items					
Share of associate's (profit)/deficit for the year		(60)	91	–	–
Depreciation		8,570	8,743	7,184	7,189
(Surplus)/deficit attributable to minority interests		(8)	80	–	–
Amortisation of identifiable intangibles		38	39	–	–
Unrealised changes in the value of subsidiaries		(117)	200	–	–
(Gain)/loss on foreign currency loan		(14)	(115)	–	–
Increase/(decrease) in employee entitlements		(77)	(47)	(80)	(54)
Increase/(decrease) in provisions	24	–	–	–	584
(Increase)/decrease in future income taxation benefit		918	(356)	1,023	(138)
		9,250	**8,635**	**8,127**	**7,581**
Add/(less) movements in working capital items					
Increase/(decrease) in payables and accruals		(769)	4,029	(396)	3,247
Increase/(decrease) in employee entitlements		547	1,427	536	1,617
(Increase)/decrease in receivables and prepayments		(2,187)	(2,377)	(2,294)	(4,046)
(Increase)/decrease in inventory and uninvoiced receivables		(3,059)	553	(2,935)	196
(Increase)/decrease in taxation receivable		(1,601)	101	(1,797)	(31)
		(7,069)	**3,733**	**(6,886)**	**984**
Net cash inflow from operating activities		**12,710**	**23,020**	**14,858**	**24,350**

20 Investments

Investment in subsidiaries	21	–	–	12,709	12,709
Investment in associates	22	559	491	500	537
		559	**491**	**13,209**	**13,246**

21 Investments in subsidiaries

Name	Principal activities	Ownership and voting interest 2007 %	2006 %
NIWA Vessel Management Ltd	Vessel charters for scientific research	100	100
NIWA Natural Solutions Ltd	Commercialisation of NIWA products	100	100
NIWA Australia Pty Ltd	Scientific research and consultancy services	100	100
NIWA Environmental Research Institute	Scientific research and consultancy services	100	100
NIWA (USA), Inc.	Scientific research and consultancy services	100	100
Unidata Pty Ltd	Supplier of environmental technology products	80	80
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 the only subsidiaries incorporated in New Zealand. NIWA Australia Pty Ltd and Unidata Pty Ltd are incorporated in Australia. NIWA (USA), Incorporated and NIWA Environmental Research Institute are incorporated in the USA.

NIWA has an A$100 equity investment in NIWA Australia Pty Ltd, a US$1 equity investment in NIWA (USA), Incorporated, and an A$250,000 equity investment in Unidata Pty Ltd. NIWA has no equity investment in NIWA Environmental Research Institute (non-stock corporation). NIWA Environmental Research Institute is a not-for-profit entity which has been classified as a publicly supported organisation by the Internal Revenue Service, and as such is exempt from US Federal income tax. NIWA Environmental Research Institute conducts scientific research with a Federal or State focus in the USA.

EcoConnect Ltd has an authorised share capital of $300,000, divided into 300 000 ordinary shares of $1.00 each, all of which have been issued, are unpaid, and are beneficially owned by NIWA at 30 June 2007. EcoConnect Ltd had not commenced trading by 30 June 2007.

No shares in subsidiaries were disposed of during the year ended 30 June 2007.

22 Investments in associates

The NIWA Group acquired 50% ownership in CRL Energy Ltd on 1 April 2006.

Name	Principal activities	Group ownership and voting interest 2007 %	Group ownership and voting interest 2006 %	Group carrying amount 2007 $'000	Group carrying amount 2006 $'000
Ensid Investments Ltd	Intellectual property investments	–	50	–	24
Ensid Technologies Ltd	Commercialisation of intellectual property	–	50	–	(30)
CRL Energy Ltd	Energy & environmental research	50	50	559	497
				559	**491**

The reporting dates of associates are 30 June. The Group's share of the results of operations for the year ended 30 June 2007 has been included in the Group Financial Statements. All associates are incorporated in New Zealand.

Ensid Investments Ltd and Ensid Technologies Ltd were sold on 29 September 2006.

	Group 2007 Actual $'000	Group 2006 Actual $'000
Carrying value of associates		
Carrying value at the beginning of the year	491	47
Shares purchased	–	535
Share of gain/(net loss)	60	(91)
Sale of Ensid Investments	(24)	–
Sale of Ensid Technologies	32	–
Carrying value at the end of the year	**559**	**491**

The associates did not have contingent liabilities or other commitments contracted for as at 30 June 2007, other than for the supply of inventories. The Group is not jointly or severally liable for any liabilities of the associate companies.

The value of investments in associates is carried in the Parent Company at cost.

23 Loans to associates

	Group 2007 Actual $'000	Group 2006 Actual $'000	Parent 2007 Actual $'000	Parent 2006 Actual $'000
Ensid Investments Ltd	–	26	–	26
Ensid Technologies Ltd	–	80	–	–
	–	**106**	**–**	**26**

The loan to Ensid Investments Limited and Ensid Technologies Limited were settled on 30 September 2006.

24 Intercompany

	Parent 2007 Actual $'000	Parent 2006 Actual $'000
NIWA non-current liability	**9,587**	**12,119**

An amount of $10.8 million is held by the Parent Company (NIWA) on behalf of NIWA Vessel Management Ltd. This is consistent with the Group policy that all surplus funds are managed by NIWA. This amount is offset by Parent Company receivables and advances to NIWA Australia Pty Ltd of $196,000, NIWA Environmental Research Institute of $168,000, NIWA (USA), Incorporated of $18,000, NIWA Natural Solutions Ltd of $2,000, and Unidata Pty Ltd of $810,000, resulting in a net non-current liability of $9.6 million. All balances are unsecured and have no set repayment terms, but are not expected to be repaid within one year of balance date. The balances are not subject to interest.

During the year the Parent Company agreed to a partial defeasance of the loans advanced to NIWA Natural Solutions Ltd to the value of NZ$240,000. The Directors still expect the remaining advances to subsidiaries to be fully recovered, but not in the short term. The Parent Company raised a provision in 2005 to the value of the subsidiaries that had a negative net asset provision. No provision was recognised in the 2006 year.

During the year NIWA contracted vessel charters from its subsidiary NIWA Vessel Management Ltd totalling $10.9 million (2006: $9.4 million) and purchased workshop services totalling $58,712 (2006: $38,224). NIWA Vessel Management Ltd contracted services from its Parent, NIWA Science, totalling $194,969 (2006: $1.2 million).

During the year NIWA contracted scientific research from its subsidiary NIWA Australia Pty Ltd totalling Nil (2006: $267,523) and provided research services to NIWA Australia Pty Ltd of $392,692 (2006: $53,245).

NIWA earned revenue of $87,565 (2006: $62,410) from research subcontracts with NIWA Environmental Research Institute.

NIWA Natural Solutions Ltd purchased products from NIWA for $709,656 (2006: $633,910).

NIWA charged its subsidiaries for administration expenses and management services totalling $1.1 million for the financial year (2006: $1.3 million).

There were no other significant transactions between any of the companies in the Group. All transactions with subsidiaries are carried out on an arms-length basis.

25 Joint ventures

The Group has a 50% participating interest in Riskscape NZ, an unincorporated joint venture of equal interests with Geological Risk Limited (a wholly owned subsidiary company of the GNS Science Ltd). Riskscape NZ commenced operations in April 2005 and had a first balance date of 30 June 2005. The Group's interests in this joint venture had an immaterial effect on the Financial Statements.

26 Related party transactions

The Government of New Zealand (the Crown) is the ultimate shareholder of the NIWA Group. All transactions with other Government-owned entities are carried out on an arms-length basis.

Research activities revenue includes amounts received from the Crown or Crown-owned entities as follows:

	Group 2007 Actual $'000	Group 2006 Actual $'000	**Parent 2007 Actual $'000**	Parent 2006 Actual $'000
Public Good Science and Technology				
Contract funding	44,324	42,895	44,324	42,845
Capability Fund	9,094	7,479	9,094	7,479
Ministry of Fisheries	17,183	16,060	17,183	16,060
Ministry for the Environment	228	443	228	443
Department of Conservation	1,287	781	1,287	781
Land Information New Zealand	4,407	6,405	1,068	973
Genesis Energy	921	1,030	921	1,030
Meridian Energy	1,328	1,788	1,328	1,788
Mighty River Power	585	832	585	832
Ministry of Agriculture & Forestry	4,728	1,578	4,728	1,578

The NIWA Group did not write off or forgive any related party balances during the year.

27 Segment information

The Group operates predominantly in New Zealand in two industries – research and vessel charter.

Industry segments	**Total**		**Research**		**Vessel charter**		**Eliminations**	
	2007 $'000	2006 $'000	**2007 $'000**	2006 $'000	**2007 $'000**	2006 $'000	**2007 $'000**	2006 $'000
Revenue:								
From customers outside the Group	113,911	106,414	107,841	100,969	6,070	5,445	–	–
Inter-segment	–	–	1,095	1,261	11,002	9,403	(12,097)	(10,664)
Total revenue	**113,911**	**106,414**	**108,936**	**102,230**	**17,072**	**14,848**	**(12,097)**	**(10,664)**
Surplus before taxation	15,843	15,706	10,590	11,203	5,253	4,310	–	(193)
Unallocated expenses	–	–						
Total surplus before taxation	**15,843**	**15,706**						
Segment assets	78,031	68,758	55,520	42,506	22,511	26,252	–	–
Total assets	**78,031**	**68,758**						

The major products or services from which the above segments derive revenue are:

Segment	**Products and services**
Research	Atmospheric and aquatic research, consultancy, and associated products and services
Vessel charter	Charter of vessels for scientific research

All inter-segment pricing is on an arms-length basis.

28 Financial instruments

28a Currency and interest rate risk

Nature of activities and management policies with respect to financial instruments:

(i) Currency

Currency risk is the risk that the value of a financial instrument will fluctuate due to changes in foreign exchange rates.

The Group undertakes transactions denominated 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 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 no forward foreign exchange arrangements in place (2006: $nil).

(ii) Interest rate

Interest rate risk is the risk that the value of the financial instrument will fluctuate because of changes in market interest rates. This could particularly affect the cost of borrowing and the return on investments.

28 Financial instruments (continued)

The interest rates on NIWA's borrowings during the year were:

	2007	2006
On call	–	7.45–11.35%
Short term	–	–

The interest rates on NIWA's investments during the year were:

	2007	2006
Cash (on call)	7.20–7.95%	6.75–7.25%

Short-term deposits have maturity dates of less than 6 months. The Directors do not consider there is any significant exposure to interest rate risk on investments. All investments 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.

(iii) 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 and transactions with financial institutions (cash and short-term deposits). 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 trade receivables dealt with.

There are no significant concentrations of credit risk. The maximum exposure to credit risk is $23,867,000 (total exposed to credit risk, which is bank, short-term investments, and debtors, net of provisions).

28b Fair values

The estimated fair values of the Group's financial instruments approximate their carrying values, as disclosed in the Statement of Financial Position.

29 Foreign currency denominated monetary assets and liabilities

	Group 2007 Actual $'000	Group 2006 Actual $'000	Parent 2007 Actual $'000	Parent 2006 Actual $'000
Current assets not hedged:				
Australian dollars	863	979	15	73
European euro	1	52	1	52
Japanese yen	82	144	82	144
US dollars	186	170	71	29
Current liabilities not hedged:				
Australian dollars	254	92	–	–

Current assets include foreign currency bank balances, deposits, and accounts receivable. Current liabilities include foreign currency accounts payable and accrued expenses.

30 Commitments

30a Operating lease obligations

Obligations payable after balance date on non-cancellable operating leases:				
Within 1 year	1,188	984	1,133	923
Between 1 and 2 years	961	885	961	825
Between 2 and 5 years	2,028	2,237	2,028	2,237
Over 5 years	4,860	3,468	4,860	3,468
	9,037	**7,574**	**8,982**	**7,453**

30b Capital commitments

Commitments for future capital expenditure:				
Contracted, but not provided for	110	98	110	23
	110	**98**	**110**	**23**

31 Contingent liabilities

New Zealand companies have a contingent liability in respect of the Accident Compensation Commission's residual claims levy. The levy will be payable annually from May 1999 for up to 15 years. Each company's future liability depends on ACC's unfunded liability for past claims and future payments to employees by the companies. There are no other significant contingent liabilities that require disclosure in the Financial Statements.

32 Subsequent events

There were no subsequent events.

Audit Report

Deloitte.

TO THE READERS OF

NATIONAL INSTITUTE OF WATER & ATMOSPHERIC RESEARCH LIMITED AND GROUP'S FINANCIAL STATEMENTS FOR THE YEAR ENDED 30 JUNE 2007

The Auditor-General is the auditor of National Institute of Water & Atmospheric Research Limited (the company) and group. The Auditor-General has appointed me, Andrew Burgess, using the staff and resources of Deloitte, to carry out the audit of the financial statements of the company and group, on his behalf, for the year ended 30 June 2007.

Unqualified Opinion

In our opinion:

- The financial statements of the company and group on pages 67 to 79:
  - comply with generally accepted accounting practice in New Zealand; and
  - give a true and fair view of:
    - the company and group's financial position as at 30 June 2007; and
    - the results of operations and cash flows for the year ended on that date.
- Based on our examination the company and group kept proper accounting records.

The audit was completed on 27 August 2007, and is the date at which our opinion is expressed.

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

Basis of Opinion

We carried out the audit in accordance with the Auditor-General's Auditing Standards, which incorporate the New Zealand Auditing Standards.

We planned and performed our audit to obtain all the information and explanations we considered necessary in order to obtain reasonable assurance that the financial statements did not have material misstatements, whether caused by fraud or error.

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 the opinion.

The audit involved performing procedures to test the information presented in the financial statements. We assessed the results of those procedures in forming our opinion.

Audit procedures generally include:

- determining whether significant financial and management controls are working and can be relied on to produce complete and accurate data;
- verifying samples of transactions and account balances;
- performing analyses to identify anomalies in the reported data;
- reviewing significant estimates and judgements made by the Board of Directors;
- confirming year-end balances;
- determining whether accounting policies are appropriate and consistently applied; and
- determining whether all financial statement disclosures are adequate.

We did not examine every transaction, nor do we guarantee complete accuracy of the financial statements.

We evaluated the overall adequacy of the presentation of information in the financial statements. We obtained all the information and explanations we required to support the opinion above.

Responsibilities of the Board of Directors and the Auditor

The Board of Directors is responsible for preparing financial statements in accordance with generally accepted accounting practice in New Zealand. Those financial statements must give a true and fair view of the financial position of the company and group as at 30 June 2007. They must also give a true and fair view of the results of operations and cash flows for the year ended on that date. The Board of Directors responsibilities arise from the Crown Research Institutes Act 1992 and the Financial Reporting Act 1993.

We are responsible for expressing an independent opinion on the financial statements and reporting that opinion to you. This 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 Institute of Chartered Accountants of New Zealand.

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

A G Burgess
DELOITTE
On behalf of the Auditor-General
Auckland, New Zealand

This audit report relates to the financial statements of National Institute of Water & Atmospheric Research Limited (NIWA) and group for the year ended 30 June 2007 included on NIWA's website. NIWA's board of directors are responsible for the maintenance and integrity of NIWA's website. We have not been engaged to report on the integrity of NIWA'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/from these 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 27 August 2007 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 statements may differ from legislation in other jurisdictions.

Performance against Statement of Corporate Intent (SCI)

Financial Performance Measures

	2006–07 Actual	2006–07 Target	2005–06 Actual
Revenue	$113.9M	$102.6M	$106.4M
Current ratio	1.3	1.0	0.9
Quick ratio	1.9	1.3	1.2
Return average on equity	22.6%	13.7%	24.4%
Return average on assets	21.2%	13.5%	22.7%
EBIT margin	13.7%	8.5%	14.5%
Non-Financial Performance Measures			
Staff composition (incl. all Subsidiaries)			
Number of permanent staff in			
Research teams	481	458	462
Research support	43	46	46
General support	101	104	104
Management	25	26	26
Postdocs	17	18	13
Total	667	655	651
Number of FTEs (permanent and postdocs)			
Research teams (incl. postdocs)	486	450	
Research support	42	45	
Other FTEs	120	145	
Total FTEs	648	640	
Staff turnover	13%	8%	9.8%
Good employer			
Lost time injuries (% of work days)	0.04%	<0.05%	0.05%
Days lost to injury (NIWA Science)	73.5		73.9
Staff receiving training	358	500	
Staff with personal development plans	55%	80%	
New positions in rural areas	4	10	
Research output*			
Commissioned reports to end-users	479	580	609
Presentations on technical information and research results	966	800	1020
Publications on technical information and research results	346	150	102
Peer reviewed articles in international journals	291	320	369
Key note and plenary presentations	13	30	
Research monographs and books	114	70	83
Popular books	11	2	1
Application and promotion of science			
Value of consultancies to NZ users	$34.5M	>$24M	$35M
Achievements of technology transfer objectives in FRST contracts	97%	95%	98%
Number of external training courses/workshops	17		15
Value of TBG and Technet contracts	$322K	>$1M	$649K
External requests serviced for information from NIWA's nationally significant public good databases			
• National Climate Database	21 740	10 000	88 690
• Water Resources Archive	55 920	1 200	10 200
• NZ Freshwater Fish Database	1 457	1 400	1 309
Magazine and newspaper feature articles plus TV and radio interviews	190	220	231
Number of teaching fellowships	3		
Number of PhD and MSc students supervised	62		
Number of significant new or improved products, processes, and services	4	20	
Number of patents granted			
– NZ	1	1	
– Overseas	1	1	11
Number of licence arrangements entered into	10	15	
Number of joint ventures or formal associations	6	1	
Number of representatives on international committees	96	110	
Visiting scientists (funded by NIWA)	10		18

** Measured for a calendar year.*

Directory

National Institute of Water & Atmospheric Research Ltd

Directors

Sue Suckling (*Chair*)
John Spencer (*Deputy Chair*)
Miranda Cassidy (resigned 30 September 2006)
Craig Ellison (appointed 1 July 2007)
John Hercus
Dr Graham Hill
Ed Johnson
Wendy Lawson
Troy Newton
David Sharp (resigned 30 June 2007)

Executive Management Team

John Morgan
Chief Executive Officer

Dr Bryce Cooper
Director, Strategic Development

Dr Mark James
Director, Operations

Dr Rob Murdoch
Director, Research

Kate Thomson
Chief Financial Officer

Geoff Baird
General Manager, Communications & Marketing

Sasha Blair
General Manager, Human Resources

Arian de Wit
General Manager, Information Systems

Science Executive Team

Nicholas Bain
General Manager, Commercialisation

Dr Barry Biggs
General Manager, Environmental Information & International

Andrew Forsythe
General Manager, Aquaculture & Biotechnology

Dr Clive Howard-Williams
General Manager, Freshwater & Coasts

Dr John McKoy
General Manager, Fisheries

Dr Murray Poulter
General Manager, Atmosphere, Natural Hazards, & Energy

Dr Don Robertson
General Manager, Aquatic Biodiversity & Biosecurity

Dr Charlotte Severne
General Manager, Māori Development & Oceans

Fred Smits
General Manager, Operations, NIWA Vessel Management Ltd

Dr David Wratt
General Manager, Climate Change

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Deloitte on behalf of the Auditor-General

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Solicitors

Bell Gully Buddle Weir

Insurance Broker

Marsh Limited

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Tel +64-4-386 0550
Fax +64-4-386 0555
www.niwavessels.co.nz

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Tel +61-8-9331 8600
Fax +61-8-9331 8611
www.unidata.com.au

CRL Energy Ltd
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Fax +64-4-570 3701
www.crl.co.nz

National Centres

Aquatic Biodiversity & Biosecurity
www.niwascience.co.nz/ncabb

Climate
www.niwascience.co.nz/ncc

Climate–Energy Solutions
www.niwascience.co.nz/ncces

Coasts & Oceans
www.niwascience.co.nz/ncco

Fisheries & Aquaculture
www.niwascience.co.nz/ncfa

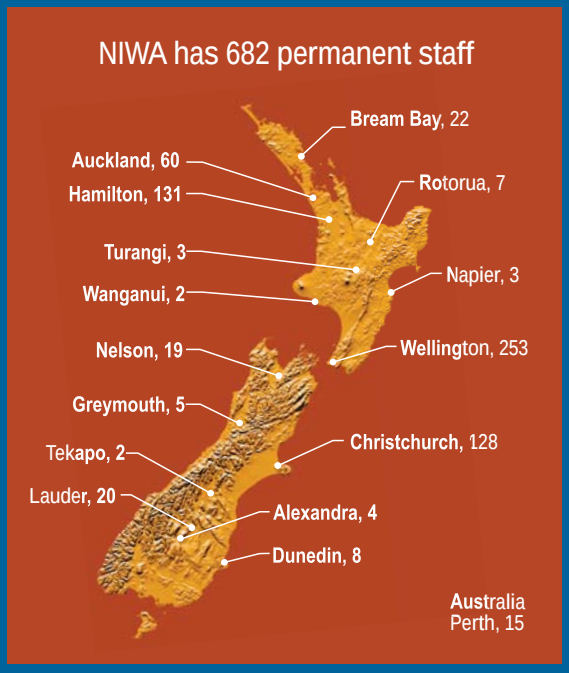
Natural Hazards
www.naturalhazards.net.nz

Water Resources
www.niwascience.co.nz/ncwr

Service Centres

Te Kūwaha
www.niwascience.co.nz/rc/maori

NIWA Instrument Systems
www.niwascience.co.nz/
instrumentsystems



www.niwa.co.nz

National Institute of Water & Atmospheric Research Ltd

science supporting sustainability