NIWA
Taihoro Nukurangi

2005
Annual Report

great science great services great staff

NIWA at a glance

NIWA is an internationally respected research organisation dedicated to creating and delivering innovative and unrivalled science-based products and services that enable people and businesses to make best use of the natural environment and its living resources, and derive benefit from them in a sustainable manner.

Our science provides the basis for sustainable resource management, and our consultancy services help clients solve problems on the use and management of:

- Atmosphere, Natural Hazards, & Energy
- Coasts & Oceans
- Freshwater
- Aquatic Biodiversity & Biosecurity
- Fisheries
- Aquaculture & Marine Natural Products

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 largely doubled or trebled: NIWA now has 611 staff at 15 sites around New Zealand, revenue of $91 million, and assets of $70 million.

NIWA Group consists of the parent company NIWA Science and six subsidiaries.
NIWA Science is the source of our innovative ideas and leading edge science, the creator of most of our intellectual property, the foundation of our extensive consultancy services, and the generator of the bulk of our revenue;
NIWA Vessel Management Ltd provides vessels for charter for scientific research;
NIWA Natural Solutions Ltd commercialises products and technologies developed by NIWA;
NIWA Australia Pty Ltd provides scientific research and consultancy services in Australia;
NIWA USA (which has registered not-for-profit and commercial entities) provides scientific research and consultancy services in the USA;
Unidata Pty Ltd (80% owned by NIWA) creates and manufactures new technologies for environmental monitoring and real-time decision support networks;
EcoConnect Ltd (a joint venture with the UK Met Office) was created to deliver real-time environmental forecasts.

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'.

www.niwa.co.nz

Cover: NIWA's deepwater research vessel Tangaroa.

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NIWA
Taihoro Nukurangi

National Institute of Water & Atmospheric Research Ltd

science behind the sustainable use of our natural environment and its living resources

It's been an extraordinary year

A report from the Chair and Chief Executive

Over the last 12 years, NIWA has developed into a very successful research organisation and commercial consultancy firm, with a reputation for excellent science, excellent services, strong financial performance, and high staff morale. During 2004–05 this tradition continued. We made major advances in many of our core science areas, further enhanced the breadth and quality of our commercial services, established several new productive partnerships, worked efficiently and effectively as a team, and finished the year with the best financial results in NIWA's history.

Chair Sue Suckling and Chief Executive Rick Pridmore.

For the year to 30 June 2005, NIWA achieved a group operating surplus before tax of $9.7 million, against $7.0 million in the previous year. Net surplus after tax was $6.4 million ($5.3 million in 2003–04). Gross revenue from research, consulting, vessel operations, and all other business activities was $91.1 million ($84.6 million in 2003–04). NIWA's after-tax return on average shareholders' equity (of $47.8 million) was 13.5%. A total of $2.2 million was allocated to NIWA's ongoing staff profit-share scheme before arriving at the surplus before tax. A dividend of $15 million was paid to the Crown.

This year's performance was particularly pleasing because it was the first year since 1998 that our research and vessel companies performed strongly at the same time. Over the last three years we have put considerable effort into increasing the competitiveness of our research and consulting business (NIWA Science) and establishing a stronger financial footing for our vessel company (NIWA Vessel Management). The benefits from these strategic initiatives are now beginning to appear.

Financial summary

	2005 $'000	2004 $'000	2003 $'000	2002 $'000	2001 $'000
Total Revenue	**91,137**	84,631	84,200	81,312	77,113
– Public Good Science	**43,729**	39,591	39,780	37,869	37,359
– Ministry of Fisheries	**16,626**	14,602	16,705	16,260	13,701
– Commercial and Other	**30,782**	30,438	27,715	27,183	26,053
Net profit before tax	**9,654**	7,036	7,216	7,465	7,328
Net profit after tax	**6,434**	5,276	4,726	4,730	4,717
Capital expenditure	**7,348**	8,389	9,064	10,173	8,586
Return on average equity (%)	**13.5**	10.7	10.6	9.6	8.7

Chair and Chief Executive's report

Strong growth in research and consulting

NIWA Science won seven new grants from the Foundation for Research, Science & Technology this year, which increased total research revenue for the year by $4.1 million. Five of these grants support four-year research programmes. They will help to develop new air quality standards, create new products based on the incorporation of antifoulant bioactive compounds into plastics, improve natural hazard forecasts and risk assessments, produce new technologies for generating energy from wastewater biomass, and enhance the measurement of greenhouse gases. Research conducted for the Ministry of Fisheries increased by $2 million this year. We completed stock assessment surveys for a variety of species, including orange roughy, hoki, scampi, oysters, southern blue whiting, and blue cod. We also carried out research on the biodiversity of seamounts, the biosecurity risks associated with vessel hull fouling, the trophic relationships of middle-depth fish on the Chatham Rise, and the spread of selected invasive species.

We produced some stunning science. For example, we used new data-mining tools to produce maps showing where the most diverse fish communities occur around New Zealand, we devised an ingenious method for assessing the health of coastal and estuarine areas, and we created a highly innovative model for resource managers that predicts the likely flow in any New Zealand stream. We developed the first stock assessment model for Antarctic toothfish in the Ross Sea, and we brought into commercial production a novel feed for maintaining the condition of lobsters before they are sent to market. We improved definition of the distribution of potential coastal earthquake sources, and we quantified how the drought risk in New Zealand might change under global warming. Many of these achievements, and more, are detailed later in this Annual Report.

Pete Hodgson, as Minister of Research, Science & Technology, launches the National Centre for Coasts & Oceans.

Our seven National Centres continued to blossom. These Centres – which cover Aquatic Biodiversity & Biosecurity, Climate, Climate–Energy Solutions, Coasts & Oceans, Fisheries & Aquaculture, Natural Hazards, and Water Resources – bridge the gap between the creators of science knowledge and the users of science knowledge. They ensure that appropriate tools, services, and information are available to guide decision making and the formulation of policies, to develop new business opportunities, to enhance the performance of existing businesses, to mitigate loss of life and property damage, and to ensure the sustainable use of New Zealand's natural resources. Each Centre is supported by a newsletter and dedicated webpages. The Centres have helped greatly to improve the we plan to improve the range of tools, services, and information to ensure that our science is quickly assimilated and used effectively in achieving New Zealand's economic, social, and environmental goals.

In fulfilling our research and consulting commitments, NIWA staff gave more than 700 presentations, published more than 450 refereed scientific papers, wrote more than 600 client reports, contributed to 194 media releases, and serviced more than 11 000 requests for information. An additional 150 000 requests for information were serviced by users interacting directly with our electronic database pages. Our website had more than 19 million pages viewed.

Our relationships, both nationally and internationally, have also grown in number and strength. In a collaborative effort with the University of Washington and Scripps Institution of Oceanography we deployed more than 200 Argo floats to monitor changes in global climate. We carried out fisheries acoustic surveys with the Irish Marine Institute in the North Atlantic and the British Antarctic Survey in the South Atlantic. We ran eight training programmes for Pacific Island states on hydrology, climatology, water quality monitoring, and stream ecosystem health.

Chair and Chief Executive's report

Our work with government departments has helped develop important national databases for biodiversity and biosecurity information, predict the spread of undesirable pests and diseases, understand the effects of climate variability on the economy, and create novel habitat and environmental classification systems for improved resource management. Through active and positive relationships with regional and local authorities, we have been able to help plan how their communities will grow and make best use of their land, water, and climate. We have improved natural hazard forecasts, and we are working with civil defence and emergency management groups to improve community response to natural hazards.

Our work with the energy sector has helped to assess new initiatives, identify and quantify sources of renewable energy, and introduce appropriate technology to remote communities. In collaboration with the primary production sector, we helped quantify the abundance of selected fish stocks, determined where best to put new aquaculture farms, brought new finfish species into commercial production, identified the best sites to plant selected crops, and helped find ways to optimise dairy production whilst minimising environmental concerns.

The tide turns for our vessels

We have had similar success with our vessel company. After two years of declining use of our research vessels *Tangaroa* and *Kaharoa*, the tide has finally turned. NIWA Vessel Management is now on a stronger financial footing as a result of two government initiatives to support the use of *Tangaroa*. Firstly, the Foundation for Research, Science & Technology received an additional $1.7 million per year to enable it to pay the full market rate to hire *Tangaroa* for oceanographic research. Secondly, Ocean Survey 20/20, a 15-year project funded through Land Information New Zealand to provide new knowledge of the nation's seafloor and ocean resources, will purchase $3.4 million of *Tangaroa* time each year for the next seven years.

Ministers Pete Hodgson and Steve Maharey with Sue and Rick at the launch of the Ocean Survey 20/20.

We also made good progress in securing third-party charters for our vessels. These included site surveys by *Tangaroa* for the oil and gas industry, and the use of *Kaharoa* to deploy profiling floats across the Pacific as part of the international Argo programme. Third-party charters made up more than 30% of the revenue earned by NIWA Vessel Management, and helped ensure that the vessels were well used this year – *Tangaroa* for 300 days and *Kaharoa* for 204.

Commercialisation – a growing range of products

Another strategic initiative which has begun to bear fruit is the generation of new revenue by selling products and services that are not tightly linked to staff time.

Over the last three years NIWA has moved from being a company that thought about the commercialisation of aquaculture products and bioactive compounds to one that is actively doing so. Since the establishment of NIWA Natural Solutions in February 2004 a rigorous stage-gate commercialisation process has been put in place, an assessment of our intellectual property has been made, governance and management frameworks for spin-off companies have been developed, and commercial targets have been set for existing businesses selling juvenile salmon, paua, and kingfish for ongrowing by industry. We have also identified how we can help transform the seafood and marine natural product sectors in New Zealand, rather than just assist them through fee-for-service contracts. Our research in aquaculture and bioactive compounds has been integrated with the aim of producing a range of value-added products for each species we bring into aquaculture. We developed strong partnerships with industry and other research providers to help achieve this goal. During 2005–06 we plan to invest significantly in the commercialisation of aquaculture products and bioactive compounds, and we look forward to forming more partnerships with industry.

Juvenile kingfish.

We also made major advances in the delivery of products and services related to environmental forecasting and real-time data assimilation. There is little doubt that environmental science has now come of age and is ready to offer a new range of products and services that are quite distinct from those of the last 25 years. This new age of environmental forecasting and real-time data assimilation will become the principal means of delivering benefits from research for most large environmental science organisations over the next ten years. It will add a whole new dimension to the economic performance and risk management of businesses, increase the scope, accuracy, and communication of natural hazard forecasts, guide efficient and effective use of resources, enhance protection of the environment, and improve the health and safety of individuals. What separates this scientific thrust from past endeavours is the technology involved. To deliver products and services in this new age will require a high-performance computing facility (such as our Cray T3E), world-class environmental models, a sophisticated electronic data storage and retrieval system, real-time monitoring networks, interactive decision support tools, and compatible communications based on internet and wireless technologies. All these technologies now exist within NIWA.

We made significant progress in establishing Unidata, our instrument manufacturing subsidiary, as a global market provider of environmental monitoring equipment and associated technologies. We improved its core products, developed effective partnerships and distributor networks in Australia, Europe, the USA, and Canada, and commissioned new leading-edge technology. Joint projects between Unidata and NIWA Science have extended our environmental monitoring services into Asia.

We have also made good progress in the development of EcoConnect, which was formed in September 2004 with the UK Met Office to deliver environmental forecasts, first in New Zealand and eventually in the United Kingdom and the rest of Europe. This year we focused on developing the appropriate infrastructure to run EcoConnect. Most of the company's processes will be automated – from weather forecasts to the electronic delivery of environmental forecasts, emergency warnings, and real-time data – so this task was immense and required (and will continue to require) extensive linking of hardware and software between the UK Met Office and NIWA. It is important that we continue to build on this progress in 2005–06 so that EcoConnect can go 'live' during the year.

The outlook for 2005–06

As a result of the strategic initiatives undertaken over the last three years, NIWA has become a much more robust company. We are no longer an organisation that just sells staff and vessel time and bears all commercial risks. We have created new opportunities to sell a diverse range of products and services, and we are increasingly promoting ourselves, sharing risks, and leading new sector initiatives with others (for example, our 80% shareholding in Unidata and our 50% shareholding in EcoConnect). This year we established appropriate governance and management frameworks to ensure that all entities within the NIWA Group develop efficiently and effectively. The emphasis in 2005–06 will be on driving all businesses harder to achieve both our financial goals and the continued transformation of NIWA. It is important that NIWA maintains its excellent science, strong market focus, and leadership role in all relevant sectors.

Tangaroa *in dry dock after hull scraping and repainting.*

Chair and Chief Executive's report

Major strategic initiatives for 2005–06 include:

- strengthening governance and management frameworks, relationships, and skills to ensure that all entities in the NIWA Group continue to develop efficiently and effectively;
- increasing the revenue and effectiveness of our research and consulting businesses (NIWA Science, NIWA Australia, NIWA USA);
- building a more secure client base for our vessel company (NIWA Vessel Management);
- establishing NIWA Natural Solutions as an important vehicle in the commercialisation of products (particularly with early-stage investors);
- strengthening the manufacturing capability and product range of Unidata to enhance NIWA's position in environmental monitoring and the development of real-time decision support tools;
- establishing EcoConnect as a highly reputable environmental forecasting service in Australasia, the United Kingdom, and the rest of Europe.


Unidata Newsline

Exciting developments at Unidata

Focus on excellence

A new company formed

The first of the Unidata Newslines.

Taking care of our greatest assets

The initiatives outlined above will have a significant impact on the way we structure activities within the NIWA Group and on staff perceptions of NIWA as an employer. It is essential that we achieve change without hurting staff morale, dampening innovation, or reducing our strong work ethic. Key staff issues across the NIWA Group include the need to reward staff well, recruitment and retention, and maintenance of critical mass. Many of our core science areas have lost considerable research time over the last six years, and maintaining these capabilities (and associated morale and productivity) is an increasing challenge. The Capability Fund (allocated by the Ministry of Research, Science & Technology) plays an important role in maintaining and fostering essential research capabilities and in developing new opportunities for growth. Without the Capability Fund we would struggle to be an innovative research and development company, and synergies between the different entities of the NIWA Group would largely end.

We are committed to providing a safe and healthy working environment that enhances professional and career development, promotes a healthy work-life balance, rewards staff within the financial constraints of the company, and promotes innovation and excellence in scientific research, commercial services, product development, and the commercialisation of intellectual property.

Safety at sea training.

Chair and Chief Executive's report

We have an excellent working relationship with the Public Services Association (PSA), and the PSA Partnership Forum is a well-established process for sharing information with the union on key issues affecting staff. We negotiated new Collective Employment Agreements for NIWA Science and NIWA Vessel Management. We developed succession, recruitment, and training plans for all core capability areas. In collaboration with the PSA we reviewed career pathways for technical staff. We reduced the number of administrative or leadership roles performed by any one individual, to ease stress and allow greater focus on research and consulting activities. We ran training modules to improve the skills of individuals managing, mentoring, and assessing staff. We revised the Project Management System to improve internal reporting, better meet client needs, provide more high-quality information, better identify risks, and improve the management and protection of our intellectual property.

We are also committed to operating in a sustainable manner. We take sustainable development reporting seriously, and we are a member of the New Zealand Business Council for Sustainable Development. Many of our core business activities contribute directly to the sustainable development of New Zealand's natural and human resources by providing scientific advice, products, and services. A growing component of our work is directed at creating new business and job opportunities, both in the main city centres and in rural areas. We take particular care to minimise the impact of our activities on the environment, and to ensure that individuals and communities potentially affected by our actions are well informed and consulted about how we plan to proceed. We support extensive interactions with non-government organisations and community groups, and we contribute significantly to the education of primary, secondary, and tertiary students. We also provide information and training for local and central government agencies and the wider public. Internationally, we represent New Zealand at a vast array of scientific meetings and inter-government forums. This year we made good progress in reducing energy use, promoting recycling and waste reduction, investigating alternative transport options, promoting teleconferencing, and conserving water. This information and more is included in the 'Sustainable Development' section of this Annual Report. Once again, this section was verified by independent experts.

In closing, we thank our Board, staff, collaborators, and stakeholders for their valuable contributions throughout the year. Together, we have brought great benefit to New Zealand.

Sue Suckling
Chair

Rick Pridmore
Chief Executive

A brief history of NIWA

NIWA (the National Institute of Water & Atmospheric Research Ltd) is a Crown Research Institute. It was incorporated as a company on 1 July 1992. Ownership is held equally between two shareholding Ministers appointed by the New Zealand Government (the Crown). NIWA is New Zealand's leading provider of atmospheric and aquatic research and associated products and services. NIWA's diverse range of activities and skills benefit New Zealand by fostering economic growth, enhancing human well-being, and ensuring the sustainable use and development of our natural resources.

The diagram shows the evolution of the NIWA Group which now consists of the parent company (NIWA Science) and six subsidiaries.

NIWA Science employs about 600 staff spread across 15 sites. The main campuses are in Auckland, Hamilton, Wellington, Nelson, Christchurch, and Lauder. Revenue is generated principally from fully contested Government research contracts and consultancy services to a diverse array of clients.

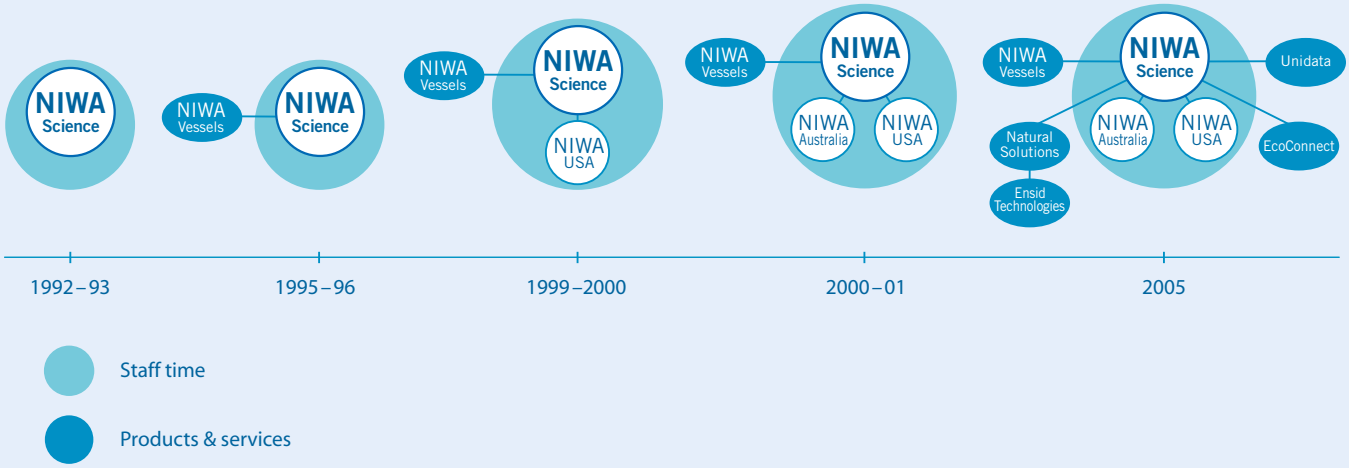
NIWA Vessel Management Ltd, NIWA Australia Pty Ltd, NIWA USA (with registered not-for-profit and commercial entities), and NIWA Natural Solutions Ltd are all wholly owned by NIWA.

NIWA Vessel Management Ltd owns and operates two research vessels (*Tangaroa* and *Kaharoa*) and employs about 40 staff. The companies in Australia and the USA provide similar services to NIWA Science, but are more targeted to the specific needs of those countries. NIWA Natural Solutions Ltd assists in the commercialisation of products and technologies developed by NIWA. It currently oversees three aquaculture businesses, and is a part-owner (50%) of Ensid Technologies Ltd, which develops and sells food-safe electronic tags.

Unidata Pty Ltd is an instrument manufacturing company in Perth, Australia, which specialises in the creation and manufacture of new technologies for environmental monitoring and real-time decision support networks. NIWA owns 80% of the shares in Unidata Pty Ltd. This company complements a similar service provided by NIWA Science in New Zealand.

EcoConnect Ltd, our newest subsidiary, is a joint venture company with the United Kingdom Met Office. NIWA holds 50% of the shares. Whilst still in the development phase, this company has been established to deliver real-time environmental forecasts in Australasia, the United Kingdom, and the rest of Europe.

NIWA's evolution



NIWA's mission

NIWA is a Crown Research Institute which helps the Government achieve its environmental, economic, and social goals.

We do this through our great science, great services, and great staff.

Our mission

NIWA is an internationally respected research organisation dedicated to creating and delivering innovative and unrivalled science-based services and products that enable people and businesses to make best use of the natural environment and its living resources, and derive benefit from them in a sustainable manner.

Our vision

NIWA will fulfil its mission by:

- maintaining and enhancing our national and international reputations for excellence in marine, freshwater, and atmospheric science;
- providing a sound scientific basis for the sustainable management and development of natural resources;
- producing new products and services to enhance environmental management, improve business performance, and increase public safety;
- ensuring optimal value is obtained from all species harvested from, or reared in, marine and fresh water;
- developing and commercialising new products to boost economic growth;
- securing a diverse portfolio of clients and partnerships to broaden our source of revenue, increase our awareness of new commercial opportunities, and minimise the Crown's ownership risks;
- operating with financial efficiency to ensure that we generate the cash flow needed to develop our business and provide an appropriate return on shareholders' funds.

This vision is consistent with the Crown Research Institutes Act 1992, which requires all Crown Research Institutes to conduct scientific research for the benefit of New Zealand and to be financially viable.

Our values

In support of our mission and vision statements we are committed to:

- promoting creativity, innovation, and teamwork;
- ensuring our core science areas are appropriately staffed and supplied with sufficient equipment and resources to conduct leading-edge science and deliver innovative and unrivalled products and services;
- maintaining a culture which is adaptable and seeks opportunities;
- being recognised for our integrity, skill, and professionalism in conducting all aspects of the company's business;
- attracting, retaining, and rewarding high quality staff;
- providing a safe and healthy working environment;
- ensuring that all staff are treated in a fair and equitable manner and that their work and private lives are appropriately balanced;
- taking social responsibility and valuing our environment;
- encouraging stakeholder participation in the setting of our research and business strategies;
- working collaboratively with other organisations and people to form partnerships that add value to our research, intellectual property, products, and services;
- honouring the principles of the Treaty of Waitangi.

The following sections illustrate the contributions our great science, great services, and great staff made in 2004–05.


A-MS

great science

Our science contributes to the sustainable use of the natural environment and its living resources. Since NIWA's establishment in 1992 our scientists have contributed substantially to environmental science and its application to sustainable development – consistently delivering great outcomes for New Zealand in our six key portfolios:

Atmosphere, Natural Hazards, & Energy

Coasts & Oceans

Freshwater

Aquatic Biodiversity & Biosecurity

Fisheries

Aquaculture & Marine Natural Products

www.niwascience.co.nz

This section reports on just a few examples of the science we conducted during 2004–05.

Atmosphere, Natural Hazards, & Energy

great science

Foot-and-mouth emergency

NIWA staff are on call at all times in case of a biosecurity alert from MAF. When MAF called in May about a possible foot-and-mouth outbreak on Waiheke Island, we put our 'Plume Dispersion Emergency Management System' (PDEMS) into operation.

Throughout the alert we fed results from Massey University's model of production of the virus into PDEMS. Our computer model incorporates data on the terrain over which the air passes, wind strength, cloud cover, land use, and other weather features, to predict the wind direction and turbulent state of the boundary layer with as much accuracy as possible. We were always able to deliver our predictions on the spread of foot-and-mouth to MAF within four hours of receiving the virus production data from Massey.

Pigs pose the greatest risk for airborne spread of foot-and-mouth. Given the weather conditions, and the few pigs on the island, our modelling showed the risk of long-range spread of the disease was slight.

Hypothetical foot-and-mouth viral plumes over Waiheke Island for the actual weather conditions on 13 May 2005, assuming that four properties with pigs were infected.

Barbara Smith (AAD) examining an ice core at Law Dome, Antarctica.

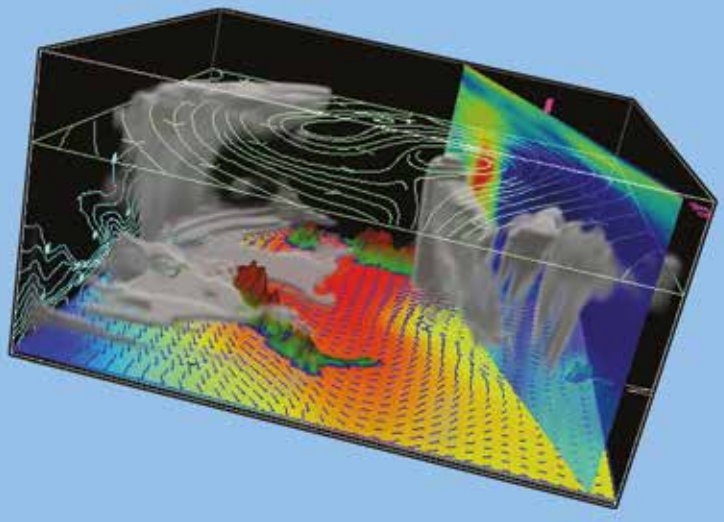
New discovery from pre-industrial methane

In the past, humans may have had a much bigger effect on the atmosphere than previously thought.

In an international collaboration between New Zealand, Australia, and the USA, methane was extracted from tiny air bubbles trapped in Antarctic ice. NIWA scientists have traced the origins of this methane by using atmospheric models and carbon isotope measurements of the extracted methane.

The isotope measurements revealed that over the last 2000 years, much higher than expected levels of methane came from forest fires, and that about 500 years ago these emissions dropped dramatically. The results parallel both natural climate change and, more surprisingly, human land use. Between 0 AD and 1500 AD, the indigenous population of the Americas burnt huge tracts of forests for agriculture and during hunting. But after European explorers arrived, the indigenous population, and emitted methane from their fires, plummeted. The results also indicate that methane emissions from wildfires are likely to be higher during El Niño events and to vary with future climate change.

Today, atmospheric methane concentrations measured at Baring Head, Wellington, are almost three times higher than those found in these ice cores.



A 3 dimensional plot of selected forecast fields from the New Zealand Limited Area Model viewed looking toward New Zealand from the northeast corner of the domain. Mean sea level pressure, surface wind vectors, cloud fraction, and wind streamlines 9 km above the surface are shown. For clarity, the vertical dimension has been exaggerated.

What the weather does

How can we accurately predict the downstream effects of weather and weather-related hazards such as flooding, storm surge, and coastal inundation? First, we need to know accurately what the weather will be. For example, flood forecasting relies on predictions of rainfall and river flow. So NIWA is developing the 'New Zealand Limited Area Model' to run on our Cray supercomputer.

Our model is an application of the most advanced numerical weather prediction model available, the Unified Model from the UK Met Office. It operates at 'high resolution' to take into account how the terrain, especially mountain ranges, affects the air flow in detail. It also operates over one of the largest 'domains' of any model of its type in the world, covering an area from New Caledonia in the north, to beyond Macquarie Island in the south, and from eastern Australia to beyond the dateline in the east. Such a large domain means we can produce accurate high-resolution forecasts for long lead times – up to 48 hours.

Another important feature, and a major research focus, is 'data assimilation', which means that we start with the best possible picture of current conditions, incorporating information from satellites as well as standard weather observing systems.

Smart badges measure UV

It's a clear day, the powder's perfect, the view breathtaking. It's time to pile on the sunblock and hit the slopes.

NIWA has used unique electronic badges in a study of UV exposure at Mt Hutt ski-field. Pinned to ski jackets, they logged the exposure every 8 seconds throughout the day. The results showed that UV exposure was much higher on the ski-field than in Christchurch on that day, but less severe than from sunbathing on a beach in summer.

The badges were designed by Martin Allen of the University of Canterbury to measure how much UV schoolchildren around the country are getting. Over the summer, almost 500 children wore the badges and recorded their activities and sun protection for a week, while we recorded ambient UV levels at each school. This is a joint project with the University of Otago, sponsored by the Cancer Society. The data are being analysed as part of a PhD study. The resulting database linking children's activities, their UV exposure, and their sunsmart awareness, will be used to develop and evaluate health promotion programmes.

great science

Mangroves are fish nurseries

As many estuaries silt up, New Zealand's mangrove forests are advancing, prompting intense debate about their ecological value and how these habitats should be managed. It's often said that mangroves support and protect young fish, but until earlier this year there was no quantitative evidence for this claim.

In March and April 2005, NIWA scientists conducted extensive field work, during night and day, sampling fish in mangrove forests around northern New Zealand.

In the relatively pristine Rangaunu Harbour (Northland), mangroves supported modest numbers of juvenile snapper, which were not found in more modified estuaries. Juvenile parore were a consistent feature of most of the six east coast estuaries studied, while juvenile grey mullet were patchily abundant in the two west coast estuaries we sampled. Yellow-eyed mullet were common in all the estuaries, and we encountered invasive bridled goby at several sites in Mahurangi Harbour. We found relatively high numbers of juvenile shortfinned eels in every mangrove forest sampled, suggesting that mangroves may also play an important nursery role for this species.

How to use radar to measure gravel

How much gravel is there on a beach? Whether there's one hundred thousand or one million cubic metres of gravel does matter.

If a beach is prone to disappearing, cliffs behind it will erode faster, and low-lying areas will be at risk from storm waves and seawater flooding. Gravel on beaches either comes from rivers in big floods or from cliff erosion, so there can be years on end when waves are washing the beach away without much replenishment. By knowing how much gravel is stored on a beach, we can tell how sensitive the coast is to fluctuations in gravel supply or to dams on rivers trapping sediment which would otherwise reach the coast.

This year, NIWA worked with the University of London to see if ground-penetrating radar could give us the answer efficiently. The radar unit is swept along a line across the ground, sending out pulses of electromagnetic radiation (like regular radar) and catching the radar waves which bounce back when the type of material under the surface changes. The technology worked well and avoids the need for time-consuming and expensive mechanical excavation (or back-breaking digging).

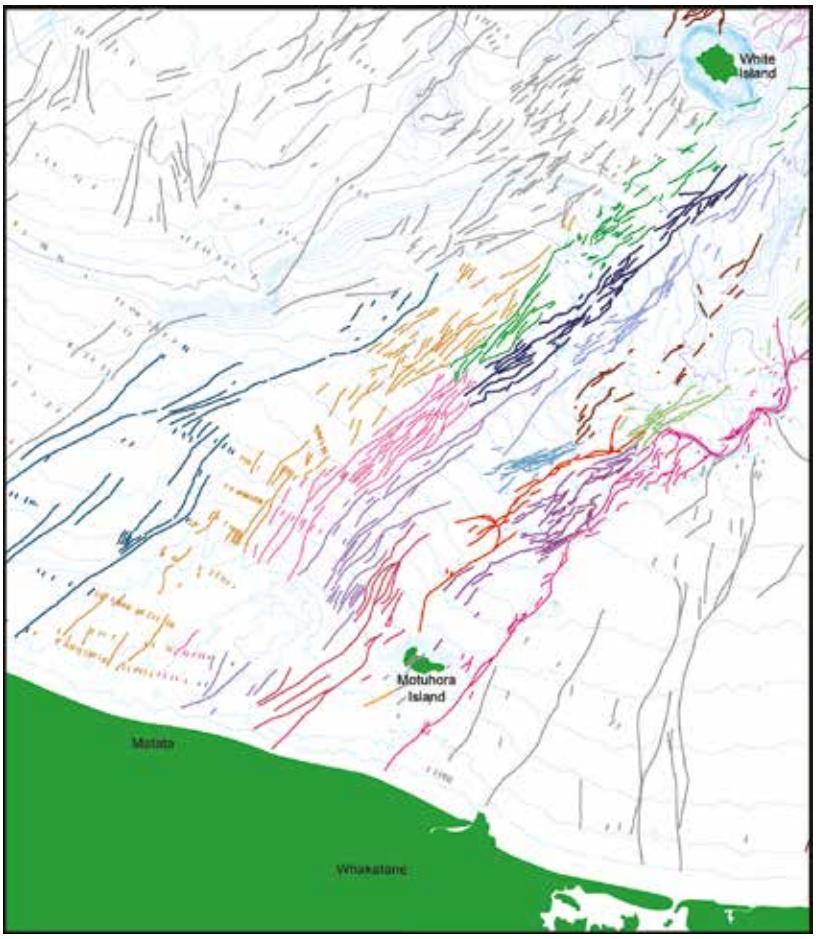
More than 150 quake sources revealed

When the Bay of Plenty's earthquake risk was assessed in 2000, 14 offshore earthquake sources were taken into account. NIWA has just completed a major 5-year study of active offshore faulting in the region, and our count now stands at 166.

The work represents a major upgrade in scientific knowledge of the region's offshore structure and active 'rifting', where the earth's crust is stretched (and potentially ripped into two plates).

Our marine geologists have mapped the seafloor precisely using multibeam acoustic equipment on *Tangaroa*. They have studied some 2200 kilometres of multi-channel seismic data, which provide them with a picture of what's underneath the seafloor down to about 3 kilometres deep. They have combined this information with high resolution seismic data showing the detail of structures as little as 40 centimetres thick in the top 40 metres of the seafloor, giving us a history of fracturation going back up to 20 000 years.

This science was funded by the Foundation for Research, Science & Technology. We are now able to provide Environment Bay of Plenty with much better estimates of the maximum magnitude of earthquakes that could credibly occur on these faults, and in some cases an estimate of their return time. The regional council will use this information for hazard planning.



How much life can the water support?

Billions of tiny plants drift in the sea around New Zealand. These phytoplankton are crucial to marine life because they use energy from the sun to produce food for marine animals. NIWA uses satellite images of the colour of the ocean to determine phytoplankton abundance: the greener the ocean, the more phytoplankton there are in the water.

Unfortunately, this method does not work near the coast, where mud and sand particles suspended in the water hide the much smaller change in colour due to phytoplankton. Brown river water, which has organic matter dissolved in it, does the same.

This year, NIWA scientists measured the colours of phytoplankton, suspended sediment, and river water in the Bay of Plenty and Hauraki Gulf. The measurements will help us to work out how abundant the phytoplankton are, even when suspended sediment and land runoff are present. This will be a major step towards estimating how much life phytoplankton can support over New Zealand's continental shelf, a result eagerly anticipated by coastal managers who have to work out how land-use changes are affecting coastal life, and where aquaculture facilities should be located.

Freshwater

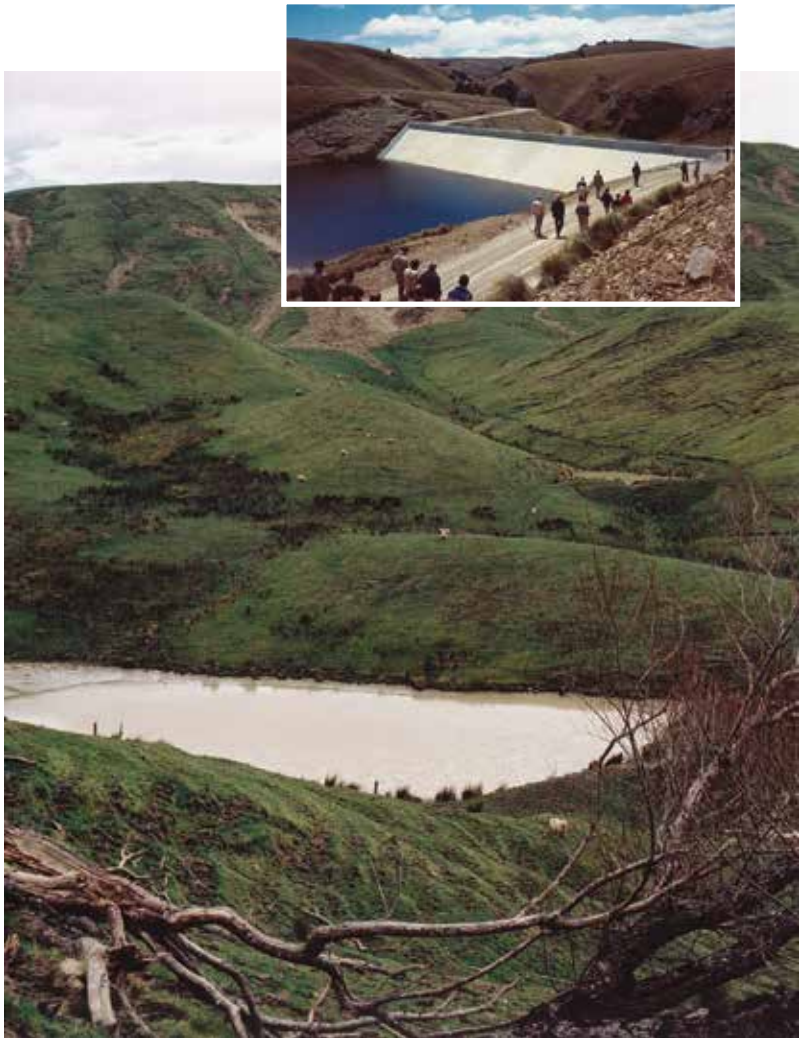
great science

Does the river look good?

Water managers have to set the minimum amount of water which must flow down a river, so they know how much extra is available for irrigation and the like. Recommendations on minimum flows have traditionally relied on evaluating how much the insects and fish in the river need. However, what humans 'like to see' when looking at rivers is becoming increasingly important in deciding on residual flows.

NIWA ecologists have teamed up with social and landscape scientists from Lincoln University and Boffa Miskell Ltd to investigate this issue. We are identifying key physical factors of riverscapes which people, often unwittingly, sense, and which make a river seem appealing or unattractive to them.

The work will link the various possible states of these factors with value judgement scores and then ultimately to two-dimensional hydraulic and spatial simulation models. This will enable water managers to see how different minimum flows affect what the river looks like, and assess people's likely response to the rules they set.



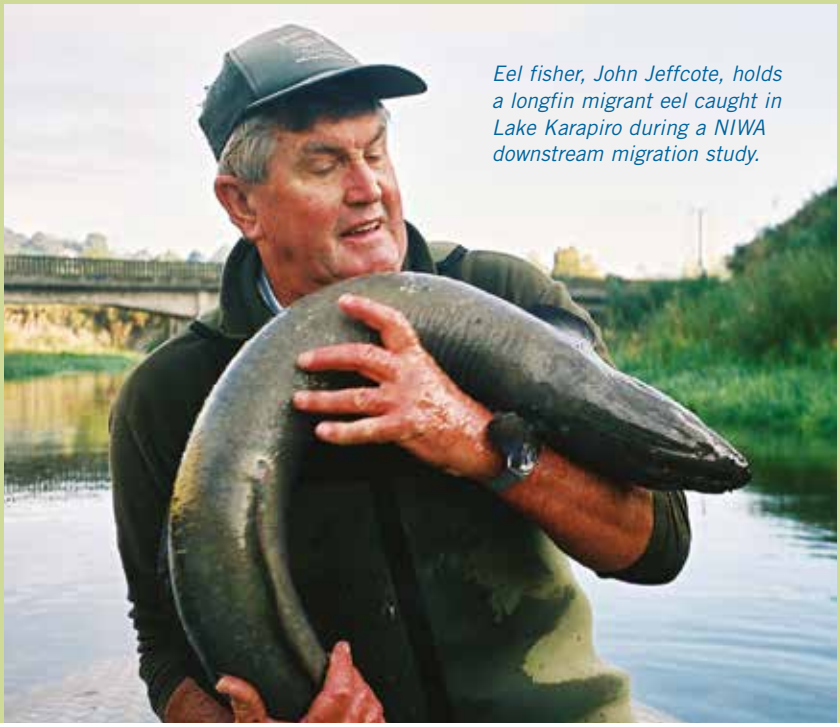
What small dams really do to water availability

Small farm dams are a rapidly increasing feature of rural landscapes. They're a handy way to collect and store water for irrigation, stock, and even domestic use. People also build them to create lakes as ornamental features, wildlife habitats, and recreational facilities.

The dams may be small, but do they stop the periodic high flows that help maintain the stream environment? Floods naturally clean out stream channels, flushing sediment from banks and pools, and keeping vegetation at bay.

We know of over 2000 small dams, though information is patchy, not least because some regions do not require resource consents for such structures. We developed an index to assess how much effect a dam could have, then we mapped this index, overlaying the position of known dams, using the River Environment Classification system.

Our analysis showed that in many areas small dams could intercept more than a quarter of the annual runoff. This could severely deplete low flows, change the movement of sediment, and significantly alter habitats for animals and plants living in the stream.



Eel fisher, John Jeffcote, holds a longfin migrant eel caught in Lake Karapiro during a NIWA downstream migration study.

How to get eels safely past hydro-dams

These days we have good methods for ensuring the safe upstream passage of young eels past hydro-dams. There are also safe ways for adult eels to get back out to sea, but ensuring the eels do not enter turbine intakes is proving a challenge.

Meridian Energy and the Foundation for Research, Science & Technology are funding us to track adult eels migrating downstream from Lake Manapouri. To assist in the tracking, electronic transmitters are surgically implanted into migrating adult eels. The latest results indicate that a significant proportion of the migrants are able to find the lake outlet and successfully pass downriver, avoiding the power station. We are now focusing on ways to deter the adult eels from entering the power station intakes, and how to encourage them to take the safer route.

Smart science improves flood forecasting

Flooding is not just a matter of how much and how fast the rain falls. It's also a question of how much a catchment can handle. Historically, flood forecasting has relied on gauges measuring the amount of water flowing down rivers.

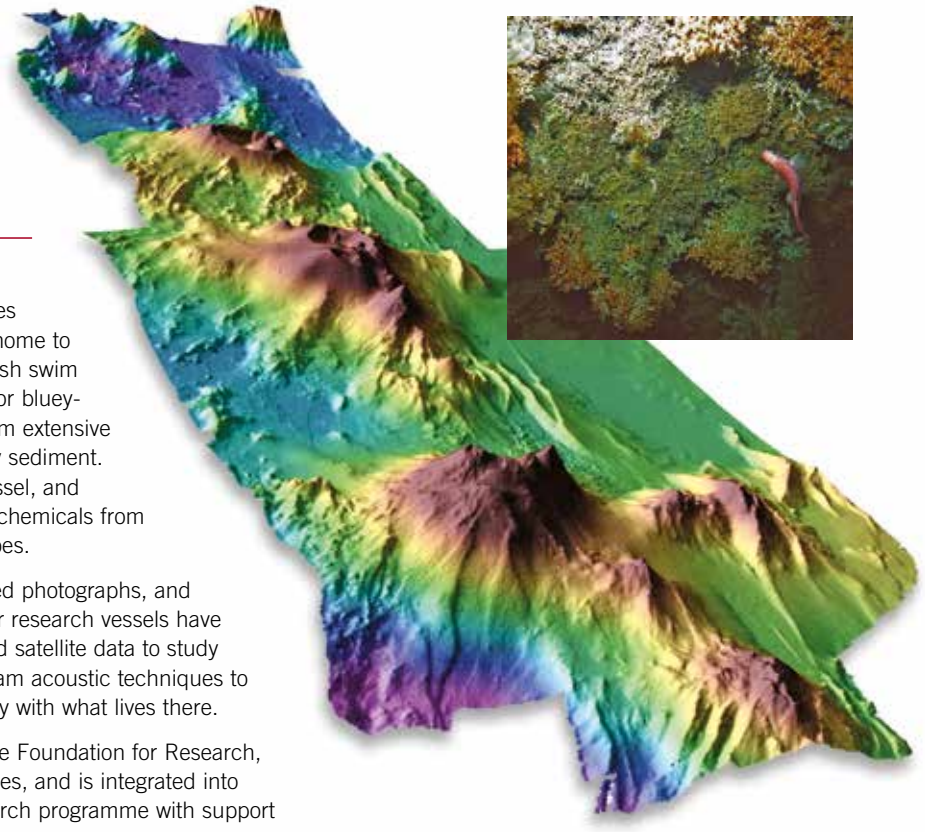
In March 2003, NIWA installed a trial version of a new, advanced flood forecasting system for the Rangitaiki River in Environment Bay of Plenty's office at Whakatane. During the Bay of Plenty floods in July 2004, the system accurately forecast the size of the river's peak flow at Te Teko, 30 hours in advance. Our prediction was 790 cubic metres per second; the actual flood flow was about 750 m^3/s.

The Bay of Plenty trial is just one application of a New Zealand-wide flood forecasting system we have developed which derives river flows from numerical rainfall forecasts.

Our 'Topnet' model, which we use for the flood forecasting system, has many other uses across the country. It can also be used for actively managing the amount of water allocated to different needs, such as irrigation, water supply, hydropower, and the in-stream environment. It can help forecast the spread of sediment or pollution, and it can be used for water resource assessment and planning.

The science behind this project was funded by the Foundation for Research, Science & Technology.

Aquatic Biodiversity & Biosecurity



Life on a seamount

There are at least 800 seamounts (undersea mountains, knolls, and hills more than 100 metres high) in waters around New Zealand. Some are home to a wide range of creatures, others to just a few. Fish swim over them in the pitch black of the deep ocean, or bluey-green twilight of shallower water. Stony corals form extensive reefs on some, while others are covered in sandy sediment. Along the Kermadec Arc, species of shrimp, mussel, and clam survive thanks to unique bacteria living on chemicals from hydrothermal venting on active undersea volcanoes.

Since 1998, NIWA has taken thousands of seabed photographs, and hundreds of direct samples from seamounts. Our research vessels have made ten seamount-specific voyages. We've used satellite data to study the water around seamounts, and used multi-beam acoustic techniques to map some seamounts and associate their geology with what lives there.

Our on-going seamount research is funded by the Foundation for Research, Science & Technology and the Ministry of Fisheries, and is integrated into the global Census of Marine Life seamount research programme with support from the Alfred P. Sloan Foundation in the USA.

Tracing alien invaders

The spread of non-native marine species is one of the greatest threats to biodiversity in the world's oceans. This threat appears to be increasing along with the volume and speed of global shipping.

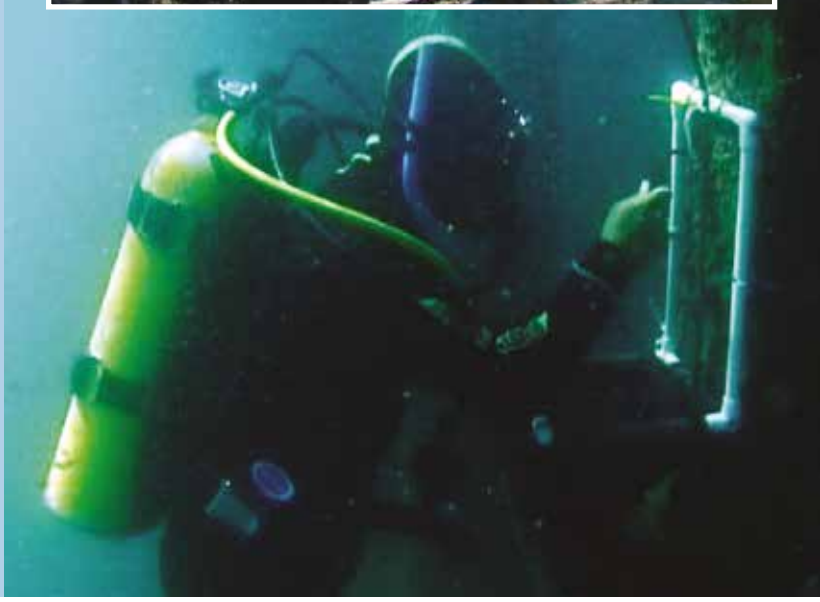
Since 2001, NIWA has been surveying the marine plants and animals in shipping ports and marinas nationwide for the Ministry of Fisheries and Biosecurity New Zealand. The surveys form a baseline for monitoring the rate of new arrivals and for communicating likely risk (or lack thereof) to our marine ecosystems or to our major trading partners. The surveys are also improving knowledge of native species living in some of New Zealand's busiest ports and harbours.

To date, we have surveyed 16 ports and marinas from Opua in the north to Bluff in the south. We repeated the surveys in about half these ports over the past summer (2004–05), and re-surveys are planned for the remainder in 2005–06.

So far, more than 1300 unique species have been identified, including 125 species that are known or suspected of being introduced to New Zealand. Nineteen of these species were recorded for the first time in New Zealand waters. Over 100 other species are potentially new to science and await more formal description.

Top: Oliver Floerl (foreground), Aleki Taumoepeau, and Nick Gust surveying in Auckland.

Bottom: Aleki samples fouling assemblages in Taranaki.



Doorways to a watery underworld

Throughout human history, springs have been valued as sources of cool, pure water. Our direct reliance on spring water has decreased in modern times, and so has our attention to them. Over the last three years, NIWA scientists have been researching springs, documenting their biodiversity, and assessing the effects of land-use practices.

The most significant human-induced threats to spring biodiversity and water quality are over-pumping or chemical contamination of groundwaters, vegetation clearance, and stock trampling. In one study we sampled 33 small springs and found they would all fail the guidelines for domestic water supply because of faecal contamination.

Our research has identified a number of ways to protect springs. The simplest are to exclude stock and maintain natural vegetation around spring heads. More broadly, greater emphasis needs to be placed on maintaining the quality and quantity of groundwaters that are feeding the springs.

This work has been funded by the Department of Conservation, the Foundation for Research, Science & Technology, and the dairy industry.

The state of the lakes

Few lakes in New Zealand retain their original native vegetation, and many lakes are threatened by land-use changes and alien aquatic plants. The challenge of monitoring dozens of waterbodies in a region, when aquatic weeds can be easily spread, is a daunting one. We have been working with regional councils on ways to better target their surveillance efforts. Our approach is to help lake managers identify threats and act early to prevent degradation, rather than having to clean up afterwards.

NIWA's LakeSPI (Lake Submerged Plant Indicators) tool is now available on-line (www.lakespi.niwa.co.nz) and is used by regional councils to provide an effective early warning system. We are also working with iwi and lake managers to develop other lake condition indicators using species of cultural significance (such as koura and kakahi) which quickly disappear as lakes become degraded.

Regional councils are also using LakeSPI information in combination with NIWA's Aquatic Weed Risk Assessment Method. This allows us to assess the risk that a new weed will infest lakes in a region, how bad any potential new weed would be, and what are the most likely ways weeds could get into a particular lake.

The underpinning research for our freshwater biosecurity has been funded by the Foundation for Research, Science & Technology.

Tracey Edwards surveying the vegetation in Lake Waikaremoana. The photograph illustrates the high water quality and clarity in the lake, with a predominance of desirable native vegetation and low impact from the only significant invasive plant in the lake, Elodea *(left).*

Fisheries

great science

Counting the recreational catch

Generations of New Zealanders have taken their rods and reels to the coast and brought back snapper, kahawai, and kingfish for tea.

Several techniques have been used in the past to measure recreational catches, but few are regarded as reliable. This is important because an underestimate could result in overfishing, and an overestimate could unnecessarily restrict commercial quota.

In an attempt to get a more reliable estimate, NIWA has started work on New Zealand's largest ever field-based survey of recreational fishers and their catch, funded by the Ministry of Fisheries. Our survey is designed to estimate the recreational catch of snapper, kahawai, and kingfish over the whole of Quota Management Area 1 (North Cape to Cape Runaway, East Cape). We are using simultaneous flights by four light aircraft to count the number of boats on the water several times during the season. Then to gauge the typical catch per boat, we are interviewing fishers at 28 boat ramps, and collecting information on fishing activity from web cameras at six key ramps.

Orange roughy otoliths.

How old is that fish?

Knowledge of the age of individual fish is vital in assessing the status of fish stocks, and in predicting the effects of fisheries management measures, such as a change in quota.

Information on the age of fish is 'stored' in various body parts, especially hard parts such as spines and otoliths (earbones). In essence, you can count rings in an otolith like rings on a tree, though it takes skill to do this. Otoliths are also a source of information about other elements of the life history of a fish, such as the temperature of the water it has lived in and the area in which it grew up. Such information can be revealed by sophisticated chemical analysis.

Recently, NIWA has developed and validated techniques for ageing kingfish, bluenose, rubyfish, stargazer, pilchards, anchovy, blue mackerel, jack mackerel, blue cod, moonfish, Antarctic toothfish, and several species of shark.

Darren Stevens and Amelia Connell identifying the stomach contents.

Who's eating what on the Chatham Rise?

In a ground-floor lab at Greta Point, Wellington, NIWA staff are painstakingly slitting open the stomachs of thousands of fish. They're sifting through the contents, from whole items to crushed pieces to smelly, goopy mess.

Some 50 000 stomachs from about three dozen species caught on the Chatham Rise will be analysed by the end of 2007. The fish will be caught during the annual multi-species survey by *Tangaroa*, and by industry vessels with Ministry of Fisheries observers onboard.

The project is funded by the ministry, and is a significant step towards a better understanding of how the fisheries fit into the wider ecosystem on the Chatham Rise. The research will contribute to the development of a model of how species relate to each other and to the environment. With a better understanding of who eats what, and how the species inter-relate, fisheries managers will be better able to predict what might happen if there were a change, for example, in the climate, quota, or abundance of bycatch or prey species.

Pioneering stock assessment for Antarctica

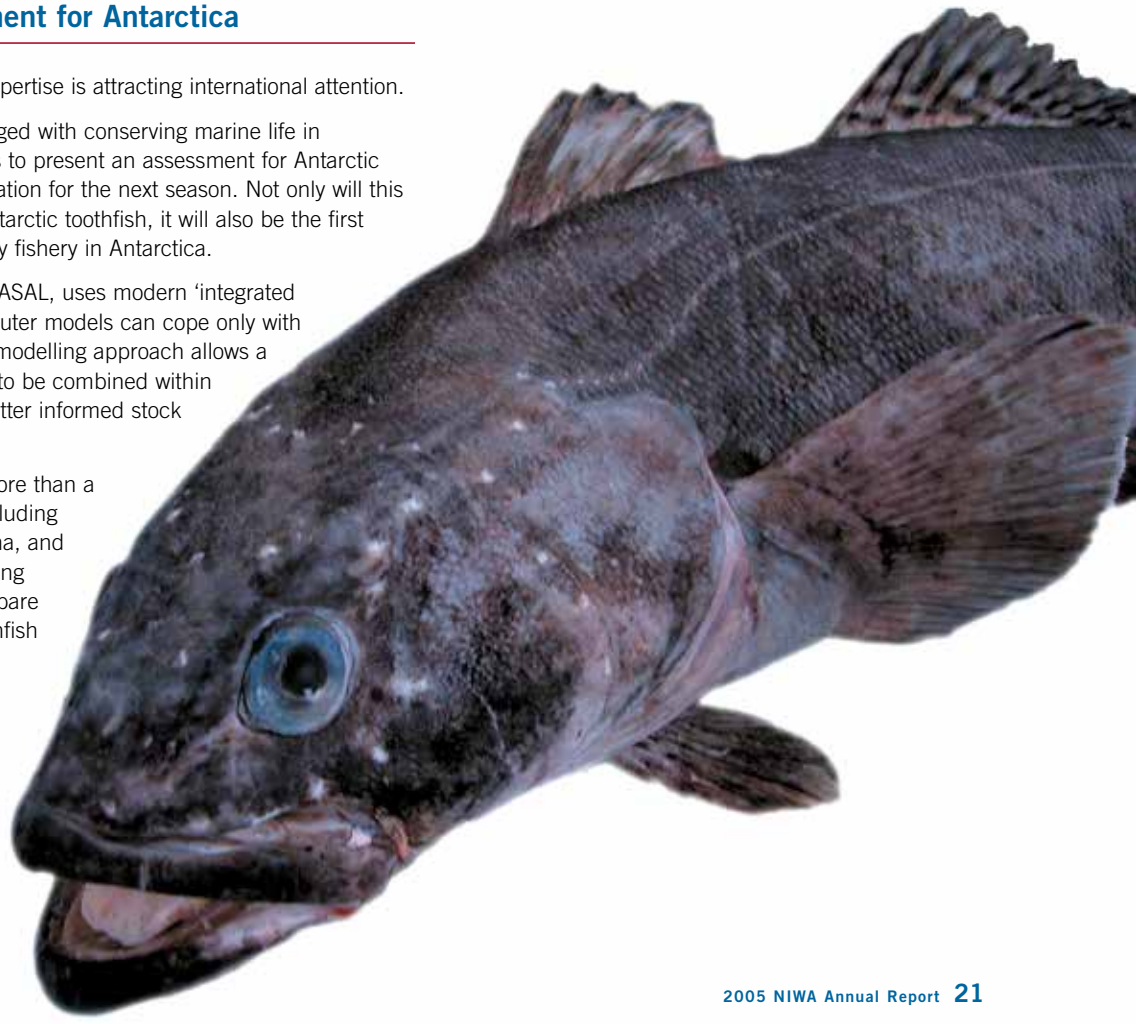
NIWA's fisheries stock modelling expertise is attracting international attention.

The international organisation charged with conserving marine life in Antarctica (CCAMLR) has asked us to present an assessment for Antarctic toothfish in the Ross Sea in preparation for the next season. Not only will this be the first stock assessment of Antarctic toothfish, it will also be the first formal assessment of an exploratory fishery in Antarctica.

NIWA's stock assessment model, CASAL, uses modern 'integrated modelling' approaches. Most computer models can cope only with simplified data, but the integrated modelling approach allows a much larger range of observations to be combined within a single model. This produces a better informed stock assessment.

CASAL is already being used for more than a dozen species in New Zealand, including hoki, hake, ling, orange roughy, tuna, and dredge oysters. NIWA is also assisting Australian and UK scientists to prepare CASAL models for Patagonian toothfish around Heard Island and South Georgia respectively.

Data from a tagging programme in the Ross Sea initiated by the New Zealand fishing industry will be an important input into our Antarctic toothfish assessment. NIWA manages this programme on behalf of the Ministry of Fisheries.



Aquaculture & Marine Natural Products

great science

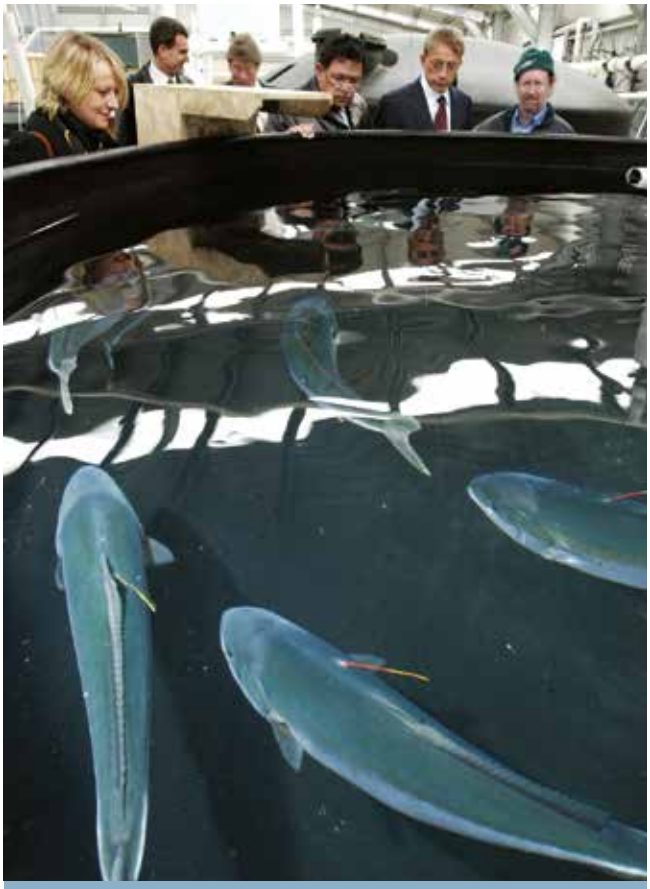
Business blossoms at Bream Bay

NIWA's Bream Bay Aquaculture Park is New Zealand's largest facility for marine aquaculture R&D and commercialisation. Here, industry and scientists work side by side every day. Our focus is on conducting commercially relevant research and successfully transferring the results all the way to commercial-scale production. The world-class facilities include large-volume seawater pumping and filtration systems, live-feed production rooms, specialist finfish and shellfish hatchery and nursery areas, and a pathology unit.

Greenshell mussels on a broodstock conditioning tray as part of a Technology for Business Growth project between NIWA and Sealord Shellfish Ltd. Sealord Shellfish have established the largest commercial greenshell mussel hatchery in the world on site.

NIWA is operating a mini commercial-scale **eel** farm at Bream Bay to test the aquaculture potential of shortfinned eels. These elvers have been recently weaned and are part of research into ongrowing techniques. The work is funded by the Foundation for Research, Science & Technology.

Robyn Marsden of OceaNZ Blue Ltd with **paua** approaching market size. OceaNZ Blue run the largest commercial paua farm in New Zealand on site.



NIWA has achieved commercial scale production and transport of **kingfish** fingerlings.

Our kingfish broodstock recently attracted the attention of a high level delegation from French Polynesia, who visited Bream Bay to discuss how new aquaculture species could boost economic growth.

From left to right: Cathy Allgaier (NZ Trade & Enterprise, Business Development Manager for French Polynesia), Andrew Jeffs (NIWA General Manager Aquaculture), Allen Jones (Chief Executive, New Zealand Yachts Ltd), Hon Keitapu Maamaatuaiahutapu (French Polynesia Minister of the Sea), Louis Tane Savoie (French Polynesia Society for Finance and Development), Ian Cameron (NIWA Bream Bay Hatchery Manager).

One of our **yellowbelly flounder** broodstock. In a world first, we have successfully spawned and weaned yellowbelly flounder for a consortium of investors, Bream Bay Flounder Ltd. In the background are Cea Smith, one of our aquaculture researchers, and Yann Gublin, a recently appointed larval finfish specialist from Norway.

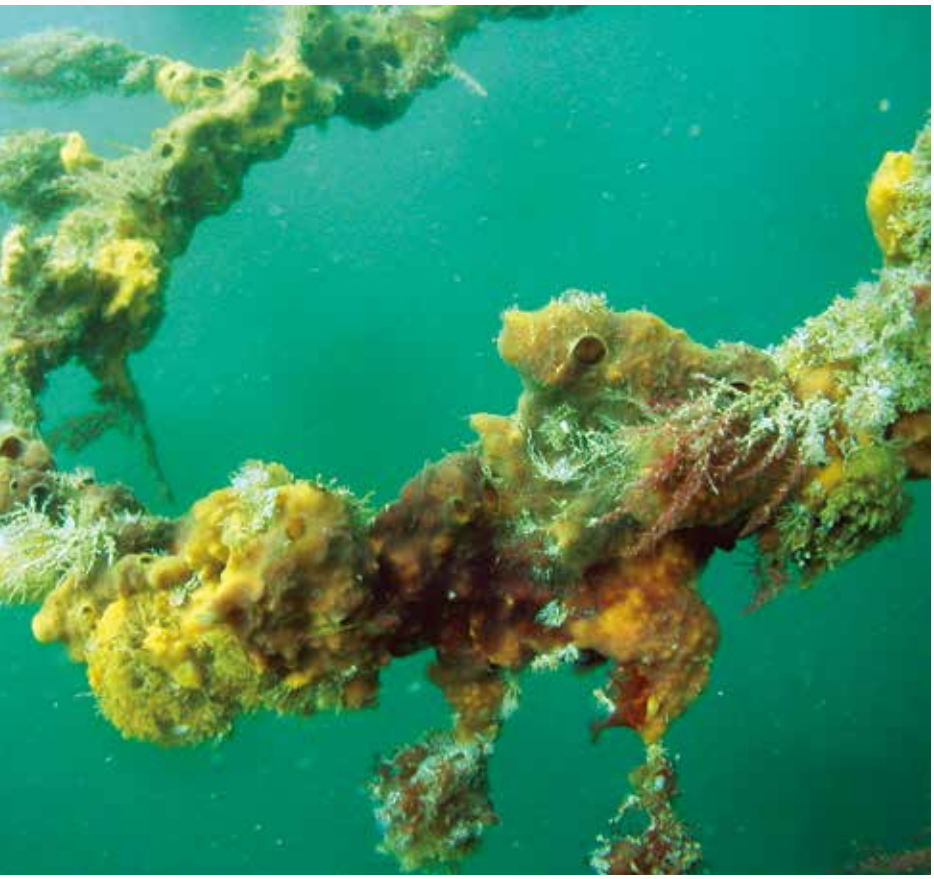
Lobster diet to boost export returns

Lobsters love our muesli bars! We worked with Ranchman's Pet Food to develop an artificial diet that maintains the condition of lobsters so fishers can earn thousands of dollars more.

About 90% of lobsters caught under quota are exported live, and fishers like to hold their stock for the best price. This strategy is hampered by the fact that wild-caught lobsters don't feed readily on most pelleted diets, and feeding them trash fish fouls the water. In practice, therefore, most lobsters are held without food. The results: lobsters lose weight; more animals die during transport; and cannibalism.

The loss to the industry is substantial. For a unit holding 10 tonne of lobsters, the fisher effectively loses 828 kg of lobster weight by holding them for 60 days. At peak market price, this equates to over $41,000 in lost earnings.

For that 10 tonne unit of lobsters held for 60 days, the NIWA/Ranchman's lobster food would cost $9,000. That means fishers could make an extra $32,000 from that unit by using the diet.



Hitting cancer with a sponge

A marine sponge with anti-tumour properties could become a lucrative aquaculture crop.

The bioactive compound Peloruside A works in the same way as an anti-cancer drug which is currently worth NZ$9 billion a year. Peloruside A was found in the sponge *Mycale hentscheli* during a joint project between Victoria University and NIWA, funded by the Foundation for Research, Science & Technology.

We are growing the sponge for drug testing by the American biotech firm Reatta Pharmaceuticals off mussel lines belonging to Marlborough Mussel Company Ltd. It takes about 1 kg of sponge (wet weight) to produce 10 mg of Peloruside A. As clinical trials advance, the Americans will need more compound, and our work with Marlborough Mussel Company aims to lay the foundation for high-value, commercial aquaculture of the sponge.

Not all specimens produce the bioactive compound, and we are working on developing high yielding sponge cultivars and selecting the best sites to grow them. We have been getting exceptional growth rates on the lines, with up to a 33-fold increase in sponge biomass over 14 months.


NIWA
TANGAROA
WELLINGTON

great services

The NIWA Group provides scientific products and services through nine specialist service centres in NIWA Science and through six subsidiaries.

Specialist service centres in NIWA Science:

National Climate Centre

National Centre for Climate–Energy Solutions

National Centre for Coasts & Oceans

National Centre for Water Resources

National Centre for Aquatic Biodiversity & Biosecurity

National Centre for Fisheries & Aquaculture

Natural Hazards Centre

Te Kūwaha

NIWA Instrument Systems

Subsidiaries:

Unidata Pty Ltd

NIWA Vessel Management Ltd

NIWA Natural Solutions

NIWA Australia Pty Ltd

NIWA Environmental Research Institute (not-for-profit)

NIWA (USA), Inc.

www.niwa.co.nz

This section profiles a few of the products and services we provided during 2004–05.

National Climate Centre

guiding responses to global change

helping people prepare for and deal with the climate – now and in the future

- climate measurement and monitoring
- climate data and summaries
- climate maps and GIS layers
- climate forecasts and seasonal outlooks
- influences on climate, including El Niño–La Niña, sea surface temperatures
- future climate changes
- effects of climate – present and future
- climate-related hazards

www.niwascience.co.nz/ncc

great services

Helping people plan for climate change

The global climate is changing. How will it affect people and places in New Zealand?

The National Climate Centre is focused on providing robust projections in sufficient detail so regional councils, farmers, utility companies, and other climate-sensitive industries can best plan for the future.

This year we released major studies into the likely effect of climate change on the risks of drought and (with Scion) rural fires. Both present 'scenarios' spanning the plausible range of likely changes, depending on future greenhouse gas emissions, and using results from validated climate models.

Severe drought (defined as the current 1-in-20 year drought) could increase markedly in already drought-prone eastern regions by the 2080s. Similarly, the frequency of very high and extreme forest fire danger is likely to increase, particularly in Bay of Plenty, the Wellington–Nelson region, and in the east of both islands. In both cases we have produced detailed maps, so people can pinpoint the likely effects where they live, farm, or operate.

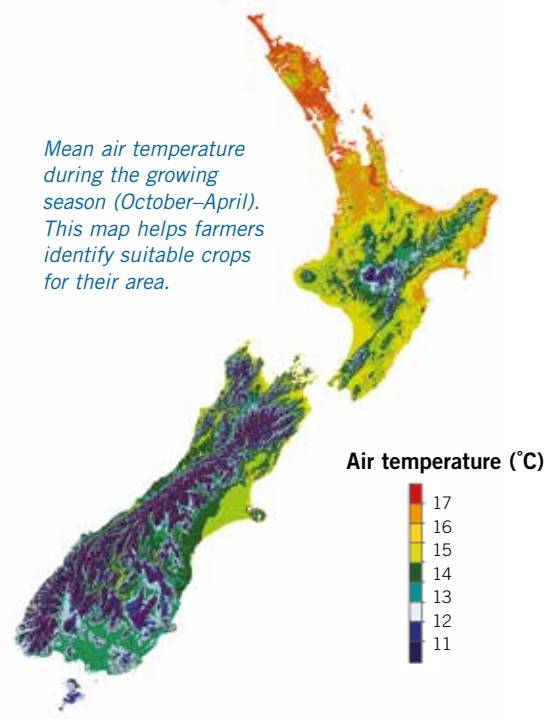
The drought report was produced for the Ministry for the Environment and the Ministry of Agriculture and Forestry. The rural fire report was produced for the Fire Service Commission.

You name it, we've mapped it

The National Climate Centre provides climate maps in GIS data layers to government departments, local and regional authorities, crown research institutes, universities, reinsurance companies, energy and transport companies, agricultural businesses, consultants, growers' associations, land developers, and interested individuals.

Since we launched our climate mapping service (www.niwascience.co.nz/ncc/mapping) in August 2003, we have built up a base of nearly 100 users.

The uses for our maps and data are as varied as our customers. They include assessing crop potential or wind energy potential, identifying the frequency and severity of climate hazards, modelling pest dispersion and habitation, analysing tolerance limits for roading and construction materials, defining industrial standards, providing evidence for legal proceedings, and producing tourism information.



Mean air temperature during the growing season (October–April). This map helps farmers identify suitable crops for their area.

National Centre for Climate–Energy Solutions

finding the energy to move New Zealand forward

Data for the electricity market – and the public

NIWA delivers vital hydrological data to M-co, the company which provides services to the New Zealand wholesale electricity market.

The market is intensely interested in lake levels, lake inflows, and other generation data, factors which can have a significant effect on wholesale prices. On average, over 60% of the country's electricity comes from hydro, but lake storage volumes are not large by international standards, and inflows vary dramatically, so careful management of lake levels is crucial to the electricity supply.

Data from sites around New Zealand are transmitted to NIWA's Christchurch office, where they are processed and sent to M-co. We have done this every day since market based trading in electricity began on 1 October 1996.

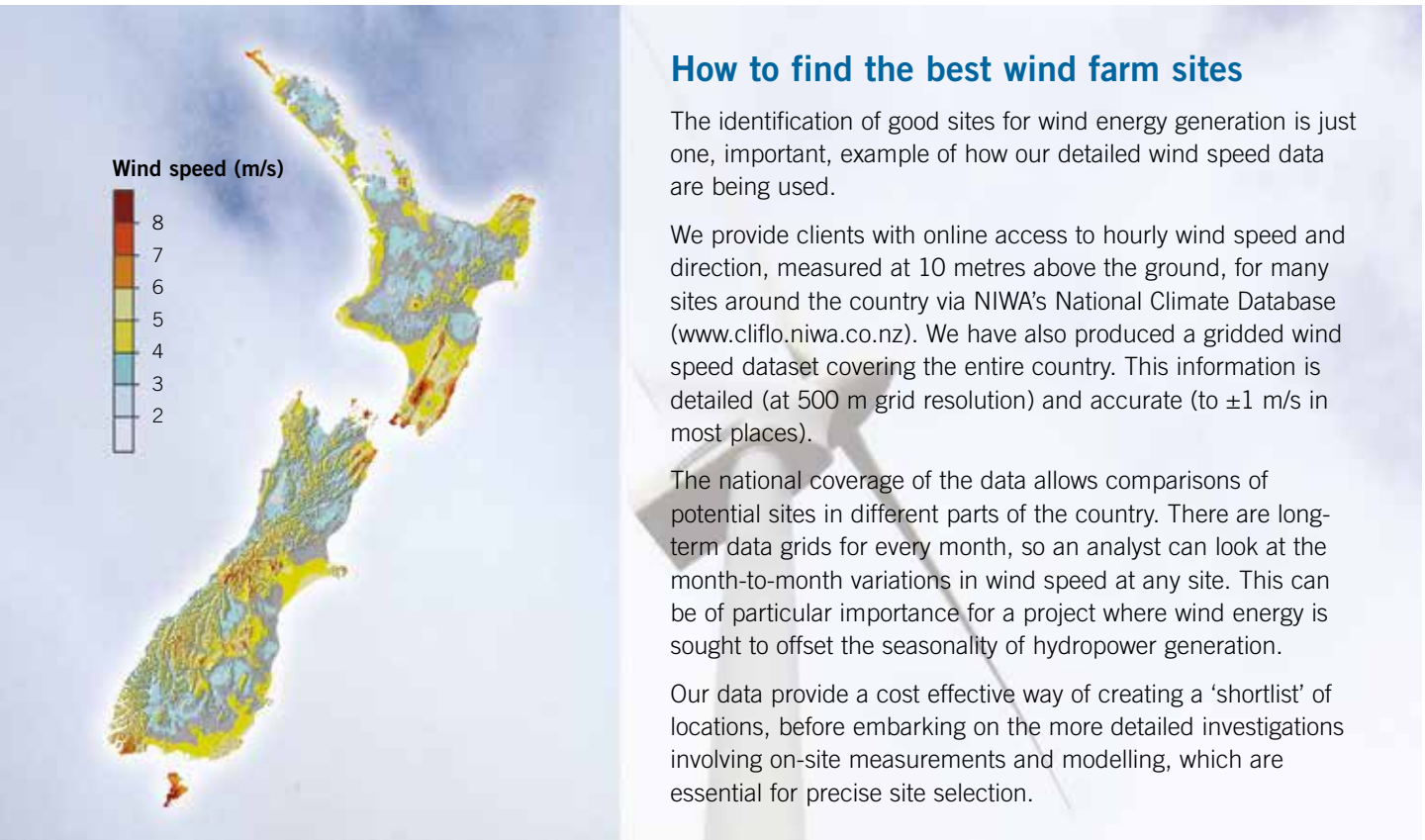
The general public can view key hydro data for free at M-co's public site www.comitfree.co.nz. Market participants get more detailed information through the COMIT trading system.

NIWA's provision of operational data contributes to the efficient operation of the market. We are working towards providing more information and predictions to help the electricity system make increased use of renewables (e.g., wind), distributed generation, and better demand-side management.

providing practical solutions to energy problems

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

www.niwascience.co.nz/nces



How to find the best wind farm sites

The identification of good sites for wind energy generation is just one, important, example of how our detailed wind speed data are being used.

We provide clients with online access to hourly wind speed and direction, measured at 10 metres above the ground, for many sites around the country via NIWA's National Climate Database (www.cliflo.niwa.co.nz). We have also produced a gridded wind speed dataset covering the entire country. This information is detailed (at 500 m grid resolution) and accurate (to ±1 m/s in most places).

The national coverage of the data allows comparisons of potential sites in different parts of the country. There are long-term data grids for every month, so an analyst can look at the month-to-month variations in wind speed at any site. This can be of particular importance for a project where wind energy is sought to offset the seasonality of hydropower generation.

Our data provide a cost effective way of creating a 'shortlist' of locations, before embarking on the more detailed investigations involving on-site measurements and modelling, which are essential for precise site selection.

National Centre for Coasts & Oceans

guiding sustainable development

guiding exploration, management, and protection of coastal & marine resources

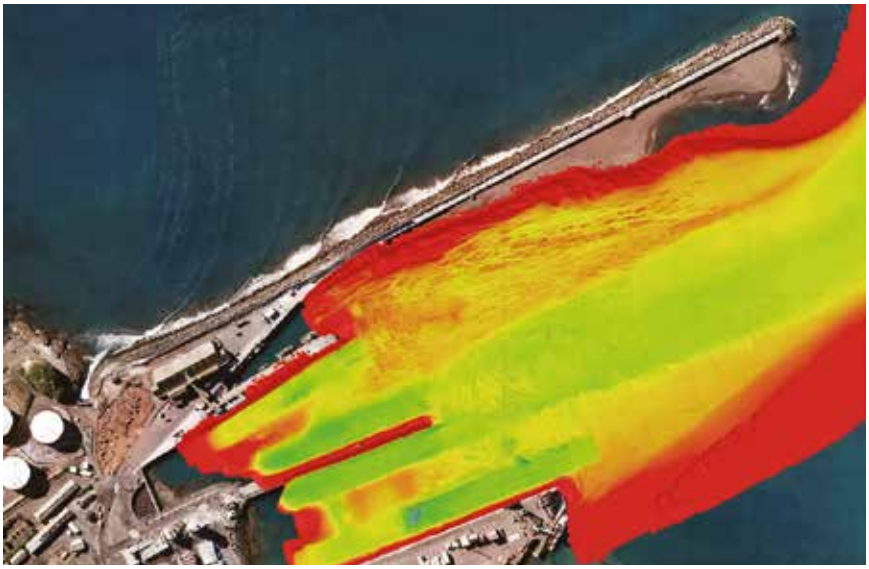
- mapping seafloor resources
- environmental assessments and surveys – sedimentation, pollution, erosion, restoration
- forecasting for the marine environment
- oceanography & ocean productivity
- coastal ecology
- environmental monitoring & modelling

www.niwascience.co.nz/ncco

Picture perfect for port

In March 2005, the engineering services firm Duffill Watts & King commissioned us to survey Port Taranaki for Westgate Transport. They wanted to get a clear picture of the seabed before the harbour was deepened.

In a single day, we surveyed both the proposed dredge areas alongside the wharves and the proposed spoil disposal site outside the harbour. Our EM3000D multibeam system acquired over 2.3 million individual seafloor data points in less than four hours inside the harbour. This density of data not only shows clearly the new and previous areas of dredging, but also the type of seafloor material and the size and distribution of large boulders which will require blasting. Such data can provide valuable information for project planning and underpin a more efficient dredging programme.



Wave forecasting service launched

Shipping companies, port authorities, and fishers are among those benefiting from our new wave forecasting service (www.niwascience.co.nz/ncco/forecast).

The National Centre for Coasts & Oceans launched the free service in January 2005. We forecast wave height and direction for the New Zealand region, the Southwest Pacific, and the Southern Ocean for up to 5 days ahead.

Our model currently uses 5-day forecasts of winds over the world's oceans from the US National Oceanic and Atmospheric Administration. We convert those wind forecasts into wave patterns, taking into account the physics of how waves build up, travel, and dissipate. NIWA's atmospheric scientists are currently developing wind forecasts for the New Zealand area that will further refine the wave forecasting.

NIWA is also working with clients to adapt the model for their particular needs and location. For example, port authorities want to know about any wave conditions which may hinder safe port operations.

National Centre for Water Resources

making every drop count

providing tools and information for the sustainable use of water

- water allocation
- water quality
- environmental monitoring & modelling
- pollution control & prediction
- lake & river restoration
- flow forecasting
- land-use effects
- wastewater treatment

www.niwascience.co.nz/ncwr

Getting to the core of the matter

A bit of digging has unmasked a major source of contaminants at the bottom of some Christchurch streams.

It's been widely believed that emissions from domestic heating were responsible for high levels of 'polycyclic aromatic hydrocarbons' (PAHs) in sediment in streams around the city. We suspected, however, that past use of coal tar binders in road construction might be the chief culprit.

In December 2004, we worked with the Christchurch City Council to analyse samples from some city streets. The PAH levels in the subsurface layers of coal tar sealed roads were more than 1000 times higher than for modern roads made with bitumen-based binders. We have since shown that coal tar is a major source of the elevated PAH levels in roadside soil, runoff, and stream sediment.

The levels of PAHs pose a potential risk to stream ecosystems. Coal tar, on the other hand, is a carcinogen and, accordingly, exposure to it should be minimised. Although the coal tar has been overlaid with more modern materials over the years, it is uncovered during road reconstruction. The city council has responded proactively, reviewing procedures for the handling and recycling of old roading material and looking at ways to reduce the ongoing release of coal tar-derived PAHs.

Water quality lab a busy place

NIWA's water quality laboratory in Hamilton conducts about 60 000 analyses on about 12 000 samples a year.

A significant amount of this work is done for outside clients, notably regional councils. The results are used in a variety of projects, including improving the performance of dairy farm wastewater ponds, monitoring the effects of marine aquaculture, and measuring the effects of land-use changes on water quality.

Our laboratory has facilities for water and sediment samples from marine, freshwater, and effluent sources. We analyse the water samples for a wide range of parameters, including chlorophyll, phosphorus, nitrate, ammonia, total organic carbon, coliforms/*E. coli*, blue-green algae, and rhodamine. We also analyse total carbon and total nitrogen in sediments.

Mike Crump reading Colilert plates for E. coli.

National Centre for Aquatic Biodiversity & Biosecurity

protecting our natural heritage

providing advice on freshwater & marine biodiversity & biosecurity

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

www.niwascience.co.nz/ncabb

Step one in saving natives and combating pests

If you want to preserve or restore a lake, stream, or wetland, you need to know what lives there. Species identification is not as easy as it sounds – even experienced researchers can find it daunting.

The National Centre for Aquatic Biodiversity & Biosecurity has published handy guides to help conservation, regional council, and other staff to identify freshwater species. The set covers identification at basic levels (e.g., guides to freshwater fish families and major groups of freshwater algae), as well as detailed guides for genus and species level identification of particular groups. The detailed guides cover native fish species, aquatic plants, various algal groups, and oligochaete worms.

A separate pest identification guide covers 57 freshwater pest fish, invertebrates, and plants, and we also produced pictorial plant guides to help aquarium hobbyists select and culture alternatives to illegally imported pest plants.

Funding was provided through DOC's Terrestrial and Freshwater Biodiversity Information System (TFBIS) programme, and the Foundation for Research, Science & Technology.

A salty solution to stop spread of aquatic pests

Fishing nets can spread pests, especially fish eggs, fry, and bits of weed, from infested to pristine waterways, unless the nets are properly sterilised. The standard method is air drying, but this usually requires nets to be laid out in a dry spot overnight – not ideal for damp conditions or when nets have to be re-used quickly.

NIWA scientists have been working with the Department of Conservation, commercial fishers, and regional council staff to find other ways to effectively and conveniently sterilise freshwater fishing nets. We identified and tested potential treatments, thanks to funding from DOC and the Foundation for Research, Science & Technology.

The winning 'recipe': soak nets for one hour in concentrated saltwater (70 grams of salt per litre, or 1 part salt to 14 parts water by volume).

We found the treatment worked well for many pest fish species, including catfish, goldfish, koi carp, gambusia, perch, rudd, and tench, and a range of aquatic weeds, including curly pondweed, elodea, egeria, hornwort, hydrilla, and lagarosiphon.

NIWA scientists working with Auckland Regional Council staff to sterilise and clear gill nets at Lake Wainamu.

National Centre for Fisheries & Aquaculture

generating wealth for New Zealand

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
- research & development for commercial application
- effects of aquaculture on the environment

www.niwascience.co.nz/ncfa

Pay-off for rock lobster fishery

Things are looking up for the southern red rock lobster fishery thanks to close consultation and some smart maths.

In the 1990s, the southern substock (Otago, Fiordland, Foveaux Strait, Stewart Island) was in poor shape. Since then, NIWA scientists, and our collaborators at Trophia and Starrfish, have worked with the National Rock Lobster Management Group and other stakeholders on better ways to manage the fishery.

The group adopted an 'operational management procedure' approach, in which stakeholders first define their objectives (e.g., healthy stock size, good catch rates, minimal risk of poor outcomes). Competing objectives involve tradeoffs, so good communication is vital.

The aim is to find a management procedure which best meets the agreed objectives. The scientists develop hundreds of alternative harvest strategies, and conduct thousands of test simulations, to work out which decision rules are best.

This approach appears to be paying dividends. Last year, the available commercial catch increased by 6%, and the stock is expected to reach the target level well within the target timeframe of 10 to 14 years.

Winning sticks produce premium oysters

NIWA and a group of leading oyster farmers have developed award-winning oyster culture sticks coated with seed oysters.

Catching wild spat is a large burden on growers during late summer, and can be hampered by toxic algal blooms in some harbours. Most importantly for growers' returns, the density of spat on sticks can be unpredictable. Spat density has a very big effect on the shape of the oysters produced and, therefore, whether they attract premium prices.

Our sticks were settled with oysters in tanks at NIWA's Bream Bay Aquaculture Park as part of a Technology New Zealand Technical Assessment Project. After some manual stock management by Barry Jessop from Parua Bay Oysters, we won the 'best stick of oysters' at the 2004 New Zealand oyster farming industry awards.

We are now developing the technology for the commercial supply of the sticks, with an emphasis on controlling spat densities to improve stock management and economic returns. The project is being undertaken by NIWA in a consortium with nine oyster farming companies in New Zealand, including Sanford, Biomarine, and Clevedon Coast Oysters.

Natural Hazards Centre

setting the foundation for a safer future

bringing together the expertise of NIWA and the Institute of Geological & Nuclear Sciences on the full range of natural hazards

- providing information for policy managers, planners, emergency managers
- helping people improve their resilience and better manage the risks
- floods & droughts, extreme weather, coastal erosion, landslides, earthquakes, volcanoes, tsunamis

www.naturalhazards.net.nz

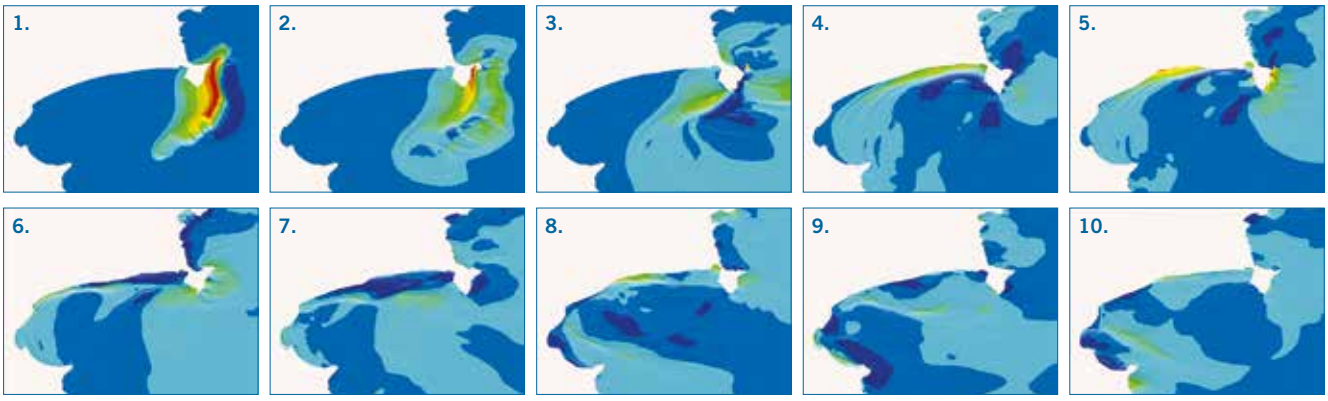
Tsunami: knowledge is safety

Before the Indian Ocean tsunami on Boxing Day 2004, the National Hazards Centre was already working to raise the profile of tsunamis, concerned that many New Zealanders had little appreciation of the dangers or knew how to respond.

New Zealand's first interactive tsunami learning centre opened in November 2004 at the National Aquarium in Napier. We developed the interactive kiosk, complete with animations, including how a tsunami could affect the region.

We show what could happen if the highly active Lachlan Fault off Hawke's Bay were to rupture. The west-moving part of the initial wave arrives at Wairoa about 38 minutes after the quake, with a maximum wave height over 3.5 metres above normal sea level. Reflected waves then spread down the coast to Napier, and Gisborne is also affected. The return time between major quakes on the Lachlan Fault is estimated at between 600 and 2300 years.

The tsunami learning centre was coordinated by the Hawke's Bay Regional Council, with expertise from NIWA and the Institute of Geological & Nuclear Sciences, and support from the Earthquake Commission and the Ministry of Civil Defence and Emergency Management.



Frames taken from a NIWA video modelling the effects of a tsunami resulting from an earthquake on the Lachlan Fault off Hawke's Bay.

Help to stop falling pylons

NIWA scientists from the National Hazards Centre have created a way for Transpower to identify the power pylons most at risk from flooding and slipping.

We developed a risk assessment tool which combines information about land cover (grass or trees), hill slope, proximity to rivers, and the size of the rivers. So, for example, a pylon on a steep grassy slope is more at risk from slipping than one on a flat, tree-covered hilltop. Similarly, a pylon that lies on the flood plain of a major river is more at risk than one well away from any watercourses.

Our risk assessment tool uses GIS layers so the different aspects can be mapped, and the risk to each pylon in the country assessed. Pylons were categorised as to how extreme each of these parameters were, and then ranked in order of risk. The system was evaluated by comparing its results for pylons already known to be at risk. Transpower is now using the risk-assessment tool to prioritise its pylon inspections.

Te Kūwaha

promoting Māori development

www.niwascience.co.nz/maori

E ngā hau e tāwhio ana huri noa i te motu, tēnei te mihi maioha o Te Kūwaha ki a koutou ngā iwi e ngākaunui ana ki ngā āhuatanga o tō tātou nei taiao. Ko mātou nei te roopu rangahau Māori o roto o NIWA e mahi ngatahi ana i te taha o ō mātou hoa kaipakihi Māori. Ānei rā ētehi o ngā mahi rangahau e whakahaere ana i tō mātou nei roopu i tēnei tau, nō reira tēnā rā koutou katoa.

Māori knowledge: weather and climate

Notwithstanding the significant scientific advances in understanding weather and climate, opportunities exist to enhance our understanding through the application of traditional Māori knowledge.

Te Kūwaha has been collaborating with Ngāti Pare and Te Whānau a Apanui to examine and document Māori traditional knowledge (Mātauranga Māori) of weather and climate. The project confirmed that Māori have an intimate understanding of such matters, including a detailed language for describing local weather and climate phenomena, oral records of past events and trends, and the ability to link 'signs' in the natural world to the forecasting of conditions. From the movements of birds to the clarity of stars in the evening sky, predictions can be made about storms brewing at sea or whether the season ahead might be wet, dry, hot, or cold.

Low-cost aquaculture for coastal iwi

Te Kūwaha is working with Hongoeka Development Trust to develop a low-cost land-based 'polyculture' system, where several aquaculture species are grown in a virtually self-sustaining unit.

We are now operating two pilot systems at NIWA's coldwater aquaculture facility at Mahanga Bay, Wellington. The aim is to produce a sustainable harvest of about 1 tonne of pāua a year with other species being used to naturally clean the system. We currently have pāua, blue mussels, Pacific oysters, and karengo (a species of red alga) in the pilot systems and are continuing our experiments. Meanwhile, the plans, detailed design, and consents for the full scale development at Hongoeka (Plimmerton) are being finalised.

Renewable energy update

Te Kūwaha is continuing to work with the Waihi (Tūwharetoa – Taupō) and the Waipoua (Te Roroa – Northland) communities to help meet their energy needs.

This was the third year of a four-year programme, and the main aims were to identify realistic renewable energy options, collectively decide which to trial, and then install them.

At Waihi Village we are trialling a grid-connected photovoltaic system and two solar hot water systems. We are continuing to investigate options for grid-connected micro-hydro generation using water from Waihi Stream. We also facilitated discussions with the lines company, power company, and subcontractors over grid connection issues and the state of local electrical, plumbing, and drainage networks.

Renewable energy at Waipoua.

Waipoua is not connected to the national grid. There we installed stand-alone photovoltaic systems for six households and the wharenui, powering an energy efficient freezer, lights, and other appliances. A micro-hydro generator now gives power to three houses and two energy efficient freezers and operates as a battery recharge station. A solar hot water system was installed for one house. We are investigating the potential for a small wind turbine in the Waipoua River valley.

NIWA Instrument Systems

accurate and dependable data for science

www.niwascience.co.nz/instrumentsystems

Reliable and accurate measurement is essential for research and consultancy. NIWA Instrument Systems is a specialist instrumentation unit supporting NIWA's substantial equipment requirements and extensive environmental monitoring networks. The group also supplies skills, expertise, and products to other organisations in the environmental measurement and general data collection industries.

Our activities include:

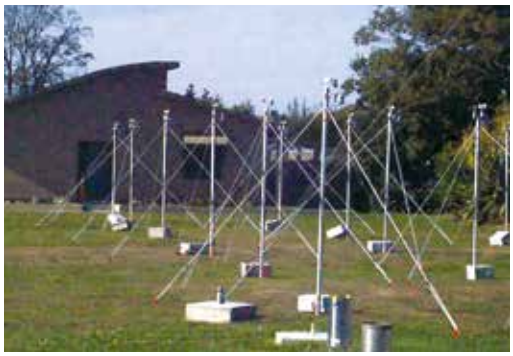
- design, development, and manufacture of instrumentation;
- supply of equipment for hydrological, meteorological, and water quality data measurement, recording, and transmission;
- development of customised monitoring systems and equipment for operation in harsh or unique conditions;
- servicing, repair, and re-calibration.

Monitoring in the harshest environments

Extreme winds (often more than 180 km/h) and temperatures (minus 20 °C is common) and regular lightning are a feature of the conditions found at Rose Ridge meteorological station in the Southern Alps. It is among the highest monitoring stations in New Zealand, and is an important part of the network providing information on potential inflows to the hydro lakes of the Waitaki Valley. Extreme environmental conditions in remote locations often mean we have to significantly customise stations when we commission them. For Rose Ridge, this included extensive lightning protection systems and the incorporation of an iridium satellite communications module.

Portable met stations required

In a very short space of time, and making use of NIWA's extensive instrumentation resources, we built, tested, and deployed a network of 23 portable meteorological monitoring stations to collect data for a NIWA client. The scientists were engaged by Network Mapping Ltd from the UK, who, as primary contractors to Transpower, were carrying out a detailed survey of large blocks of the Transpower network of transmission lines. The goal was to determine how much extra power could be put down the lines before they sagged so much they got too close to roads, buildings, trees, and the like. The temperature and sag of the lines are influenced by the ambient air temperature, heating by the flow of current and by the sun, and cooling by the wind. We deployed the portable stations at about 20 kilometre intervals, along several hundred kilometres of the Transpower national transmission grid in order to provide the data the scientists needed. The project requirements were defined just before Christmas, and all the stations were assembled, tested, and in operation by early February.



Testing the portable met stations before they were installed along the transmission line.

Design, build, install

Researchers often demand such specialised data that there is no commercial equipment available to record it. Over the years, Instrument Systems staff have taken many of the research requirements and from them developed a variety of tools, specialised equipment, and accessories for environmental monitoring.

One example is the NIWA AQ Auto-sampler, which automatically collects air samples over time for subsequent laboratory analysis. The auto-sampler means that the air quality scientists can deploy the apparatus and leave it unattended for long periods, knowing the onboard data logging device will control the sampling to give them the information they need.

An automatic air sampler in operation.

Unidata –

environmental monitoring & industrial measurement

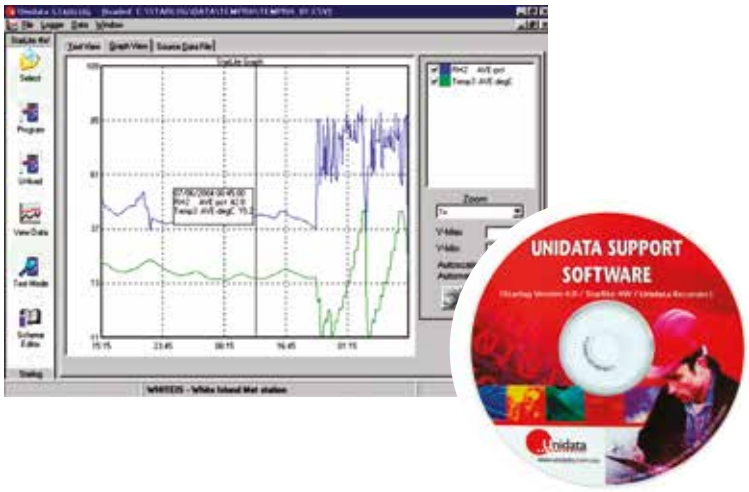
www.unidata.com.au

For nearly 30 years Unidata has been servicing hydrographic and environmental monitoring companies. Early in 2004 the company was restructured as Unidata Pty Ltd, with NIWA as the major (80%) shareholder. What followed was an exciting year which focused on re-establishing the company by:

- restoring key product manufacturing;
- addressing quality control and documentation issues, including electromagnetic compliance and C tick accreditation for products;
- rebuilding customer confidence in the company and its products.

We are well on the way to achieving these aims and see a bright future building on the history of a proud Australian manufacturer of data loggers and associated instrumentation. During 2004–05 we appointed new distributors, upgraded the website, and launched the quarterly newsletter *Unidata Newsline*. One of the distributors, Measurement Engineering Australia, now jointly markets Unidata products throughout much of Australia.

A major achievement was the release of Starlog 4.0, a fully revised and Windows-enabled software package for our data loggers which are used throughout the world in a large range of applications.



AMS hydrographer Gary Bruecher at one of the nineteen automatic weather stations around Western Australia using Unidata loggers.

Over 1500 station-years of data

Asset Monitoring Services records hydrological and environmental data for the Western Australian Water Corporation. To date, the group has collected more than 1500 station-years of continuous data using Unidata loggers. It maintains and operates more than 450 current model instruments – over half of which are Unidata data loggers – supplied and supported by Unidata. With the latest instruments installed they now cover more than 120 sites across Western Australia, from Kununurra to Esperance and across the Perth metropolitan area.

Unidata instruments installed at the constructed wetland in Bog Burn, Southland, New Zealand.

Artificial wetlands reduce pollution

Unidata instruments were installed in an artificial wetland built to measure how effective it could be in reducing agriculture drainage pollutants – nitrogen, phosphorus, and faecal microbes. The wetland is one of three being studied by NIWA's aquatic pollution group in conjunction with AgResearch. The project is funded by Fonterra. The instruments record the flow from the drain feeding water into the wetland, the flow received by the wetland, and the outlet flow. Nitrogen and phosphorus loads are estimated from the flow information, and their concentrations are determined from samples. Data from the station are retrieved via a digital phone modem.

NIWA Vessel Management

www.niwavessels.co.nz

Argonauts of the Pacific

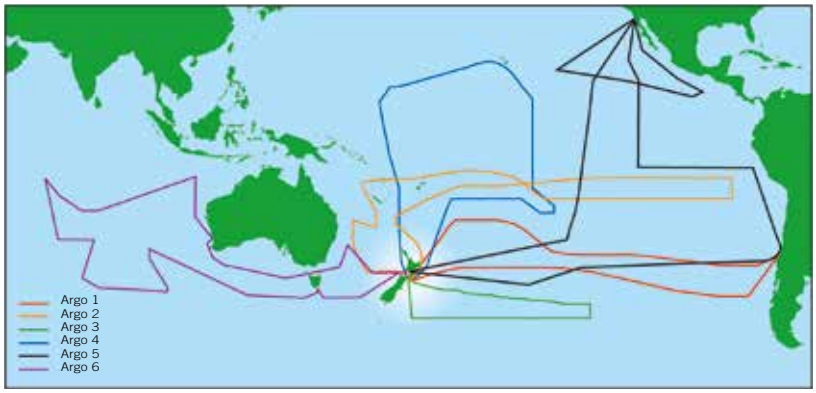
NIWA research vessels now hold the world record for the greatest number of Argo floats launched by one organisation.

The Argo programme is a worldwide effort to deploy a network of high tech floats which will help scientists measure climate change, predict the strength of tropical cyclones, and even get a better fix on the path of toxic algal blooms.

Once deployed, the floats sink to a depth of 1000 metres and are carried along by ocean currents. After nine or ten days, they sink further to between 1250 and 2000 metres, then rise to the surface, measuring the temperature and salinity of the water on the way up. Once on the surface, the floats transmit the recorded information and their location via satellite.

During April 2005, *Tangaroa* deployed 45 of these floats on a mission that took the vessel to the Southern Ocean and more than halfway to Chile. Within two weeks of *Tangaroa* returning to port, the 28-metre *Kaharoa* sailed for the warm equatorial waters of the Pacific to deploy a further 60 floats during a two month round trip to Hawaii.

NIWA has now completed four voyages, covering over 45 000 nautical miles, and deployed 246 floats. Two more voyages are planned in the next two years. The first of these (134 floats) will take *Kaharoa* to the west coast of South and North America; the second will see *Kaharoa* sail to Mauritius in the Indian Ocean (100 floats).



The deployments are funded by the University of Washington (Seattle), Scripps Institution of Oceanography (San Diego), and NIWA.

The Argo float deployments (1–4) and the voyages planned for the next two years.

Vessels for oil and gas surveys

NIWA vessels are providing cost-effective, high quality surveys for the oil and gas industry.

NIWA's deepwater research vessel *Tangaroa* surveyed the Kupe gas/condensate field in the South Taranaki Bight in association with Fugro Surveys for Origin Energy, which acts as operator on behalf of the Kupe Joint Venture. We carried out a detailed survey of the planned Kupe Platform site and of two potential pipeline routes between the platform and the shore approaches. The survey launch *Pelorus* was operated from *Tangaroa* to complete the inshore parts of the survey.

Tangaroa also recently completed a survey of the Tui Area Development, off the Taranaki coastline. This was an offshore seabed survey for New Zealand Overseas Petroleum Ltd which is investigating the development of a sub-sea oil field.

Tangaroa is the only fully equipped, New Zealand-based survey vessel capable of operating in virtually all weather.

On the run

One evening in January 2005, NIWA Vessel Management received an urgent call from the United States. Stanford University's high tech 'Very Low Frequency Buoy' had broken free of its mooring deep in the Southern Ocean and was drifting rapidly towards Antarctica. Could *Tangaroa* find and retrieve it?

The buoy is massive: 3.1 metres in diameter, 7.1 metres tall, weighing just under 4 tonnes. It was designed and built by Stanford, with support from other institutes and commercial suppliers, and is equipped with three very sensitive VLF-loop antennas which are each almost 2.5 metres in diameter. It is used for research into the ionised regions of the upper atmosphere known as the ionosphere and magnetosphere.

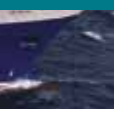
Tangaroa had deployed the buoy in extremely deep water (5400 metres) nine months earlier. After constant battering by massive seas, it appears the tether holding the buoy in position gave way.

We reorganised *Tangaroa*'s programme and set sail. It was a rough ride through 12 metre waves and 70 knot winds, chasing the buoy. Three days later, we saw it, then had to keep track of it for another day until the waves dropped to 'only' 4.5 metres before we could haul it on board.

We currently have the buoy in storage awaiting an electronic upgrade. *Tangaroa* will redeploy it later this year with a modified tether.

Tangaroa *deploys Stanford's buoy.*

NIWA Natural Solutions



NIWA Natural Solutions was established to generate commercial opportunities from products of NIWA's science. It is a wholly owned subsidiary of NIWA. It bridges the early-stage development and finance gap by actively participating in the commercialisation process by:

- identifying product opportunities;
- undertaking technology and commercial feasibility analysis;
- funding product and market development;
- creating and implementing partnerships and other commercial arrangements.

New species for aquaculture

Aquaculture is a key science area for NIWA. An important component of our R&D is the development of culture techniques for species that are not currently being cultured. NIWA Natural Solutions has the vital role of commercialising such species. The aim is to establish new production activities and then to focus on complementing flesh production with products such as high value ingredients for the nutraceutical and cosmaceutical industries.

Establishing a new kingfish aquaculture industry in New Zealand is a key priority, and our world class aquaculture facility at Bream Bay provides the basis for us to build momentum in this industry. We are also developing culture techniques for other species, as well as assisting NIWA with paua and salmon hatchery activities.

Innovative RFID tags

Ensid Technologies, a joint venture with a New Zealand industry partner, is the pioneer of plastic RFID (radio frequency identification) transponder tags, using its patented plastic infusion technology. The company was established to commercialise the food safe plastic transponder tags developed by NIWA for use in a Ministry of Fisheries snapper stock assessment project.

With Swiss-based Sokymat SA, the world's largest supplier of RFID tags, as a key strategic partner and manufacturer of the plastic transponder tags for Ensid, the focus is on developing export sales for both animal and industrial uses.

Cara Brosnahan with samples tested for marine natural products.

Marine natural products

The combination of NIWA's marine science expertise, and the fact that about 80% of marine species found in New Zealand and Australia are unique to Australasia, has led to the development of a number of partnerships to commercialise marine natural products in areas such as cosmaceuticals, nutraceuticals, and biopharmaceuticals.

Smart, clean, and green

A new industrial market is emerging for products that kill noxious weeds by using naturally occurring fungal pathogens that are host specific, do not leave toxic residues, and are completely biodegradable. These are the so-called mycoherbicides, and we are developing products to solve some of the invasive aquatic weed problems that are estimated to cost New Zealand $20–30 million each year.

NIWA USA & NIWA Australia

www.niwa-eri.org

www.niwa.com.au

NIWA has established three businesses outside New Zealand to provide research and consulting services similar to those offered by NIWA Science. Two operate in the USA – **NIWA Environmental Research Institute** (a not-for-profit entity that focuses on US-funded research) and **NIWA (USA), Inc.** (which provides environmental consulting services for a range of clients) – and one in Australia – **NIWA Australia Pty Ltd**, which has staff in Brisbane who create a front door for marketing NIWA Science capabilities in Australia.

Where on earth is Nooksack?

The Nooksack River catchment covers an area of about 3600 sq km in the far north of the US state of Washington.

A group of stakeholders in Washington state, including citizens, local government, tribes, and state and federal agencies are developing plans for allocating water, protecting water quality, and restoring fish habitat in this catchment.

NIWA-ERI, under contract to Utah State University, developed a detailed hydrology model of the Nooksack catchment. The project used an extension of NIWA's Topnet system to simulate rainfall-runoff processes, irrigation and artificial drainage, reservoir storage, water abstraction (including minimum flow restrictions), and 'return flows' from water users. The results from the Topnet model feed into Utah State University's water quality model and stream habitat model. These three models are linked within a decision support system being used by the stakeholders to allocate water resources and plan land use.

Smart software helps track air pollution for NASA

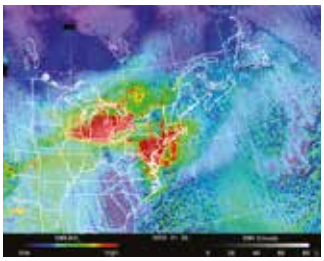


Image generated by the NASA Goddard Space Flight Center OMI NO_2 team.

NASA's Goddard Space Flight Center contracted NIWA ERI to develop a software package to read and prepare data on trace gases collected from an international network of ground-based instruments. These measurements will be used to help validate information from NASA's Aura satellite.

This image from Aura's ozone monitoring instrument shows the total amount of nitrogen dioxide in the atmosphere over the USA on 29 January 2005. Nitrogen dioxide is a precursor in the formation of tropospheric ozone. The red areas on the map show high amounts of nitrogen dioxide; the purple areas show regions of cloud where no readings could be taken. Air quality alerts were issued for Michigan during this period.

The troposphere is the lowest layer of air, approximately the first 10 km from the ground, and ozone here is a pollutant. By contrast, ozone in the next layer up, the stratosphere, helps protect us from harmful solar ultraviolet radiation.

Human health risk assessed

Many water management agencies in Australia assess water-related *ecological* 'health' risks across an entire region. Very few, however, attempt to assess *human* health risks at such scales.

NIWA Australia has conducted a human health risk assessment for all of South East Queensland, covering contact recreation, drinking water, and the harvesting of aquatic organisms (prawns, shellfish, etc.).

The project was commissioned by the Secretariat of the Moreton Bay Waterways and Catchments Partnership, on behalf of its stakeholders (local government, industry, research bodies, and community groups in South East Queensland). NIWA Australia involved ESR and a Brisbane engineering firm, WBM, as subcontractors.

After reviewing international best practice, we adopted a 'comparative risk assessment' approach, where experts assign scores to hazardous events, taking into account their likelihood, scale, severity, and duration of human health effects. Amongst other things, we developed a series of models such as that illustrated here. They show links between water use and hazardous events in various locations, and are being used to communicate risk to the public and non-medical specialists.

Conceptual model illustrating hazardous events identified as potential risks to people undertaking recreational activities in South East Queensland.

great staff

Our success is a team effort.

Together, and with a wide range of collaborators, our staff make a huge contribution to:

- scientific knowledge around the world
- the environment, both in New Zealand and globally
- the community, social and cultural development
- economic development and successful, environmentally-sustainable business
- local, regional, and central government decision-making
- New Zealand's commitments under international conventions and obligations

www.niwa.co.nz

This section celebrates some of the achievements of our staff during 2004–05.

Staff highlights

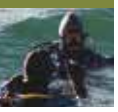
NIWA fisheries scientists **Dr Malcolm Francis** and **Michael Manning** are part of an international team studying the movement of great white sharks in the southwest Pacific. White shark population numbers are low. They grow slowly and have low reproductive rates. White sharks are not protected in New Zealand, and while they are protected in South Africa and Australia, it is not known whether white sharks in these areas are part of the same population.

In April 2005, Malcolm and Michael went to the Chatham Islands, along with scientists from the New York-based Wildlife Conservation Society and the Department of Conservation, to fit four sharks with satellite tags. These pop-up archival tags collect detailed information about the depth, temperature, and light levels (used to calculate position), before detaching at a pre-programmed time and transmitting the data to a satellite.

Michael and Malcolm prepare berley to attract the sharks.

Already one of the sharks, a four-metre female nicknamed Tessa, has surprised the team. By early July, Tessa was 1000 kilometres away in an area not previously known to be inhabited by white sharks.

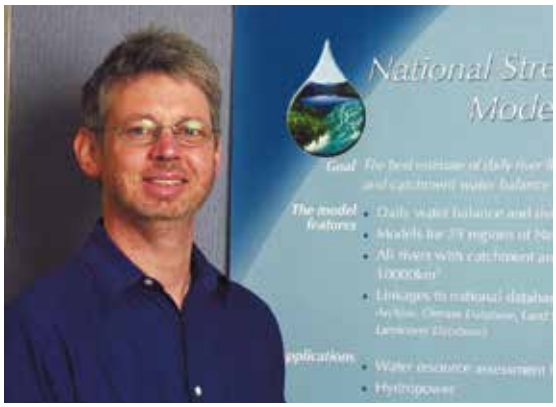
great staff



As coordinator of New Zealand's sea-level monitoring network, **Dr Rob Bell** spent Boxing Day monitoring the New Zealand situation in the aftermath of the Indian Ocean tsunami. Then there were weeks of intensive work advising government and answering media enquiries. Rob was also part of the reconnaissance mission to Thailand sponsored by the NZ Society for Earthquake Engineering, and the Earthquake Commission. Among the lessons for Rob: 'No single measure can provide complete protection – it needs to be a combination of early tsunami detection, robust warning-message systems, clear evacuation plans, strengthening or alternative location of critical facilities, and wise long-term planning of coastal subdivisions.'

Along with his usual swag of research and consulting projects, Rob is currently contributing to government-commissioned reports on this country's tsunami risk and preparedness, and advising Land Information New Zealand on a tsunami early warning system here.

Dr Sheryl Miller (Ngāi Tahu, Kati Mamoe, Waitaha) received a National Māori Academic Excellence Award in November 2004 for her PhD on ecophysiological aspects of *Ecklonia radiata*, a common large kelp in Doubtful Sound, Fiordland. Sheryl is working on a polyculture system with Hongoeka Development Trust to make aquaculture accessible to coastal iwi, and she's part of a team exploring the feasibility of growing seaweed as a secondary crop in mussel farms. But, while her main expertise is in seaweed, she enjoys any opportunity to get out in the field working with iwi. For instance, she's been helping with night-time surveys of eels and other mahinga kai species at Taumutu, a Ngāi Tahu rūnanga.



Water is vital to life, and a pressing issue in many parts of the world. Hydrological science has a lot to offer, but: 'often when I go to solve a practical problem that requires an estimate of how much water is available and the likely human effects on that resource, much of the relevant international research is untapped because no-one knows whether or not it applies to the catchment I need to know about,' says **Dr Ross Woods**.

Ross is one of the prime movers behind an international effort to develop useful ways of classifying and comparing catchments so hydrological research can be used more widely and appropriately. It carries the dry title of 'Theme Leader, Basin Classification and Intercomparison', which is part of the 'Prediction in Ungauged Basins' (PUB) project of the International Association of Hydrological Sciences.

As a NIWA principal scientist, Ross plays a leading role in many research projects such as creating a hydrological model of New Zealand.

When the Royal Society of New Zealand elected **Dr Lionel Carter** as a Fellow, the citation (in part) read: "Lionel Carter, Principal Scientist, NIWA, Wellington, is a leading New Zealand oceanographer and an expert on long-term ocean change … Dr Carter's various roles in science and project leadership have been outstandingly effective". Lionel finds this sort of thing embarrassing, but we couldn't have said it better ourselves. As one of our most experienced scientists, Lionel now spends part of his time teaching marine geology students at Victoria University of Wellington, strengthening the relationship between NIWA and the university. His current research includes a Marsden Fund project on effects of Antarctica on the Southern Ocean, in collaboration with the university's Antarctic Research Centre.

Drew Lohrer.

Three NIWA scientists are attracting international recognition for their work on the sandy, muddy expanses which cover most of the seafloor. In October 2004, the pre-eminent science journal *Nature* published a paper by **Drs Drew Lohrer** and **Simon Thrush** and **Max Gibbs**. They showed that soft-sediment seafloor ecosystems are much more complicated and valuable than previously thought.

In their experiments, Drew, Simon, and Max manipulated a small section of seafloor habitat in Otarawao Bay, near the mouth of Mahurangi Harbour. They focused on 'bioturbators' – organisms that stir up and displace sediment while they move and feed. The group of bioturbators they studied (burrowing heart urchins) are important to the ocean's productivity because their activities stimulate the release of nutrients, which are then used by marine microalgae for photosynthesis. The research shows that loss of large bioturbators, such as through bottom trawling, can impair the performance of these often-overlooked ecosystems.

Judith McKinnel is NIWA's longest-serving receptionist. She's been the friendly and efficient voice of our Christchurch office since NIWA was formed in 1992. Judith has worked as a telephonist for 26 years, starting in the RNZAF, and says she's always liked reception work because of the opportunities to meet and help people. Then she's busy putting us in touch with another scientist once more.

At about $70 a kilo on the domestic market, kina roe is much pricier than rock lobster, but the yield from wild-caught kina is highly variable.

Phil James works at our cold-water aquaculture facility at Mahanga Bay, Wellington. He has shown that holding kina in sea-cages with the right diet and handling can more than double their roe yield in just ten weeks, opening up a way for fishers to generate more income from the same number of animals. This research won him the Agriculture, Forestry and Fishing section of the 2005 MacDiarmid Young Scientist of the Year awards. Phil is now leading our work on kina husbandry and environmental effects, with a number of commercial partners, including Sea Urchin New Zealand.

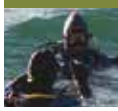
Phil James receives his award from Steve Maharey, Minister of Research, Science & Technology.

They're the men of our little ship that could: **Captain Ron Palmer and crew** have criss-crossed the Pacific in the 28-metre *Kaharoa*. Second mate, **John Hunt**, and cook, **Mark Styles**, hold the world record for successful deployments of 'Argo' floats. These high tech devices are providing detailed measurements of the upper ocean around the globe.

'For me, *Kaharoa*'s a perfect ship,' says John Hunt, 'unless we're going straight into the weather when things can get a bit rough.' They're off again in October 2005 for an epic voyage across the south, central, and northeast Pacific. *Kaharoa* will not return to Wellington until mid March 2006.

NIWA's involvement in the Argo programme is coordinated by marine physicist, **Dr Phil Sutton**. It's thanks to his association with Scripps Institution of Oceanography, San Diego, that Scripps and the University of Washington, Seattle, initially chartered *Kaharoa*. Now the vessel and crew have well and truly proved their worth.

Home at last: John Hunt, with his wife Paula, after three months at sea. So far, John has deployed over 200 Argo floats on voyages to Chile, Peru, and Tahiti.



Staff highlights

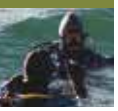
In January 2005, **Dr Barbara Hayden** was appointed to the newly established Biosecurity Ministerial Advisory Committee. The 13-member committee provides the Minister of Biosecurity with independent advice on how the biosecurity system is performing. Barb is one of our principal scientists. She leads the National Centre for Aquatic Biodiversity and Biosecurity, and a multidisciplinary research programme on sustainable aquaculture.

Dr Andrew Jeffs has been listening to curious tunes. He was one of the authors of a paper published in the prestigious weekly *Science* in April 2005. It showed for the first time that reef fish not only use the clicks, pops, and clacks emanating from underwater reefs to find places to settle, they also discriminate between sounds.

Andrew worked with Professor John Montgomery, director of the University of Auckland's Leigh Marine Laboratory, and a number of international collaborators. Their experiments on the Great Barrier Reef used an innovative underwater speaker system which Andrew developed for broadcasting imitation reef noises, such as snapping shrimps and fish calls.

Andrew and his colleagues have used this equipment to show that larval crabs and rock lobsters are probably using reef noises to find their way back to the coast. Understanding this behaviour and pinpointing the acoustic cues even more precisely will help in active management of reef fish.

great staff



Dr Janet Bradford-Grieve retired from NIWA in November 2004, but we still see a lot of her because she retains an emeritus role with us. Janet has devoted much of her professional life to studying calanoid copepods – small aquatic crustaceans. These plankton are an important food source for many larval fish. Janet is also a strong advocate of interdisciplinary science, and enjoys integrating the work of biologists, ocean chemists, sedimentologists, and physical oceanographers to get a better appreciation of how whole systems operate. She was elected a Fellow of the Royal Society of New Zealand for her work as a leading New Zealand biological oceanographer and world-leading copepod taxonomist. Now she's retired, she's got a stream of younger scientists asking her to review their manuscripts – which she's happy to do, 'provided they take notice'.

Professor Carolyn Burns, NIWA Board member and President of the Academy Council of the Royal Society, formally recognises Janet's election as Fellow at a function on Tangaroa.

NIWA scientists have been diving to explore undersea volcanoes between Tonga and the Bay of Plenty. The hot, sulphur-rich vents in these volcanoes sustain unique and complicated ecosystems. In April–May 2005, a multidisciplinary team of New Zealand and American scientists used the submersible *Pisces V* to study them first-hand.

NIWA geologist **Dr Ian Wright** contributed his expertise in hard rock geology, while biologists **Drs Malcolm Clark**, **Ashley Rowden**, and **Alison MacDiarmid** handled most of the study of 'macrofauna' (animals you can see with the naked eye).

Pisces V is owned and operated by the University of Hawaii. Ian, Malcolm, Ashley, and Alison were working with scientists from the Institute of Geological & Nuclear Sciences, the US National Oceanic and Atmospheric Administration, and the University of Mississippi.

They're world-renowned atmospheric scientists, but few New Zealanders have ever heard of them or the tiny Central Otago township of **Lauder** near where they work.

You'll usually find 16 permanent staff and a handful of international students and visiting scientists at NIWA's atmospheric research station about a kilometre outside Lauder. This little group has a big reputation.

To take one example: five Lauder scientists are invited authors on chapters of the 2006 Scientific Assessment of Ozone Depletion from the World Meteorological Organization and the UN Environment Programme. This is the authoritative scientific assessment on ozone, and very few other organisations in the world have as many invited authors.

Lauder's clear skies make it ideal for high precision atmospheric measurements, and there's a strong spirit of cooperation on global projects. Lauder is, for instance, the only fully equipped site in the southern hemisphere mid latitudes in the international Network for the Detection of Stratospheric Change (looking at ozone and other gases in the stratosphere, between about 50 and 100 km up). It is also one of just four charter sites worldwide in the global Total Carbon Column Observing Network (measuring carbon dioxide and other greenhouse gases through the whole atmosphere).

When **Dr Stu Hanchet** is not doing fisheries-related research, or kitesurfing off a Nelson beach, he convenes one of two working groups for the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR). Stu's role as convenor of CCAMLR's Fish Stock Assessment Working Group requires him to collaborate with scientists from the 26 member states and the secretariat based in Hobart. The international meetings on the complex business of assessing the stocks of toothfish and icefish can take all the skills of a diplomat, especially when you throw in political agendas and questions of illegal, unregulated, and unreported fishing and the like.

Dr David Wratt leads NIWA's National Climate Centre, but he is also the only New Zealander on the Bureau of the Intergovernmental Panel on Climate Change (IPCC). The IPCC was set up by the World Meteorological Organization and the United Nations Environment Programme in 1988, and almost every country in the world belongs. The IPCC produces regular assessments of the current state of knowledge on climate change. These assessments involve hundreds of experts and are highly influential.

David is one of three representatives of the Southwest Pacific on the 30-strong Bureau. 'The Bureau is a bit like a board of directors for the IPCC', David explains. They have the crucial job of selecting leading scientists to write sections of the reports. They also ensure the lengthy process runs smoothly, including extensive review by other scientists and governments.

In just four months this financial year, **Lou Reddish** watched well over 100 000 cars go by. Lou is the main operator of our remote sensing equipment for vehicle emissions. The technology uses beams of light to measure exhaust pollution in real life driving conditions.

Lou's got used to the 5 a.m. starts needed to survey rush hour traffic, but we do give him the occasional break from endless car-watching. This year has seen Lou working on temperature and wind speed sensors in the depths of Waitomo Caves and at the top of the Sky Tower in Auckland, and counting recreational fishing vessels from a light plane, as well as other air quality projects.

Dr Julie Hall is the first woman to lead the development of a new project within the International Geosphere-Biosphere Programme. The IGBP looks at the effects of global-scale problems and attempts to understand how the 'Earth System' works; for example, the links between land, ocean, and atmosphere. Julie's work brings together scientists from 37 countries with administrative support based in France. The topics are enormous,

such as the impact of fishing on the food web – in Julie's words, 'from viruses to walruses'. The research will take the next 10 years. This is just one of half a dozen international positions held by the busy ocean scientist. Julie also coordinates NIWA's work in science education.

Ian Maze likes to spend as little time as possible sitting in the office. Ian leads our Dunedin-based field team, and has some 36 years of field experience. His four-strong team does just about anything – from monitoring hydro lakes, to surveying ports, to maintaining NIWA's climate and hydrological networks.

Modern technology means data from most of the remote stations can be relayed automatically by radio, cellphone, or satellite link. However, the team still has to collect river flow measurements, maintain and inspect field equipment, and undertake special projects in all conditions.

Ian Maze (right) helps Dr Michael Reid collect sediment samples from the bottom of Lake Gunn, Southland, to study the effect of different nutrient levels on diatom species.

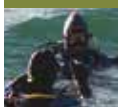
Says Ian, 'It can be bleak out there, but we've got the right gear.' And it beats sitting in the office.

'It's all about spending time with people, listening, and responding to their needs,' says **Dr Michelle Kelly** of her work with the people of Makaurau Marae, Ihumātao, Manukau.

Until about three years ago, the marae's taonga kai moana reef, Ngā Kuia e Toru, was covered by a thick layer of mud and Pacific oysters. After 40 years of circulation changes, the Mangere Sewage Treatment Plant oxidation ponds have been removed and the reef is now in recovery mode.

Michelle has been working with the marae's kaumatua, tamariki, and parents, to help them get reacquainted with the animals and plants on their recovering reef.

One of Michelle's most recent projects is this poster for schools, featuring a hikoi wananga (field trip) held in 2004 to learn about the reef.



Education & Training

NIWA is committed to the promotion of science in schools and universities and to the general public.

Our school sponsorship centred on three key areas: Regional Science and Technology Fairs and the national 'Realise the Dream' event, the Teacher Fellowship scheme, and the Discovery Room at Kelly Tarlton's.

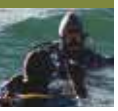
Winner of the Wellington fair Simon McVeagh discusses his project 'Why girls should not swim in Evans Bay' with judge Lionel Carter.

We are the major sponsor for **Regional Science and Technology Fairs** in Auckland City, Waikato, Bay of Plenty, Wellington, and Nelson, and we assist with sponsorship of the Central Northland, North Harbour, Taranaki, Marlborough, Central South Island, South Canterbury, and Otago fairs. These sponsorships promote science in secondary and intermediate schools and to the community at large because parents invariably outnumber students at the fairs.

Our association with the Royal Society of New Zealand's Science, Mathematics, and Technology **Teacher Fellowship** scheme continued with our hosting of two Teacher Fellows working on stream water quality. We also helped develop and provide ongoing support of the SEREAD project, which developed teaching resources on weather, climate, and sea level rise for use in Pacific Island schools.

We continued our sponsorship of the marine educational facility, the **'NIWA Discovery Room'** at Kelly Tarlton's Underwater World in Auckland. This gives children the chance to watch an octopus, identify sea life in the touch pool, and discover secrets of the marine world. More than 42 000 children visit the NIWA Discovery Room each year during school visits alone. The new children's interactive room at Kelly Tarlton's was also developed with our assistance.

great staff



Our linkages with universities through the joint postgraduate **Centres of Excellence** with the Universities of Auckland (Institute of Aquatic and Atmospheric Sciences (IAAS)), Canterbury (Centre of Excellence in Aquaculture and Marine Ecology), and Otago (Centre of Excellence in Chemical Oceanography) produce postgraduates in areas we require for core science. Of particular significance this year was the initiation of a closer relationship with Victoria University of Wellington, particularly in areas of marine science.

Our staff supervised 55 **postgraduate students** in six universities, 48 at PhD level. We provided two PhD scholarships, and several of our supervised students have received funding from the Foundation for Research, Science & Technology's Enterprise Fellowships, Tūāpapa Pūtaiao Māori Postgraduate Fellowships, or Bright Futures Fellowships. In many cases we also provide infrastructure and operational support.

We also funded 11 **postdoctoral fellowships** in areas where we need a rapid input of high quality expertise. These included water allocation, marine biosecurity, biodiversity, aquaculture, water resources, oceanography, and simulation modelling.

We provided **educational opportunities** for capacity building within NIWA with sabbatical leave grants for two senior scientists, and three technical training awards in overseas institutions.

In public education, we offer a wide range of sponsored and self-funded training courses within our core areas to assist in the professional development of staff in regional councils, government departments, and consultancy organisations. These courses transfer NIWA's technology and information to users. We ran 13 training courses this year, including a new initiative in aquaculture training in conjunction with the Seafood Industry Training Organisation (SITO). Others included the popular freshwater biodiversity courses on topics such as native freshwater fish, wetland plants, and aquatic invertebrates.

Steph Parkyn shows a Waitete landowner how to measure water clarity in a community stream restoration project.

NIWA's Executive team

Rob Murdoch, Bryce Cooper, Rick Pridmore, and Mark James.

Rick Pridmore, *Chief Executive Officer*

Rick became Chief Executive Officer of NIWA in August 2002 after having served as Deputy Chief Executive (Strategic Development) and Research Director of NIWA. Born in the USA, Rick came to New Zealand in 1976. He completed his PhD at the University of Otago in 1980, and from 1980 to 1993 he worked as a government scientist, specialising in marine and freshwater ecology.

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, NIWA Australia, and partnerships with Māori, government agencies, and industry.

Mark James, *Director, Operations*

Mark completed his PhD in aquatic ecology at the University of Otago, and has spent 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 was appointed as NIWA's Director of Operations in September 2003.

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 held the positions of research leader and Regional Manager at NIWA in Wellington before taking on roles overseeing NIWA's strategic research and NIWA Vessel Management Ltd.

General Managers John McKoy, Charlotte Severne, Clive Howard-Williams, Murray Poulter, Andrew Jeffs, and Don Robertson.

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, and an Adjunct Professor at the University of Canterbury.

Andrew Jeffs, *General Manager, Aquaculture & Marine Natural Products*

Andrew has a research background in marine ecology and aquaculture, with a strong interest in applied research. He has a PhD from the University of Auckland and worked as a scientist for the Cawthron Institute and the Department of Conservation before joining NIWA eight years ago.

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 and fisheries biology in New Zealand, Australia, 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, Biodiversity & Biosecurity*

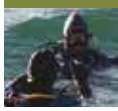
Don holds a PhD in marine biology from the University of Otago and has spent much of the last 30 years in marine fisheries research, including deepwater fisheries around New Zealand, and Antarctic marine resource management. He has had roles in marine science leadership, regional management, and information 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.

Charlotte Severne, *General Manager, Māori Development & Oceans*

Ka pāwaha te tai nei, hoea tātou

I raro i te maru o ngā maunga hakahaka, ngā awa teretere me ngā tūpuna, kua whetūrangitia o ngā motu e rua, tēnā rā koutou katoa.

Tēnei te mihi tioriori o Taihoronukurangi ki ngā iwi huri noa i te motu. Ko Charlotte Severne tōku ingoa. Ko ahau tētahi o ngā uri o Tūwharetoa me Tūhoe Potiki. Heoi anō ko taku nei tūanga, ko ahau te kaiwhakahaere Māori o roto o NIWA whānui tonu me tō mātou nei roopu rangahau Māori, e kiia nei ko Te Kūwaha-o-Taihoronukurangi. Ko te tino kaupapa o Te Kūwaha hei tautoko i ngā tūmanako, wawata o te iwi Māori.



sustainable development

is our business, and we practise what we preach

Our core business provides the basis for the sustainable development of the environment and natural resources.

In the following pages we illustrate our **environmental sustainability** by showing how we minimise our effect on the environment, and the effect of others;

we demonstrate our **social and cultural responsibility** both inside NIWA – by showing how we look after our staff and operate responsibly and outside NIWA – by showing how we help improve the lives of the wider community;

and we show we are **economically sustainable** by maintaining our return on equity and ensuring we operate at a profit, and by helping maintain or improve the economic viability of others.

Sustainable Development Report

NIWA is fully committed to operating in a sustainable manner and working with others to achieve both NIWA's and New Zealand's environmental, economic, and social goals. Many of our core business activities contribute directly to the sustainable development of New Zealand's natural and human resources by providing scientific advice, services, and products. Our mission statement and vision reflect this commitment by stating that we provide a sound scientific basis to help ensure that we use and benefit from our natural resources in a sustainable manner, while providing economic growth.

A growing part of our work is directed at creating new business and job opportunities, in both main city centres and in rural areas. We take particular care to minimise the impact of our activities on the environment and to ensure that individuals and communities potentially affected by our actions are well informed and consulted about how we plan to proceed. We support extensive interactions with non-government organisations and community groups, and we contribute substantially to the education of primary, secondary, and tertiary students. We also provide information and training for local and central government agencies and the wider public. Internationally, we represent New Zealand at a vast array of scientific meetings and inter-government forums.

In support of our mission and vision, our values include:

- contributing to environmental sustainability by developing and maintaining core capabilities to deliver leading edge science and innovative services focused on the natural environment;
- being socially responsible;
- ensuring that our staff are treated fairly and equitably;
- providing staff with a safe and healthy work environment.

We continue to promote sustainable development through our involvement in the New Zealand Business Council for Sustainable Development, have contributed to the NZBCSD's Sustainable Energy Futures project, and have members on national and international environmental and conservation committees. We also have our own sustainable Business committee, and this year we joined the Sustainable Business Network.

The Crown Research Institutes Act 1992 sets out the principles under which CRIs operate. We are committed to these principles, which include:

- undertaking research for the benefit of New Zealand;
- pursuing excellence in all activities;
- complying with all ethical standards;
- promoting and facilitating the application of research findings and technological developments;
- being a good employer;
- maintaining financial viability.

These principles form the basis of our non-financial performance measures, which are agreed each year with the shareholding ministers as part of our Statement of Corporate Intent (SCI). These measures and performance against targets are reported at the end of this section.

Our science helps to ensure the sustainable development of New Zealand's natural resources

Our core business is providing scientific advice, products, and services that underpin the sustainable development of New Zealand's natural resources. Some examples of how we did this are included below, but the underlying principle of sustainability applies to all our activities.

Sustainable management of marine resources

- We developed a model to assess the general health of coastal and estuarine environments based on the natural variability of seabed communities. The model can be applied to a range of anthropogenic impacts and provides a much better basis for the sustainable management of a healthy environment in coastal and estuarine systems than the conventional assessments based on a limited number of species.
- We participated in working groups assessing fish species and provided information to the Ministry of Fisheries for stock assessments of species including orange roughy, snapper, toothfish, hoki, ling, blue cod, oysters, southern blue whiting, kahawai, southern bluefin tuna, red cod, red gurnard, giant stargazer, and tarakihi.

Sustainable use of freshwater resources

- We made a major breakthrough in providing access to environmental information on New Zealand's freshwater resources. With a click of your mouse, a GIS search tool will give you a raft of catchment-related information (for example, sediment load or catchment mean rainfall and runoff) on any part of any stream in the River Environment Classification network (www.niwascience.co.nz/ncwr/rec). This can be used to predict environmental change in response to changes in other variables.

- Two of our web-based resources are now available for use by environmental managers of freshwater. LakeSPI (lakespi.niwa.co.nz) lets managers search for information on lake condition in about 50 lakes. It has historic and current evaluations, and uses submerged plant characteristics and information on other biota to assess the ecological health of a lake. The latest version of Freshwater Biodata Information System (fbis.niwa.co.nz) has new freshwater plant datasets and tailored queries for resource managers involved in sustainable management.

Sustainable land use

- Changes in the amount of nitrogen entering Lake Taupō under different land-uses can be predicted by a catchment model which has been developed into a simple web-based tool. This can now be done on the dedicated website by selecting parts of the Taupō catchment on a map and entering the new land-use (for example, changing the amount of pasture or entering point sources such as wastewater treatment plants). The model provides advice for environmental managers and a tool to help the public better understand the effects of changing land-use on the sustainable management of land and fresh water (taupo2020.niwa.co.nz).
- Tools to help predict the effects of sediments, nutrients, heavy metals, and pathogens on waterways (streams, lakes, and estuaries) are the aim of a large research programme we started this year. Erosion and dispersion of fine sediments are now monitored in the Raglan/Whaingaroa catchments as part of the study. The information will eventually be used to develop better computer models to help resource managers responsible for sustainable use of these environments. The project also involves close liaison with local communities.

Sustainable management of biodiversity & biosecurity

- Studies on the biodiversity of rocky reefs in and around the Hāhei Marine Reserve on the Coromandel Peninsula showed the effects of terrestrially derived sediments on kelp beds and faunal diversity. The work, backed up by laboratory experiments, has important implications for the sustainable management of marine reserves and catchment activities which might affect reserves.
- Braided rivers are under increasing pressure from water demands for irrigation and hydroelectricity, and managers need to balance these uses with maintaining the rivers as important natural resources. A NIWA study of biodiversity patterns of the Waimakariri River and associated springs and spring creeks highlighted the high biodiversity values of these ecosystems to help managers maintain such a balance.

Improving the quality of life in urban and rural areas

- We continued development of an advanced physico-chemical treatment system as an 'add-on' to our Advanced Pond System or to existing oxidation ponds commonly used in New Zealand for wastewater treatment. The new system significantly improves the quality of the discharged water, can remove 90% of phosphorus and similar levels of *E. coli*, and can reduce turbidity levels.
- We began work on a project aimed at protecting New Zealand's clean air – providing the science behind National Environmental Standards for air quality required by local authorities. We are investigating pollution emissions, dispersion modelling, atmospheric chemistry, monitoring networks, health and ecological effects, and pollution mitigation. Ultimately, the programme will provide a scientific basis for the definition of air quality management regions for all New Zealand.

Renewable and alternative energy sources

- Working with local iwi, we designed photovoltaic (direct conversion of solar energy to electricity) and solar hot water systems for two small communities (Waipoua in Northland, Waihi near Taupō), as well as a small microhydro scheme (500W) at Waipoua. Such schemes have enormous potential to provide energy for communities like Waipoua which have no reticulated electricity supply, and we will monitor their technical and economic performance over the next year.

Renewable energy at Waipoua.

- We have developed a new algorithm to estimate different components of measured solar irradiance at a number of sites. This will enable better nationwide estimates of solar energy for the design of water heating installations and photovoltaic generation.

The solar tracker and instrument array measures direct and diffuse solar radiation at Lauder, Central Otago.

Working with Māori

- In collaboration with Wairewa Rūnanga, we are assessing the tuna (eel) stocks of Wairewa (Lake Forsyth). Rūnanga members are involved in all phases of the sampling. Size distribution and stock numbers will be used to help assess sustainable levels for the fishery.
- Te Kūwaha staff are helping four iwi organisations (Ngāti Rārua, Maungaharuru-Tangitū Society Incorporation, Te Rūnanga-o-Te Whānau, and Te Rūnanga-o-Ngāti Whātua) develop strategic research plans to underpin environmental, economic, social, and cultural aspirations identified in their Annual Plans and Environmental Plans.

We operate in a sustainable manner

We are committed to operating in a sustainable manner. That means that we minimise our consumption of natural resources and the impact of our activities on the environment.

We develop financial and non-financial performance measures each year, and include them in our monitoring and reporting framework. These measures are realistic, measurable, cost-effective, aligned with our values and core business, and involve staff. They can be updated to reflect our changing business environment and growth in key sectors. They complement those used by the Crown Company Monitoring and Advisory Unit to monitor our performance, and they were expanded this year to include goals for recycling and reducing paper use. We also introduced new social performance measures. Our Sustainable Development Committee is the focus for sustainable development activities in NIWA, reporting and promoting awareness among staff.

Economically sustainable

Economic sustainability addresses our effect on the economic circumstances of our stakeholders and their economic systems. As a Crown Research Institute, NIWA is required to be financially viable and to undertake research for the benefit of New Zealand.

Highlights this year included:

- NIWA Group exceeded its financial targets;
- record high revenue of $91 million;
- net surplus, at $6.4 million, produced a return on average equity of 13.5%; this is well above the weighted average cost of capital of the organisation.

Direct customers

Our direct customers are those who fund our science and research. The Government 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.

Total revenue

NIWA Group for the year ended 30 June

2003	$84,200,000
2004	$84,631,000
2005	$91,137,000

To continue to provide the best science for all our customers, we have to grow with the market. The continued increase in our revenue shows the ongoing growth in demand for the science, products, and services we provide.

Suppliers

We aim to be good customers ourselves by supporting our suppliers and subcontractors by paying them in a timely manner in accordance with agreed terms.

Cost of all goods, materials, and services

NIWA Group for the year ended 30 June

2003	$35,223,000
2004	$36,153,000
2005	$38,071,000

Employees

Total payroll and benefits

NIWA Group for the year ended 30 June

2003	$41,491,000
2004	$41,864,000
2005	$43,214,000

Providers of capital

NIWA had interest bearing debt at 30 June 2005 of $1,700,000 (2004: nil). Changes in economic value to our shareholder are:

Operating surplus before tax

NIWA Group for the year ended 30 June

2003	$7,216,000
2004	$7,036,000
2005	$9,654,000

Return on equity

NIWA Group for the year ended 30 June (net surplus/average shareholders' funds)

2003	10.6%
2004	10.7%
2005	13.5%

Public sector

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

As a commercial entity, we also contribute by paying tax. Taxes paid in other countries were minimal.

Taxes paid

NIWA Group for the year ended 30 June

2003	$3,297,000
2004	$1,506,000
2005	$3,000,000

The economic challenges next year include:

- continuing to meet NIWA's economic targets in the face of increasing competition, increasing resource costs, and reduced funding in some areas;
- continuing to find new investment and growth opportunities that add value to our organisation and our services;
- maintaining our profitability and continuing to produce acceptable returns to our shareholders balanced against the increasing costs to retain the best scientists in an increasingly tight labour market and increasing operating costs;
- turning our research outcomes into new products, services, and industries for New Zealand.

Environmentally sustainable

Environmental sustainability identifies the need to meet customer needs while maintaining the environment in at least its present state, thereby ensuring that future generations receive the same benefits. We acknowledge this responsibility and act accordingly to minimise the impact of our activities on the environment.

Our environmental policy recognises that we need to conduct all our activities to a high standard of environmental awareness by complying with relevant legislation, taking all practical steps to minimise any impact, having contingency plans for accidental spills, minimising waste production and the consumption of resources, and striving to improve our environmental performance.

Highlights this year included:

- increased use of recycling facilities;
- targets for the amount of recycling and waste disposal were exceeded;
- greater staff awareness and involvement in minimising the impacts of NIWA's activities;
- no incidents of non-compliance with discharge regulations.

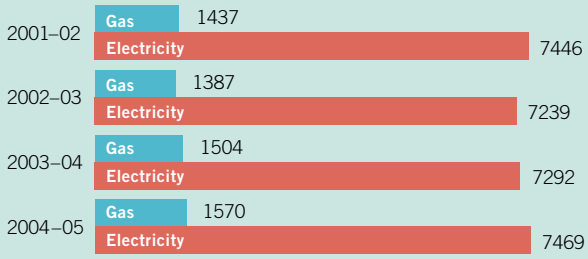
Resource use

We are a foundation member of the Energy Wise Government Programme, which is administered by the Energy Efficiency and Conservation Authority (EECA). We use energy efficiently in all our premises, plant, and equipment wherever it is cost-effective.

NIWA Science carried out energy audits at the larger sites in 2002 and established baselines for energy use. We aim to reduce electricity use without compromising our service levels, productivity, or staff comfort. We investigate all potential energy saving initiatives, including:

- increasing staff awareness through staff meetings, email, and newsletters;
- changing heating water practices and reducing heat loss (Lauder);
- investigating alternative energy sources, such as solar power (Christchurch), and new reticulation systems to conserve energy and water (Bream Bay).

Energy use* (kWh) per fulltime staff equivalent



**Next year we will develop a measure that can be related to productivity.*

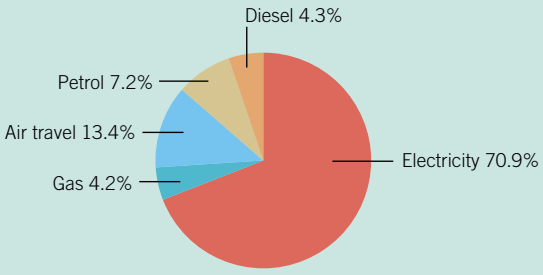
Despite our energy efficiency initiatives, use increased this year. We will investigate initiatives to reduce it to at least 2003–04 levels. The electricity use for 2003–04 and 2004–05 excludes the new site at Bream Bay and the upgrade to the supercomputer at Greta Point. The goal to reduce energy use was set before these facilities were established and, although we are working on reducing the energy demand there, it is not appropriate to include those sites in baseline comparisons. Bream Bay is NIWA's newest facility, specialising in large-scale aquaculture production, and it accounted for 20% of the total electricity use at NIWA in 2004–05. A water reticulation system at Bream Bay is being designed and built to conserve water and save energy. This system will reheat water for abalone production. The supercomputer upgrade accounted for 12% of the total electricity use.

2004–05 Target	2004–05 Performance	2005–06 Target
To achieve at least a 15% saving per fulltime staff equivalent in electricity and gas use (from the baseline for 2001–02) over the 5-year period to 30 June 2007.	Electricity and gas use increased by 1.8% compared with 2001–02.	Reduce electricity and gas use by at least 5% by June 2006 (from the baseline for 2001–02).

In addition to auditing our use of electricity and gas, we gathered information on our use of motor vehicles, hire of taxis, and air travel to enable an assessment of the equivalent greenhouse gas emissions produced by our activities. We estimated that the consumption of fossil fuels to support our activities emitted 2983 t of carbon dioxide in the year ending 30 June 2002, 3030 t in 2003, and 3373 t in 2004, and 4039 t in 2005 (using the New Zealand Business Council for Sustainable Development protocol). The increase in 2005 was expected, and was due to the installation of the supercomputer at Greta Point and the full use of the facilities at Bream Bay. The use of motor vehicles, hire of taxis, and air travel are essential to enable us to carry out our business. While we will continue to minimise travel where possible, our use of these resources is likely to increase in future as our business continues to grow. However, we will attempt to balance this through energy savings and other initiatives.

Electricity is a significant resource used by NIWA. This year it accounted for 70% of the total carbon dioxide emissions. Our major resource use was:

Resource use %



Based on fulltime staff equivalents (578), carbon dioxide emissions increased from 5.06 t in 2003–04 to 6.99 t in 2004–05. The main reason for this was the increased air travel and electricity use at Greta Point and Bream Bay. We are considering:

- installing video conferencing facilities at major NIWA sites in an effort to reduce air travel;
- purchasing hybrid vehicles in an effort to reduce the use of petrol and diesel by our vehicles;
- investing in energy efficient systems and building management systems to conserve energy.

CO_2 gas emissions (t) per full-time staff equivalent

The Inventory of New Zealand's Greenhouse Gas Emissions (www.niwascience.co.nz/ncces/ghge) and the Residential Carbon Dioxide Calculator (www.niwascience.co.nz/ncces/co2calc) are both active on the NIWA website. The latter tool enables individuals to estimate their contribution to carbon dioxide emissions.

2004–05 Target	2004–05 Performance	2005–06 Target
NIWA's total annual contribution to greenhouse gas emissions based on full time staff numbers does not increase above the baseline for 2001–02.	The equivalent emission of carbon dioxide was 7%* higher than 2001–02 (* excludes the new developments).	NIWA's total annual contribution to greenhouse gas emissions does not increase above the baseline for 2001–02.

NIWA Vessels

NIWA Vessels manages two large research vessels – *Tangaroa* (deepwater) and *Kaharoa* (coastal and inshore). Both vessels operate on diesel fuel, and the equivalent carbon dioxide emissions were:

Year ending 30 June 2002	6682 t (12.7 t per sea-day)
Year ending 30 June 2003	6091 t (12.5 t per sea-day)
Year ending 30 June 2004	5522 t (11.7 t per sea-day)
Year ending 30 June 2005	6954 t (13.3 t per sea-day)

2005–06 Target

To reduce the carbon dioxide emissions by *Tangaroa* and *Kaharoa*, based on tonnes of fuel per sea-day by reducing vessel speed when practical.

Fuel consumption increased substantially in 2004–05 because several voyages required all-day steaming.

We ensure that emissions from diesel fuel are minimised by continually reviewing work schedules and updating servicing and maintenance plans. Both vessels are classified with Det Norske Veritas (DNV), an internationally recognised classification society, and both are maintained in accordance with the society's rules. These require the vessels to comply with stringent, planned maintenance routines and high levels of operational practice.

NIWA Vessels carries out underwater hull scrubbing of *Tangaroa* and *Kaharoa* about every 9 months to improve fuel consumption. Fuel consumption was also considerably reduced (by as much as 28% at times) by *Tangaroa* reducing normal cruising speed from 12 to 10 knots.

Every 6 months the vessels are inspected for introduced species, such as *Undaria*, and are cleaned. This is also done before they enter areas where *Undaria* and other noxious plants have not been recorded, such as Antarctica. A waste separation station has also been established on *Tangaroa* for recycling glass, paper, cardboard, cans, and plastics.

Waste management and recycling

We are continually evolving our waste management and recycling strategies, including providing recycling facilities in all offices and at each site, and increasing awareness of the need to reduce waste and increase recycling. There were no incidents of non-compliance with discharge regulations. The waste management and recycling facilities for NIWA's vessels follow those of the International Ship Management Plan.

Our four main sites (Auckland, Hamilton, Wellington, and Christchurch) accounted for 26 544 kg of recycled paper (56 kg per FTE) and 64 980 kg (137 kg per FTE) of solid waste in 2004–05. The goal set in 2003–04 was to increase recycling of paper and reduce solid waste by at least 10% over the next 5 years (based on the number of full time staff). We met this target this year, but it is important that we improve on this.

2004–05 Target	2004–05 Performance	2005–06 Target
To achieve at least a 10% increase in recycling of paper and reduce solid waste by 10% per fulltime staff equivalent (from the baseline for 2003–04) over the 5-year period to 30 June 2009.	The increase in recycling of paper was 23% compared with 2003–04 and there was a decrease of 11% in solid waste.	To maintain and where possible increase the recycling of paper, glass, and plastic and to reduce solid waste production.

Paper use

Paper is the most significant area of waste for NIWA and we have developed strategies to reduce its use.

2004–05 Target	2004–05 Performance	2005–06 Target
To reduce the use of paper by 10% over the next 5 years compared with the base in 2003–04.	There was a reduction from 14.6 (FTE: 586) to 11.1 (FTE: 578) reams of paper per FTE, which is a reduction of 24% compared with 2003–04.	Continue to reduce the use of paper and not exceed the 2004–05 use.

Key environmental challenges next year include:

- minimising waste as the company grows and becomes more involved in product sales;
- maintaining and enhancing staff awareness of the need to conserve energy and develop alternatives;
- continuing investment in energy saving infrastructure and equipment (for example, video conferencing and hybrid cars) while meeting the heavy demand for capital equipment;
- reducing energy consumption (energy audits should be repeated at all major sites) while the business continues to grow.

Our social and cultural responsibilities

Social responsibility starts with the well-being of our biggest asset – our staff. We are committed to providing competitive salaries, enhancing professional and career development, promoting work-life balance, investing in new capital equipment, providing overseas travel opportunities, and providing a safe workplace.

Highlights this year included:

- establishing a working party to investigate and recommend career development pathways for technical staff;
- increasing staff benefits;
- targeting initiatives for work-life balance;
- providing career and personal development opportunities after discussions with staff and developing formal succession plans;
- reducing annual leave balances, so that only 15 staff had more than 30 days leave at 1 December 2004;
- providing access to more than 60 different training courses for staff;
- maintaining a high workplace safety record and secondary level in the ACC Partnership Programme;
- increasing involvement with iwi in both research and sustainable development projects;
- running training courses for a range of users, continuing sponsorship of science fairs, and continuing the association with the very successful and high profile Kelly Tarlton's Underwater World.

How we help our staff

Benefits

We successfully renegotiated the collective agreement with the PSA, and in the process enhanced many of the benefits. We improved the level of allowances, widened our unique training leave to include personal development and participation in community events such as organised sporting or cultural activities and helping with school trips. We improved the long service leave provisions and increased the health care subsidy available to PSA members by 50% as well as providing better access to benefits. We also made a commitment to further investigate practices in relation to retirement.

All permanent staff benefit from:

- a subsidised superannuation scheme;
- an annual review of remuneration;
- a profit share scheme;
- competitive salaries;
- sick leave and bereavement leave as necessary;
- a 6 week ex gratia payment after returning from maternity leave;
- Capability Fund support for sabbaticals, technical training awards, postdoctoral grants, and overseas travel.

These benefits reflect our strong commitment to treating our staff fairly and equitably.

We have an excellent working relationship with the PSA, and the PSA Partnership Forum enhances the sharing of information on key issues affecting staff. Membership of the PSA is voluntary, and 54% of staff are members.

Rewarding staff

We need to retain and recruit top staff to maintain our excellent reputation for innovative, leading edge science, and high quality products and services. In addition to the financial benefits and the other benefits listed above, we invest in leading edge scientific equipment and fund overseas travel to maintain international reputations and opportunities.

Our performance remuneration system acknowledges the range, depth, and type of skills our staff have. We also have a profit-share scheme, which allows for a proportion of the after-tax operating surplus to be distributed to all staff.

Our average remuneration for most levels meets or exceeds the market median, based on the Hay Survey of Pure and Applied Research. We aim to ensure it remains ahead of the market across all levels, within financial constraints.

Staff development

After the review of scientific and administrative workloads and the redistribution of responsibilities in 2003–04, we held a series of staff development workshops to identify and develop critical skills and to help with career development and prospects. The most successful of these workshops was the commercial skills module, which focused on client management and selling services. Workshops on communication, staff management, and project management were also held for appropriate staff, and staff attended a range of courses identified for personal development. More than 60 different courses were available, and 465 training sessions were completed.

Employee well-being and work-life balance

We are committed to promoting an appropriate level of work-life balance. Staff are encouraged to make the most of the non-financial benefits. We ran briefing sessions on our subsidised superannuation scheme, provided workplace training on stress and stress management, and funded retirement planning seminars for interested staff and their partners. In addition, we support crèche facilities at our largest site in Wellington, and maintain a flexible policy with regard to work hours and leave. We also included personal development and support of school events in the training leave programme.

We encourage participation in community events (and directly sponsor some staff), such as the running relay around Lake Taupō, the Lake Taupō bike relay, and the Auckland Marathon.

Parents Alistair Dunn (left) and Owen Anderson with Rose Dunn, Elliott Allen, and Nina Anderson (obscured) at the Greta Point crèche.

Health and safety

We rigorously promote safe working practices and procedures for all operations. We have comprehensive health and safety systems which aim to minimise risk, monitor and manage known hazards, and ensure that staff are adequately trained, informed, and protected. The success of this practice is shown by our continued acceptance at secondary level in the ACC partnership programme in recognition of safety management practices and systems.

Our employee participation system played a pivotal role in the development and monitoring of these systems. The National Health and Safety Committee, a body of employee and union representatives, met regularly to facilitate communication between staff and management and to implement safety solutions.

Work-related incidents increased from 76 to 90. Although the total number of incidents increased, we identified potential hazards, reviewed areas such as driver fatigue, and put remedial actions in place where appropriate. There were four lost-time accidents, two of which required significant recovery times and gradual return to work plans. As a result, there were 157.6 equivalent full days lost to injury, which corresponds to less than 0.1% of total work days per year for science staff. More than 300 staff received specialised safety-related training during the year.

Staff composition

Staffing levels have remained fairly constant over the last two years. There have been new positions in key growth areas, such as aquaculture and biosecurity, and the figures now include all subsidiaries. Turnover increased from 7.7% to 9.6%, which partly reflects the greater opportunities for staff movement as the labour market tightened towards the end of 2004 and the beginning of 2005.

Age profile (%) by 10 year age groups for NIWA and its subsidiaries

Category	<20	20–29	30–39	40–49	50+
Research teams	0.0	10.8	28.8	30.2	30.2
Research support	0.0	0.0	15.9	29.5	54.5
General support	1.0	17.8	21.8	26.7	32.7
Marketing & promotion	0.0	0.0	20.0	40.0	40.0
Executive/Management	0.0	0.0	8.3	41.7	50.0
Total	0.2	10.6	25.9	30.1	33.2

How we help others

Working with Māori

We are committed to building strong relationships with Māori through the continued development of collaborative research partnerships at 'flaxroots' level with iwi, hapū, and Māori organisations. Our Māori Research and Development Unit, Te Kūwaha, focuses on research that underpins Māori aspirations for business development and sustainable resource management. A new area of collaboration between Te Kūwaha scientists and iwi is the development of strategic research plans – a novel way of prioritising the research aspirations of iwi, hapū, and Māori organisations. Our Māori researchers and scientists specialise in the core areas of climate and energy, freshwater, marine, and aquaculture research.

A key aim for Te Kūwaha is to improve all staff interactions with iwi partners, based on 'tikanga tangata' and 'kawa atua', thus making NIWA an attractive place for Māori researchers to work. Te Kūwaha now comprises a General Manager and 16 key Māori scientists and technicians. We have daily interactions with iwi, and currently have 78 iwi relationships, are involved with 19 interested parties, have 15 letters of understanding, 18 draft proposals, and 9 signed memorandums of understanding. The latest MOU signed was with Te Ohu Kai Moana, which advanced the development of marine and freshwater research collaboration between the two organisations.

Te Kūwaha has engaged in several hui and wānanga with their iwi research partners, users, and stakeholders. Particular highlights include second stage discussions with Tainui hapū at Whaingaroa investigating an acceptable model of treating wastewater from a Māori perspective, and the weather and climate wānanga involving 15 kaumātua from Te Whānau-ā-Apanui, held at Te Wānanga a Awanuiārangi at Whakatāne.

Contributing to education and training

We contribute substantially to education that advances science, particularly in our core areas of marine and freshwater resources and atmospheric and climate science. We do this through targeted sponsorship initiatives for schools, joint research and teaching ventures with universities, and training courses for the public. We sponsor a number of education activities including:

- the regional school science and technology fairs in Auckland, Waikato, Bay of Plenty, Wellington, and Nelson;
- assisting with the sponsorship of several other science fairs;
- the national 'Realise the Dream' event.

The 'NIWA Discovery Room' at Kelly Tarlton's Underwater World is aimed at school pupils and attracts some 42 000 each year.

The field inspection in Otukikino Reserve, Christchurch, as part of one of our freshwater biodiversity and biosecurity training courses.

We have strong links with New Zealand universities. Our postgraduate Centres of Excellence at the Universities of Canterbury and Otago, and the Institute of Aquatic and Atmospheric Sciences at the University of Auckland, form the core of this collaboration, and our staff supervised 55 postgraduates this year. In a new initiative with Victoria University of Wellington, we are negotiating to lease space to the university to jointly develop areas of mutual interest. We continued our very successful public training courses; these range from environmental monitoring and aquaculture to biodiversity, and there are 14 such courses scheduled for 2005–06. We also funded 11 postdoctoral fellowships in core areas.

Terry Hume (centre, in shorts) discusses the morphology of Wainui Beach during a 2-day coastal hazards course.

Maintaining a high regard for animal welfare

We use fish in environmental research to help us understand the ecological requirements of indigenous species, to help us assess the impacts of proposed developments on the health of the environment, and to assess and develop species for aquaculture.

Our Animal Ethics Committee ensures that all our animal-based research is conducted in accordance with the Animal Welfare Act (1999) and NIWA's Code of Ethical Conduct for the Use of Live Animals in Research, which has ministerial approval as required under the Act. We report our use of animals annually to the Ministry of Agriculture and Forestry.

Our code of ethical conduct permits the use of animals only when the committee considers that the benefits of the research outweigh the suffering imposed on the animals. We use only the minimum number of animals needed to produce statistically sound results. The total number and the range of species (mainly fish) depends entirely on funded projects, so use varies from year to year.

In compliance with the provisions of the Act, we developed a new code this year to replace the code which expired in December 2004. MAF approved the new code on 7 October 2004.

New social performance measures adopted

Five new social performance measures were developed this year, and they will be added to our reporting framework. They were the number of staff receiving internal and external training, the percentage of staff that have personal development plans, the number of job opportunities created in main city centres and rural areas, and the number of financial and non-financial benefits received by staff.

This year we created 28 new positions in key growth areas such as aquaculture, energy, and monitoring. Twelve of these were in small cities and rural areas such as Bream Bay, Northland (8 positions).

Michelle Harvey in the algal culture room at Bream Bay.

Key social challenges for next year include:

- further improving work-life balance, and maintaining or improving morale in the face of reduced funding in some areas;
- continuing to provide staff with a healthy work environment, and maintaining our excellent health and safety record;
- the recruitment and retention of top staff in key areas;
- maintaining competitive salaries and conditions;
- keeping our profile high through training courses and education and involvement with Māori, while meeting competing demands on projects, funding, and staff time.

Performance against Statement of Corporate Intent on page 58.

Performance against Statement of Corporate Intent (for NIWA Group)

Financial Performance Measures	2004–05 Actual	2004–05 Target	2003–04 Actual
Revenue ($millions)	91.1	86.9	84.6
Current ratio	1.0	0.8	1.4
Quick ratio	1.3	0.9	1.8
Return on equity (%)	13.5	6.7	10.7
Return on assets (%)	13.4	7.7	9.8
EBIT margin (%)	10.2	5.8	8.0
Non-Financial Performance Measures			
Staff composition (including subsidiaries)			
Number of staff			
Research teams (including postdocs)	437	433	438
Research support	44	47	47
General support	101	92	96
Marketing and promotion	5	7	7
Management	24	22	24
Staff turnover (%)	9.6	8	7.7
% male:female	73:27		72:28
Good employer			
Lost time injuries (% of work days)	0.1	<0.1	<0.005
Days lost to injury (NIWA Science)	157		38
Research output*			
Papers in international, externally refereed journals	347	280	307
Papers in local, internally, or editor-refereed journals	127	180	183
Conference papers and other presentations	781	800	724
Research monographs and books	88	70	82
Popular books	0	2	1
Client reports	606	500	510
Application and promotion of science			
Value of consultancies to NZ users ($millions)	24	25	27
Achievements of technology transfer objectives in FRST contracts (%)	95	95	99
Number of training courses	13		
Number of joint ventures	2		
Value of TBG and Technet contracts ($thousands)	759	800	440
Requests serviced for information from NIWA's nationally significant public good databases			10 664
• National Climate Database**	8500	9000	
• Water Resources Archive	1120	800	
• NZ Freshwater Fish Database	1452	1200	
Magazine and newspaper feature articles plus TV and radio interviews	194	230	248
Number of patents or licensed products owned	6		4

* *Measured for a calendar year.*

** *The National Climate Database is now a web-based fully automated system. The numbers reported are for the 70 external subscribers who regularly access the database and do not include the 6000 data requests from internal NIWA users.*

Qtv is here

NIWA staff, CEO Rick Pridmore in particular, were heavily involved in developing Project Q with OliverGiles Productions, from the initial conceptualisation, through a myriad of funding and sponsorship manoeuvres, and finally to the filming and review. A dynamic, new multimedia series designed to engage young people's interest in the world of science, Q first screened on TV One on 21 September 2005.

Four young people with a passion for finding out for themselves what makes the real world tick explore aspects of a 'big science' theme with New Zealanders whose job it is to help find sustainable solutions to the global issues confronting us. Whether it's checking out the conservation issues behind the extinction of the moa, journeying to the depths of undersea volcanoes, or investigating the threat of tsunamis, the Q team happily share their fears, phobias and fascinations with us and ask the questions that kids are really interested in – 'Is a dolphin faster than a jet-ski, Is bottled water any different from tap water, Can animals be gay?'

Project Q is a joint venture between OliverGiles Productions Limited, the Sir Peter Blake Trust, TVNZ, NIWA, the CRIs, Transpower, The Vodafone Foundation, and the Ministry of Education, with strategic partners Oktober Interactive and the Royal Society of NZ. It encompasses a 13-part television series, an interactive website, and a suite of learning tools for teachers and students, including the Q Careers series on DVD, which features the Q team promoting careers in science to their peers.

www.qteam.co.nz

1. *NIWA's Doug Ramsay and the team discuss the tsunami threat, while* **2.** *Ashley Rowden introduces some of the marvels of NIWA's marine biology collection.* **3.** *The Q team: Barnaby, Chelsie, Tess, and Paora.*

URS New Zealand
Engineering and Environmental Management

VERIFICATION STATEMENT

Scope and Methodology

URS New Zealand (URS) has carried out an independent audit of the National Institute of Water and Atmospheric Research (NIWA) Sustainable Development Report 2005 – a section of the Annual Report 2005 – to provide to readers assurance on the accuracy of the report content and feedback on the appropriateness and completeness of reporting.

The audit methodology draws on the AA1000 Assurance Standard (March 2003) – an international standard developed to guide the assurance of public reporting on social, economic and environmental performance. The audit was designed to investigate whether NIWA has provided adequate evidence to support the information contained in the report and to assess how well the AA1000 principles of Completeness, Materiality and Responsiveness are applied.

The audit methodology was to:

- Review the draft Sustainable Development Report 2005 – to identify statements of fact/claims and data requiring verification.
- Assess Sustainability Context and main issues.
- Conduct interviews with key personnel at the NIWA Auckland and Wellington offices.
- Sight documented information, computer and hard-copy files, data sources and data.
- Identify errors or weakness in data, provide feedback to NIWA and verify the final report.

The full contents of the report were investigated.

Independence

There is no aspect of the relationship between URS and NIWA that has influenced the independent nature of these verification findings. URS has collaborated with NIWA on hydrological investigations and other projects.

Findings

On the basis of the described audit methodology, URS verifies that the content of the NIWA Sustainable Development Report 2005 provides an accurate description of the company's environmental, social and economic performance.

Comments/Recommendations

Based on our review NIWA has covered the key performance areas of health and safety, being a good employer, minimising environmental impact, financial outcomes and community contribution in a transparent and open manner.

NIWA's commitment to improving the sustainability of its internal operations was evident throughout the verification process with good discussion on trends and the development of new social measures.

Changes to the report format have added value to this year's report providing greater reader accessibility. Overall this year's report marks a notable progression in reporting on NIWA's internal sustainability performance from last year.

NIWA needs to be sure that its data are comparative year on year and that any changes in calculations and data parameters are highlighted, e.g., changing parameters for CO_2 emissions calculation. In some cases better explanation of reported data would be helpful to readers.

As noted last year improved management systems and processes for the collection of data would help to ensure consistent reporting and the process of verification.

It was clear throughout the verification process that NIWA is committed to achieving a transparent and comprehensive report relevant to their stakeholders. We commend NIWA on their continued commitment to sustainability reporting and look forward to future reports reflecting improved performance.

URS New Zealand Limited
09 September 2005

Kerry Griffiths
Principal, Sustainability Consultant

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Report of the Directors to the Shareholders

Directors' profiles

NIWA Board: (left to right) Ed Johnson, John Hercus, David Sharp, Graham Hill, Sue Suckling (Chair), Carolyn Burns, John Spencer, Troy Newton, Miranda Cassidy.

Sue Suckling *(Chair)*, OBE, BTech (Hons), MTech, is a Christchurch-based director and strategic business consultant. She is Chair of Agriquality New Zealand Ltd and chair of several private companies. Previously, she was Deputy Chair of the Institute of Geological & Nuclear Sciences Ltd. Sue was appointed NIWA Chair in July 2001.

Professor Carolyn Burns is a distinguished limnologist at the Department of Zoology, University of Otago. She holds a doctorate from the University of Toronto, was awarded the CBE in 1984, and is a Fellow of the Royal Society of New Zealand. She has held visiting research professorships in US universities and was a research scientist at the Max-Planck Institute for Limnology. In 1999 she was honoured with the University of Canterbury Distinguished Alumni Award.

Miranda Cassidy, BA in sociology, MSc (Hons) in resource management, is an Auckland-based company director and consultant. She is a former customary fisheries manager of Ngai Tahu Development Corporation and is currently Director of FOLKUS Ltd, an environmental consulting company.

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 at the University of Auckland and the Auckland University of Technology. From 1967 to 1996 he was a research scientist at the National Research Council of Canada – Dominion Astrophysical Observatory in Victoria, BC, and is a scientific computer software consultant for 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, Goldpine Industries Ltd, and Custom Fleet (NZ) Ltd, and a director of several entities including the Bank of New Zealand, Port Otago Ltd, MDC Holdings Ltd, and Mudhouse Wine Company Ltd. He retired as Chairman and Chief Financial Officer of Shell New Zealand in 2002 after having senior management roles in New Zealand, the USA, 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.

David Sharp, BSc, is Chairman of the New Zealand Seafood Industry Council, and holds a number of other positions in the seafood industry. He was previously executive director of a major New Zealand primary produce exporting and seafood company.

John Spencer is the Chairman of Tainui Group Holdings Ltd and a Director of Tower Ltd, Solid Energy Ltd, and Triage Capital Ltd. He was the Chief Executive of New Zealand Dairy Group before Fonterra was established, and he 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.

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 2005.

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 $6.4 million (2004: $5.3 million) against a budgeted net surplus of $3.1 million. This was achieved on a turnover of $91.1 million (2004: $84.6 million), against budgeted revenue of $86.9 million.

Shareholders' equity at 30 June 2005 totalled $43.7 million (2004: $51.9 million). Total assets totalled $66.9 million at 30 June 2005 (2004: $72.3 million). Both shareholders' equity and total asset values declined on the previous year as a result of the payment of dividends.

Donations

No donations were made during the year.

Dividends

Dividend payments of $15.0 million were made to the Government of New Zealand (the Crown) as the sole shareholder.

Directors

The appointment of Ed Johnson on 9 June 2005 was the only change to the Board of Directors for the year ended 30 June 2005.

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'.

Group actual performance versus Statement of Corporate Intent (SCI)

Years ended 30 June	**Actual 2005 $'000**	SCI 2005 $'000	Actual 2004 $'000
Revenue	91,137	86,908	84,631
Operating expenses and depreciation	81,627	81,845	77,746
Operating surplus before tax	9,654	4,953	7,036
Net surplus	6,434	3,065	5,276
Average total assets	69,558	66,015	69,480
Average shareholders' funds	47,817	45,600	49,296
Profitability			
Operating surplus (%) (EBIT/revenue)	10.2	5.8	8.0
Return on average equity after tax (%) (net surplus/average equity)	13.5	6.7	10.7
Return on assets (%) (EBIT/average total assets)	13.4	7.7	9.8
Liquidity and Efficiency			
Current ratio	1.0	0.8	1.4
Quick ratio	1.3	0.9	1.8
Financial Leverage			
Debt to average equity (%)	48	47	41
Gearing (%)	5	23	1
Proprietorship (%) (shareholders' funds/total assets)	69	69	71

Interests Register

The following are transactions recorded in the Interests Register for the year.

(a) 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.

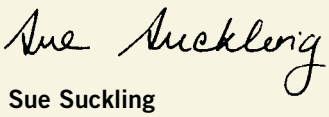
Use of Company Information by Directors
Pursuant to section 145 of the Companies Act 1993 there were no recorded notices from Directors requesting to use company information received in their capacity as Directors that would not otherwise have been available to them.

Share dealings
During the year no Directors purchased or disposed of any equity securities of the NIWA Group.

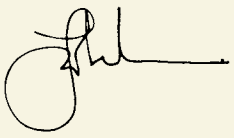
Directors' Loans
There were no loans by the NIWA Group to any Directors.

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 2005

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 2005.

Sue Suckling
Chair
24 August 2005

Rick Pridmore
Chief Executive

Corporate governance

Approach to corporate governance

Corporate governance is concerned with how companies are directed and controlled and, in particular, with the role of the board of directors ("the Board") and the need to ensure a framework of effective accountability and transparency.

The Company 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 Company 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 contained 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 the following:

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

The Board and Management of the Company is committed to ensuring that the Company adheres to best practice governance principles and maintains the highest ethical standards.

This governance statement outlines the Company's main corporate governance practices as at 30 June 2005. Unless otherwise stated they reflect the practices in place throughout the financial year ending on that date.

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 and Unidata Pty Ltd, which constitute the NIWA Group.

The functions of the Board include:

- establishing the Company's objectives;
- reviewing and approving major strategies for achieving the Company's objectives;
- managing risks;
- determining the overall policy framework within which the business of the Company is conducted; and
- monitoring management's performance with respect to these matters.

The Board delegates management of the day-to-day affairs and management responsibilities of the Company 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 must operate.

Board composition and activity

During the financial year ended 30 June 2005 the Board comprised of eight independent non-executive Directors (including the Chair). The Director's profiles are on page 60. Board meetings are held monthly. The Board formally met eleven times during the year (details on page 65).

Remuneration

Directors' remuneration is annually reviewed and approved by the shareholding Ministers. Directors' remuneration received, or due and receivable during the year, is as follows:

	Parent	
	2005 $'000	2004 $'000
Directors of the National Institute of Water & Atmospheric Research Ltd		
Sue Suckling (Chair)	52	52
Carolyn Burns	26	26
Miranda Cassidy	26	26
John Hercus	26	26
Graham Hill	26	26
Troy Newton	26	30
David Sharp	26	26
John Spencer	33	30
New appointees during the 30 June 2005 year		
Ed Johnson	–	–
	Group	
Directors of NIWA Natural Solutions Ltd		
John Baird *	8	–
Directors of NIWA Australia Pty Ltd		
Paul Twynham	1	1

**John Baird was appointed as independent chair to the Board of NIWA Natural Solutions Ltd.*

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 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 three 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 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.

Remuneration Committee
The Remuneration Committee is a sub-committee of the Board and comprised of 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 actions undertaken by them as Directors. Certain actions are specifically excluded; for example, the incurring of penalties and fines which may be imposed in respect of breaches of the law.

Remuneration of employees

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

	Group	
$	**2005**	2004
100,000–109,999	23	11
110,000–119,999	10	16
120,000–129,999	4	1
130,000–139,999	2	3
140,000–149,999	2	1
150,000–159,999	2	4
160,000–169,999	2	1
170,000–179,999	–	2
180,000–189,999	2	–
190,000–199,999	–	1
200,000–209,999	1	–
290,000–299,999*	–	1
330,000–339,000*	1	–

** Chief Executive Officer's remuneration band.*

Risk management

Risk management has been incorporated into the normal business processes of the Company, such as business planning and budgeting, operational management and project management.

The Board has established a risk management framework and also annually reviews the delegation of authority framework. The delegation of authority framework set authorities for the treasury functions.

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

Auditor independence

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

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.

Membership and Attendance:

Director	Date of Appointment	Appointment term expires	Board	Audit Committee	Remuneration Committee
Sue Suckling *(Chair)*	1 March 2001	30 June 2006	10	3 [1]	1
Carolyn Burns	31 October 2000	30 June 2006	11		
Miranda Cassidy	28 June 2001	30 June 2007	8	–	
John Hercus	27 October 2000	30 June 2006	9		
Graham Hill	27 May 2002	30 June 2008	9		
Ed Johnson [2]	9 June 2005	30 June 2008	–		
Troy Newton *(Audit Committee Chair)*	18 June 2002	30 June 2008	11	3	
David Sharp	4 July 2001	30 June 2007	11		
John Spencer *(Deputy Chair)*	16 June 2003	30 June 2006	10	3	1

[1] The Chair is an ex-officio member of the Audit Committee.
[2] Ed Johnson had not attended any meetings as he was appointed shortly before the financial year end.

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 [2]		✓ [1]			
Carolyn Burns			✓ [1]	✓ [1]	
Miranda Cassidy			✓		
Bryce Cooper [3]		✓			✓
John Hercus	✓				
Graham Hill				✓	
Troy Newton		✓			
Rick Pridmore [3]	✓	✓	✓	✓	✓
David Saunders [4]					✓
David Sharp	✓ [1]				
John Spencer		✓			✓ [1]
Paul Twynham [2]			✓		

[1] Chair.
[2] Independent Directors.
[3] Executive members of the Parent company.
[4] Director representing Minority interest.

National Institute of Water & Atmospheric Research Ltd and Group

Statement of Financial Performance

for the year ended 30 June 2005

	Note	**Group 2005 Actual $'000**	Group 2005 Budget $'000	Group 2004 Actual $'000	**Parent 2005 Actual $'000**	Parent 2004 Actual $'000
Revenue	3	91,137	86,908	84,631	86,807	83,396
Operating surplus before taxation	4	**9,654**	**4,953**	**7,036**	**4,765**	**5,398**
Taxation expense	5a	3,220	1,888	1,760	2,357	1,751
Net surplus		**6,434**	**3,065**	**5,276**	**2,408**	**3,647**
Net surplus comprises:						
Parent interest		6,437	3,021	5,280		
Minority interest	8	(3)	44	(4)		
		6,434	**3,065**	**5,276**		

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 2005

	Note	**Group 2005 Actual $'000**	Group 2005 Budget $'000	Group 2004 Actual $'000	**Parent 2005 Actual $'000**	Parent 2004 Actual $'000
Net surplus for the year:						
Parent		6,437	3,021	5,280	2,408	3,647
Minority interests		(3)	44	(4)	–	–
Foreign currency translation reserve movement	6b	312	44	(113)	–	–
Total recognised revenues and expenses		**6,746**	**3,109**	**5,163**	**2,408**	**3,647**
Distributions to owners						
Dividends	7	(15,000)	(15,000)	–	(15,000)	–
Movements in minority interests						
Acquisition of subsidiary	8	–	–	68	–	–
Movements in equity for the year		**(8,254)**	**(11,891)**	**5,231**	**(12,592)**	**3,647**
Equity at the beginning of the year		**51,944**	**51,545**	**46,713**	**41,370**	**37,723**
Equity at the end of the year		**43,690**	**39,654**	**51,944**	**28,778**	**41,370**

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'.

Statement of Financial Position

as at 30 June 2005

	Note	**Group 2005 Actual $'000**	Group 2005 Budget $'000	Group 2004 Actual $'000	**Parent 2005 Actual $'000**	Parent 2004 Actual $'000
Equity						
Share capital	6a	24,799	24,799	24,799	24,799	24,799
Equity reserves	6b	18,830	14,787	27,081	3,979	16,571
Shareholders' interest		43,629	39,586	51,880	28,778	41,370
Minority shareholders' interest	8	61	68	64	–	–
Total equity		**43,690**	**39,654**	**51,944**	**28,778**	**41,370**
Non-current liabilities						
Unsecured Loans	9	403	454	424	–	–
Employee entitlements	10	1,598	2,121	1,752	1,522	1,676
Intercompany	22	–	–	–	14,285	8,015
Total non-current liabilities		**2,001**	**2,575**	**2,176**	**15,807**	**9,691**
Current liabilities						
Payables and accruals	11	13,163	6,698	13,339	12,599	12,963
Short-term advance facility	12	1,700	11,750	–	1,700	–
Employee entitlements	10	6,278	3,283	4,825	5,498	4,582
Taxation payable		18	–	–	–	–
Total current liabilities		**21,159**	**21,731**	**18,164**	**19,797**	**17,545**
Total equity and liabilities		**66,850**	**63,960**	**72,284**	**64,382**	**68,606**
Non-current assets						
Property, plant, & equipment	13	43,295	45,926	45,174	30,580	30,909
Identifiable intangibles	15	59	63	68	–	–
Investments	19	47	–	–	12,746	12,709
Future income taxation benefit	5b	1,460	727	979	3,338	3,218
Receivables and prepayments	16	208	–	547	208	547
Total non-current assets		**45,069**	**46,716**	**46,768**	**46,872**	**47,383**
Current assets						
Cash and short-term deposits		1,357	4,566	5,195	923	4,600
Receivables and prepayments	16	15,721	8,163	15,022	13,290	13,123
Taxation receivable		109	500	791	107	525
Contract work in progress		2,313	2,565	2,422	2,303	2,161
Inventories	17	2,281	1,450	2,086	887	814
Total current assets		**21,781**	**17,244**	**25,516**	**17,510**	**21,223**
Total assets		**66,850**	**63,960**	**72,284**	**64,382**	**68,606**

For and on behalf of the Board:

Sue Suckling
Chair
24 August 2005

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'.

Statement of Cash Flows

for the year ended 30 June 2005

	Note	**Group 2005 Actual $'000**	Group 2005 Budget $'000	Group 2004 Actual $'000	**Parent 2005 Actual $'000**	Parent 2004 Actual $'000
Cash flows from operating activities						
Cash was provided from:						
Receipts from customers		90,442	86,574	85,580	86,702	86,234
Interest received		355	9	242	351	241
		90,797	86,583	85,822	87,053	86,475
Cash was disbursed to:						
Payments to employees and suppliers		(71,048)	(71,507)	(71,904)	(72,456)	(73,169)
Interest paid		(1)	(110)	(14)	(1)	(7)
Taxation paid		(3,000)	(1,926)	(1,506)	(2,060)	(1,752)
		(74,049)	(73,543)	(73,424)	(74,517)	(74,928)
Net cash inflow from operating activities	18	**16,748**	**13,040**	**12,398**	**12,536**	**11,547**
Cash flows from investing activities						
Cash was provided from:						
Sale of property, plant, & equipment		169	300	168	161	169
Loans advanced from subsidiary company		–	–	–	3,937	384
Cash was applied to:						
Purchase of property, plant, & equipment		(7,348)	(7,281)	(8,389)	(6,974)	(7,431)
Investment in subsidiary	19	–	–	–	–	(288)
Investment in associates	21	(107)	–	–	(37)	–
Net cash outflow in investing activities		**(7,286)**	**(6,981)**	**(8,221)**	**(2,913)**	**(7,166)**
Cash flows from financing activities						
Cash was applied to:						
Issue of equity share capital to minority shareholders	8	–	44	68	–	–
Unsecured loan received	9	–	–	424	–	–
Dividends paid to shareholders	7	(15,000)	(15,000)	–	(15,000)	–
Short-term advance facility received/(repaid)	12	1,700	11,250	(600)	1,700	(600)
Net cash outflow from financing activities		**(13,300)**	**(3,706)**	**(108)**	**(13,300)**	**(600)**
Net increase/(decrease) in cash held		**(3,838)**	**2,353**	**4,069**	**(3,677)**	**3,781**
Add opening cash balance		5,195	2,213	1,126	4,600	819
Closing cash balance		**1,357**	**4,566**	**5,195**	**923**	**4,600**
Made up of:						
Cash		1,350	4,566	1,638	923	1,050
Short-term deposits		7	–	3,557	–	3,550
Closing cash balance		**1,357**	**4,566**	**5,195**	**923**	**4,600**

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 2005

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 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 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 several liability 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 are incorporated into the Parent Company and Group Financial Statements on a line by line basis using the proportionate 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 "Contract work in progress", which is stated at cost 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.

(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.

(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; and
- adequate resources exist, or their availability can be demonstrated, to complete the projects and market or use the product or process.

Capitalisation is limited to the amount which, taken together with further related costs, is probable of recovery from related future economic benefits.

When the criteria above no longer applies, 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.

(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.

(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. Maximum useful lives used are as follows:

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

NIWA has commenced reviewing its accounting policies and financial reporting to comply with the New Zealand equivalents of International Financial Reporting Standards ("NZ IFRS"). NIWA intends 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 our 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. The company has allocated internal resources and may engage external consultants to conduct impact assessments to isolate key areas that will be impacted by the transition to NZ IFRS.

Set out below are the key areas where accounting policies may change and have an impact on the financial reports of NIWA. It should be noted that at this stage NIWA is not able to reliably quantify the impacts of the new standards. NIWA 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. Changes continue to be made to NZ IFRS and therefore there may be further changes to the information disclosed.

(i) NZ IAS 12 – 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. This change may lead to larger deferred tax balances being carried. Any initial impact will be on retained earnings as at 1 July 2006 but it is not expected to impact significantly on the tax expense reported in subsequent periods.

(ii) NZ IAS 36 – 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. Fixed 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.

(iii) NZ IAS 39 – Financial Instruments: Recognition and Measurement

NZ IFRS requires NIWA to recognise the derivatives used 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 in each period except in those cases where effectiveness tests are met and hedge accounting can be used. If a derivative instrument does qualify for hedge accounting then any change in fair value will be recognised directly within the Statement of Movements in Equity, then released to the Statement of Financial Performance in the same period as the hedged item is recognised in the Statement of Financial Performance. Any ineffectiveness is recognised in the Statement of Financial Performance immediately. 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.

A number of other items related to financial reporting are also under consideration in conjunction with the transition to NZ IFRS.

These include:

- Consideration of the current accounting policy on fixed assets, given the opportunity to revalue assets and apply a 'deemed cost' equivalent to values on the transition to NZ IFRS.
- The appropriate breakdown of reported segments for future reporting.

3 Revenue

	Group 2005 Actual $'000	Group 2005 Budget $'000	Group 2004 Actual $'000	Parent 2005 Actual $'000	Parent 2004 Actual $'000
Public Good Science and Technology					
– Contract funding	39,469	37,800	35,881	39,469	35,881
– Non-specific output funding (NSOF)	4,260	3,600	3,710	4,260	3,710
Ministry of Fisheries	16,626	16,500	14,602	16,626	14,602
Commercial	30,487	28,999	30,196	26,101	28,962
Share of Associate's net deficit	(60)	–	–	–	–
Interest income	355	9	242	351	241
	91,137	**86,908**	**84,631**	**86,807**	**83,396**

All revenue was derived from continuing activities.

4 Operating surplus before taxation

	Group 2005 Actual $'000	Group 2004 Actual $'000	Parent 2005 Actual $'000	Parent 2004 Actual $'000
The operating surplus before taxation is stated after charging/(crediting):				
Depreciation	9,204	9,533	7,282	7,508
Amortisation of identifiable intangible assets	9	–	–	–
Rental and operating lease costs	1,093	1,141	997	1,085
Remuneration of Directors	260	237	248	237
Net gain on sale of property, plant, & equipment	(147)	(166)	(140)	(166)
Bad debts written off	92	8	82	8
Provision for doubtful debts	76	2	76	2
Net realised foreign currency gain	(338)	(27)	(320)	(33)
Interest expense	1	14	1	7
Remuneration of the auditors of these Financial Statements:				
– Audit fees	104	58	88	55
– Other services	15	22	15	22
Provision for intercompany advances	–	–	2,332	–

4a. Depreciation

Buildings & Improvements	1,289	1,255	1,265	1,232
Vessels	758	758	–	–
Plant & Equipment	3,995	4,348	3,249	3,341
Electronic Data Processing Equipment	1,933	1,876	1,653	1,748
Office Equipment	477	537	462	528
Furniture & Fittings	90	87	52	49
Motor Vehicles	536	532	516	511
Small Boats	126	140	85	99
Total	**9,204**	**9,533**	**7,282**	**7,508**

5 Taxation

5a. Taxation expense

Operating surplus before taxation	9,654	7,036	4,765	5,398
Prima facie tax @ 33%	3,186	2,322	1,573	1,781
Add/(less) tax effect of permanent differences	14	20	783	20
Share of Associate's net deficit	20	–	–	–
Tax losses recognised	(1)	(279)	–	–
Under/(over) provision in previous year	1	(303)	1	(50)
Income taxation expense	**3,220**	**1,760**	**2,357**	**1,751**
The income taxation expense is represented by:				
– Current taxation	3,701	1,417	2,477	1,389
– Deferred taxation/(Future income taxation benefit)	(481)	343	(120)	362
	3,220	**1,760**	**2,357**	**1,751**

5b. Future Income Taxation Benefit

Balance at the beginning of the year	979	1,322	3,218	3,580
Prior period adjustment	39	2	23	(62)
Current year movement	442	(345)	97	(300)
Balance at the end of the year	**1,460**	**979**	**3,338**	**3,218**

No tax losses are available to be carried forward and offset against future taxable income.

6 Equity

		Group 2005 Actual $'000	Group 2004 Actual $'000	Parent 2005 Actual $'000	Parent 2004 Actual $'000
6a.	**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.				
6b.	**Equity reserves**				
	Equity reserves include:				
	Retained earnings	18,766	27,329	3,979	16,571
	Foreign currency translation reserve	64	(248)	–	–
	Total equity reserves	**18,830**	**27,081**	**3,979**	**16,571**
	Movements in reserves during the year were as follows:				
	Retained earnings				
	Balance at the beginning of the year	27,329	22,049	16,571	12,924
	Add net surplus	6,437	5,280	2,408	3,647
	Less Dividend paid	(15,000)	–	(15,000)	–
	Balance at the end of the year	**18,766**	**27,329**	**3,979**	**16,571**
	Foreign currency translation reserve				
	Balance at the beginning of the year	(248)	(135)	–	–
	Add foreign exchange gain (loss) on translation of independent foreign operations	312	(113)	–	–
	Balance at the end of the year	64	(248)	–	–

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).

7 Dividend payments

Payments were made on the following dates:				
5 January 2005	(7,500)	–	(7,500)	–
28 June 2005	(7,500)	–	(7,500)	–
	(15,000)	**–**	**(15,000)**	**–**

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

8 Minority shareholders' interest

Balance at the beginning of the year	64	–	–	–
Increase due to acquisition of subsidiary	–	68	–	–
Share of surplus/(deficit) for the year	(3)	(4)	–	–
Balance at the end of the year	**61**	**64**	**–**	**–**

9 Unsecured loan

Shareholder loan	**403**	**424**	**–**	**–**

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.

10 Provision for employee entitlements

	Group 2005 Actual $'000	Group 2004 Actual $'000	Parent 2005 Actual $'000	Parent 2004 Actual $'000
Balance at beginning of year	6,577	8,052	6,258	7,772
Additional provision recognised	3,665	4,167	3,101	3,847
Amount utilised	(2,366)	(5,642)	(2,339)	(5,361)
Balance at end of year	**7,876**	**6,577**	**7,020**	**6,258**
Classified as follow:				
Non-Current	**1,598**	**1,752**	**1,522**	**1,676**
Current	**6,278**	**4,825**	**5,498**	**4,582**

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

11 Payables and accruals

Trade payables	6,519	7,458	5,986	7,082
Revenue in advance	6,644	5,881	6,613	5,881
Total	**13,163**	**13,339**	**12,599**	**12,963**

12 Short-term advance facility

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

Advance facility	**1,700**	**–**	**1,700**	**–**

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. The relevant interest rate for the period was 6.95%.

13 Property, plant, and equipment

	2005 Cost $'000	2005 Accum Depn $'000	2005 Book Value $'000	2004 Cost $'000	2004 Accum Depn $'000	2004 Book Value $'000
Group						
Land	2,217	–	2,217	2,217	–	2,217
Buildings & improvements	23,410	7,873	15,537	22,888	6,535	16,353
Vessels	18,869	7,464	11,405	18,869	6,706	12,163
Plant & equipment	45,881	35,270	10,611	41,824	31,429	10,395
Electronic data processing equipment	19,863	18,045	1,818	18,228	16,171	2,057
Office equipment	6,268	5,992	276	5,933	5,567	366
Furniture & fittings	1,979	1,793	186	1,909	1,687	222
Motor vehicles	3,066	2,054	1,012	3,089	1,980	1,109
Small boats	1,273	1,040	233	1,294	1,002	292
Total	**122,826**	**79,531**	**43,295**	**116,251**	**71,077**	**45,174**
Parent						
Land	2,217	–	2,217	2,217	–	2,217
Buildings & improvements	23,190	7,746	15,444	22,668	6,431	16,237
Plant & equipment	39,660	29,710	9,950	35,623	26,513	9,110
Electronic data processing equipment	18,677	17,287	1,390	17,258	15,715	1,543
Office equipment	6,066	5,804	262	5,757	5,399	358
Furniture & fittings	1,548	1,397	151	1,525	1,345	180
Motor vehicles	2,935	1,951	984	2,958	1,896	1,062
Small boats	1,029	847	182	1,011	809	202
Total	**95,322**	**64,742**	**30,580**	**89,017**	**58,108**	**30,909**

13a. Property, plant, and equipment valuation

Independent valuers, Tse Wall Arlidge Limited, undertook a valuation of Land and Buildings in June 2002. This valuation totalled $33.4 million, and while the Directors consider this value to be relevant, they have elected not to revalue for reporting purposes.

13b. Vessels

As agreed with the shareholders, an amount has been earmarked within the Group for any shortfall between the current insured value of $40 million and the estimated replacement cost of the research vessel RV *Tangaroa*, in the event of loss of that vessel.

14 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 invertebrate animals.
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.

15 Identifiable intangibles

	Group 2005 Actual $'000	Group 2004 Actual $'000	**Parent 2005 Actual $'000**	Parent 2004 Actual $'000
Copyrights and Trademarks				
At cost	68	68	–	–
Accumulated amortisation	(9)	–	–	–
Book value	**59**	**68**	**–**	**–**

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

16 Receivables and prepayments

Trade receivables	15,520	14,282	13,174	12,604
Provision for doubtful debts	(100)	(24)	(100)	(24)
Prepayments	509	1,311	424	1,090
Total	**15,929**	**15,569**	**13,498**	**13,670**
Classified as follow:				
Non-Current	**208**	**547**	**208**	**547**
Current	**15,721**	**15,022**	**13,290**	**13,123**

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

17 Inventories

Consumables	391	457	–	–
Finished goods	1,550	1,273	797	742
Work in progress	340	356	90	72
Total	**2,281**	**2,086**	**887**	**814**

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

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

	Note	Group 2005 Actual $'000	Group 2004 Actual $'000	Parent 2005 Actual $'000	Parent 2004 Actual $'000
Net surplus		**6,434**	**5,276**	**2,408**	**3,647**
Add/(less) items classified as investing activities					
Net gain on disposal of property, plant, & equipment		(147)	(166)	(140)	(166)
Add/(less) non-cash items					
Share of Associate's deficit for the year		60	–	–	–
Depreciation		9,204	9,533	7,282	7,508
Amortisation of identifiable intangibles		9	–	–	–
Unrealised changes in the value of subsidiaries		313	(113)	–	–
(Gain)/Loss on foreign currency loan		(21)	–	–	–
Increase/(decrease) in employee entitlements		(154)	(208)	(154)	(205)
Increase/(decrease) in provisions		–	(571)	2,332	(571)
(Increase)/decrease in future income taxation benefit		(481)	343	(120)	362
		8,930	**8,984**	**9,340**	**7,094**
Add/(less) movements in working capital items					
Increase/(decrease) in payables and accruals		(176)	2,599	(363)	3,285
Increase/(decrease) in employee entitlements		1,453	(1,266)	916	(1,309)
(Increase)/decrease in receivables and prepayments		(360)	(1,053)	172	363
(Increase)/decrease in inventory and contract WIP		(86)	(1,887)	(215)	(1,003)
(Increase)/decrease in taxation receivable		700	(89)	418	(364)
		1,531	**(1,696)**	**928**	**972**
Net cash inflow from operating activities		**16,748**	**12,398**	**12,536**	**11,547**

19 Investments

	Note				
Investment in subsidiaries	20	–	–	12,709	12,709
Investment in associates	21	47	–	37	–
		47	**–**	**12,746**	**12,709**

20 Investments in subsidiaries

Name	Principal activities	Ownership and voting interest 2005 %	2004 %
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

All subsidiaries have a balance date of 30 June.

NIWA Vessel Management Ltd and NIWA Natural Solutions 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.

No shares in subsidiaries were acquired or disposed of during the year ended 30 June 2005.

21 Investments in associates

ENSID Investments Ltd and ENSID Technologies Ltd were both incorporated on 9 March 2005.

Name	Principal activities	Group Ownership and Voting interest 2005 %	Group Ownership and Voting interest 2004 %	Group Carrying Amount 2005 $'000	Group Carrying Amount 2004 $'000
ENSID Investments Ltd	Intellectual property investments	50	–	34	–
ENSID Technologies Ltd	Commercialisation of intellectual property	50	–	13	–
				47	**–**

The reporting dates of all associates are 30 June, and the Group's share of the results of operations for the year ended on that date have been included in the Group financial statements. Both companies are incorporated in New Zealand.

	Group 2005 Actual $'000	Group 2004 Actual $'000
Carrying value of associates		
Carrying value at beginning of year	–	–
Shares purchased on incorporation	107	–
Share of net loss	(60)	–
Carrying value at end of year	**47**	**–**

The associates did not have contingent liabilities or other commitments contracted for as at 30 June 2005, other than for supply of inventories. The Group is not jointly or severally liable for any liabilities of the associate companies.

22 Intercompany

	Parent 2005 Actual $'000	Parent 2004 Actual $'000
NIWA non-current liability	**14,285**	**8,015**

An amount of $16.0 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 $1.4 million, NIWA Environmental Research Institute of $537,000, NIWA (USA), Incorporated of $303,215, NIWA Natural Solutions Ltd of $995,000, and Unidata Pty Ltd of $832,000, resulting in a net non-current liability of $11.9 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 Directors considered it prudent to raise a provision of $2,332,000 in the Parent Company against the value of advances to subsidiaries that currently have a negative net asset position. The advances were used to fund the establishment of the subsidiaries. The Directors still expect the advances to be fully recovered, but not in the short term. The provision is included in the NIWA Intercompany non-current liability of $14,285,000.

During the year NIWA contracted vessel charters from its subsidiary NIWA Vessel Management Ltd totalling $9.4 million (2004: $9.1 million) and purchased workshop services totalling $37,851 (2004: $3,962). NIWA subcontracted revenue of $250,719 from NIWA Vessel Management Ltd during the financial year (2004: $102,423).

During the year NIWA contracted scientific research from its subsidiary NIWA Australia Pty Ltd totalling $135,489 (2004: $0) and provided research services to NIWA Australia Pty Ltd of $258,800 (2004: $263,758).

NIWA earned revenue of $102,000 (2004: $84,000) from research subcontracts with NIWA Environmental Research Institute.

NIWA Natural Solutions Ltd purchased products from NIWA for $454,000 (2004: $747,000)

NIWA charged its subsidiaries for administration expenses and management services totalling $1.3 million for the financial year (2004: $1.1 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.

23 Joint Ventures

The Group has a 50% equity interest in EcoConnect Ltd, a joint venture company set up with the United Kingdom Met Office to develop environmental forecasting. The company was formed during June 2004 and had not commenced trading by 30 June 2005.

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 Institute of Geological & Nuclear Sciences Limited). 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.

24 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 2005 Actual $'000	Group 2004 Actual $'000	**Parent 2005 Actual $'000**	Parent 2004 Actual $'000
Public Good Science and Technology				
– Contract funding	39,469	35,881	39,469	35,881
– Non-Specific Output Funding (NSOF)	4,260	3,710	4,260	3,710
Ministry of Fisheries	16,626	14,602	16,626	14,602
Ministry for the Environment	505	396	505	396
Department of Conservation	755	1,334	726	1,334
Land Information New Zealand	1,507	5,553	926	5,553
Genesis Energy	968	1,029	968	1,029
Meridian Energy	1,050	573	1,050	573
Mighty River Power	834	499	834	499

No related party balances were written off or forgiven during the year.

25 Segment information

The Group operates predominantly in New Zealand in two industries – Research and Vessel Charter.

Industry Segments	**Total**		**Research**		**Vessel Charter**		**Eliminations**	
	2005 $'000	2004 $'000	**2005 $'000**	2004 $'000	**2005 $'000**	2004 $'000	**2005 $'000**	2004 $'000
Revenue:								
From Customers outside the Group	91,137	84,631	87,469	82,378	3,668	2,253	–	–
Inter-segment	–	–	225	102	9,481	9,136	(9,706)	(9,238)
Total revenue	**91,137**	**84,631**	**87,694**	**82,480**	**13,149**	**11,389**	**(9,706)**	**(9,238)**
Surplus before taxation	9,654	7,006	6,502	4,548	3,272	2,458	(120)	–
Unallocated expenses	–	30						
Total surplus before taxation	**9,654**	**7,036**						
Segment assets	66,850	72,284	52,158	56,061	14,692	16,223	–	–
Total Assets	**66,850**	**72,284**						

The major products/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.

26 Financial instruments

26a. 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 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.

(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.

The interest rates on NIWA's borrowings during the year were:

	2005	2004
On Call	7.0–10.9%	5.7–6.4%
Short term	–	6.3–6.4%

The interest rates on NIWA's investments during the year were:

	2005	2004
Cash (on call)	6.0–6.75%	5.0–5.8%

26 Financial instruments *(continued)*

Short-term deposits have maturity dates less than 6 months. The Directors do not consider there is any significant exposure to interest rate risk on its 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 $17,178,000 (total exposed to credit risk which is bank, short term investments and debtors, net of provisions).

26b. Fair values

The estimated fair values of the Group's financial instruments approximate their carrying values as disclosed in the Statement of Financial Position.

27 Foreign currency denominated monetary assets and liabilities

	Group 2005 Actual $'000	Group 2004 Actual $'000	**Parent 2005 Actual $'000**	Parent 2004 Actual $'000
Current assets not hedged:				
Australian dollars	1,033	685	5	24
European euro	4	11	4	11
Japanese yen	142	154	142	154
US dollars	122	342	6	6
Current liabilities not hedged:				
Australian dollars	363	192	–	–

Current assets include foreign currency bank balances, deposits and accounts receivable. Current liabilities include foreign currency accounts payable and accrued expenses.

28 Commitments

28a. Operating lease obligations

Obligations payable after balance date on non-cancellable operating leases:				
Within 1 year	938	704	822	694
Between 1 and 2 years	786	279	786	279
Between 2 and 5 years	2,175	632	2,175	632
Over 5 years	4,271	2,503	4,271	2,503
	8,170	**4,118**	**8,054**	**4,108**

28b. Capital commitments

Commitments for future capital expenditure:	119	428	79	428
Contracted, but not provided for	**119**	**428**	**79**	**428**

29 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 upon ACC's unfunded liability for past claims and future payments to employees by these Companies. There are no other significant contingent liabilities that require disclosure in the Financial Statements.

30 Subsequent events

There were no subsequent events.

Auditor's report

Deloitte.

TO THE READERS OF

NATIONAL INSTITUTE OF WATER AND ATMOSPHERIC RESEARCH LIMITED AND GROUP'S FINANCIAL STATEMENTS FOR THE YEAR ENDED 30 JUNE 2005

The Auditor-General is the auditor of National Institute of Water and Atmospheric Research Limited (the company) and group. The Auditor-General has appointed me, Andrew 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 2005.

Unqualified Opinion

In our opinion:

- The financial statements of the company and group on pages 66 to 78:
  - 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 2005; 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 24 August 2005, 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 2005. 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, the Public Finance Act 1989 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, section 21(1) of the Crown Research Institutes Act 1992 and the Public Finance Act 1989.

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.

In addition to the audit we have carried out assignments in the areas of taxation and other assurance services, which are compatible with those independence requirements. Other than the audits of the company, group and subsidiary companies, we have no relationship with or interests in the company or any of its subsidiaries.

A G Burgess
DELOITTE
On behalf of the Auditor-General, Auckland, New Zealand

Directory

National Institute of Water & Atmospheric Research Ltd

NIWA Group

Directors

Sue Suckling *(Chair)*
John Spencer *(Deputy Chair)*
Dr Carolyn Burns
Miranda Cassidy
John Hercus
Dr Graham Hill
Ed Johnson *(appointed 9 June 2005)*
Troy Newton
David Sharp

Executive Management

Dr Rick Pridmore
Chief Executive Officer

Dr Bryce Cooper
Director, Strategic Development

Dr Mark James
Director, Operations

Dr Rob Murdoch
Director, Research

Dene Biddlecombe
Chief Financial Officer & Company Secretary (resigned 29 July 2005)

Dr Andrew Jeffs
General Manager, Aquaculture & Marine Natural Products

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

Communications Manager
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Auditors

Deloitte on behalf of the Auditor-General

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The National Bank of New Zealand Limited

Solicitors

Kaimai Law
Bell Gully Buddle Weir

Insurance Broker

Marsh Limited

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NIWA Science [Parent Company]

National Centres

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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

Te Kūwaha
www.niwascience.co.nz/maori

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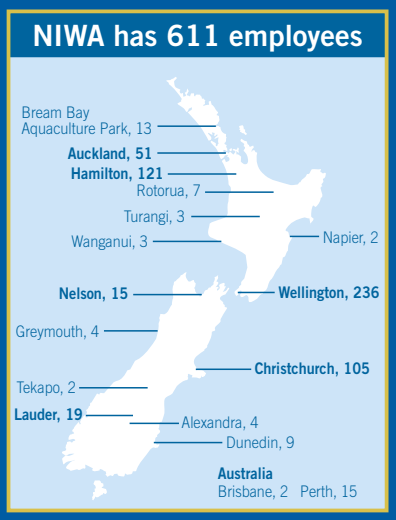
NIWA Regional Managers: (left to right) (back) Dave Roper, Charles Pearson, Ken Becker, Andrew Laing, Andrew Forsythe, (front) Terry Hume, Ken Grange, Barry Biggs, Rosie Hurst.



NIWA on the Web
www.niwa.co.nz

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National Institute of Water & Atmospheric Research Ltd