
NIWA
2003
Annual Report

NIWA at a glance

NIWA is New Zealand's leading provider of environmental research and consultancy services. Its science provides the basis for sustainable resource management, and its consultancy services help clients solve problems on the use and management of:

- Atmosphere and Climate
- Coast and Oceans
- Freshwater
- Fisheries
- Aquaculture

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 held by the Crown. In its establishment year, the company had 329 staff, revenue of $35.5 million, and assets of $20 million. Eleven years later, these measures had largely doubled or trebled: NIWA now has 627 staff at 15 sites around New Zealand, revenue of $84 million, and assets of $65 million. The company now has subsidiaries in Australia and the USA and a vessel company.

NIWA has a project-management-based structure which enables synergies from strong multidisciplinary research and the ability to work in large integrated teams and to shift resources to meet the client's requirements – the 'One NIWA' concept.

NIWA is a technology-driven innovative company in the business of creating wealth as well as providing policy advice. Its clients include New Zealand and overseas governments; local and regional councils; industries such as energy, fisheries, forestry, dairy, horticulture, and agriculture; port authorities and oil companies; consulting engineers; and others who use water and air for commercial and recreational purposes.

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'.

NIWA's mission is to provide a scientific basis for the sustainable management and development of New Zealand's atmospheric, marine, and freshwater systems and associated resources.

www.niwa.co.nz

Cover: Looking down into the 3–4 m thick ice cover on Lake Vanda, Antarctica.

2003 Annual Report

of the National Institute of Water & Atmospheric Research Ltd

Contents

NIWA
Taihoro Nukurangi

great science, great services, great staff

Financial summary

	2003 $'000	2002 $'000	2001 $'000	2000 $'000	1999 $'000
Revenue	**84,200**	81,312	77,113	71,556	65,139
– Public Good Science	**39,780**	37,869	37,359	37,010	35,056
– Ministry of Fisheries	**16,705**	16,260	13,701	11,343	11,777
– Commercial	**27,715**	27,183	26,053	23,203	18,306
Net profit before tax	**7,216**	7,465	7,328	8,001	7,037
Net profit after tax	**4,726**	4,730	4,717	5,326	4,693
Capital expenditure	**9,064**	10,173	8,586	7,448	7,927
Return on average equity (%)	**10.6**	9.6	8.7	10.9	10.7

Chair's report

Sue Suckling

Since the innovative restructuring of NIWA in 1994 to embody the 'One NIWA' concept, the company 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. Our growth has been based on strong revenue gains in both public good research and commercial projects. This trend has continued in 2002–03, with NIWA Group recording revenue of $84.2 million, a new record. This result is particularly pleasing given that funds for environmental research have started to plateau, and there is stiff competition in the high-end science consulting market.

During 2002–03, 67% of our revenue came from two key clients – the Foundation for Research, Science & Technology (47.2%) and the Ministry of Fisheries (19.8%). The research we conduct for these two organisations maintains the backbone of our core science capabilities. Significant revenue was also obtained from direct charter of our research vessels by other organisations (4.5%) and from consulting services provided to a diverse range of clients, including the energy sector, central and local government, the seafood industry, and the dairy sector (28.3%). Our strong performance in obtaining revenue was matched by a solid performance in cutting costs, resulting in a net profit after tax of $4.7 million and a return on average equity of 10.6%.

One of the biggest challenges facing the organisation in 2002–03 was leadership succession. The Chief Executive for the last eight years, Mr Paul Hargreaves, retired in August 2002, and Dr Rick Pridmore was appointed to the position. Rick has the unique combination of strong executive management experience and an in-depth understanding of NIWA's science. Rick has implemented an enhanced management structure that reflects strong market-focused science portfolios. Appointments into these positions came from within the organisation, and we have a very strong, high performing executive team. The outcome of this process, and the professionalism and timeliness of it, has been positive for NIWA and ensured stability in performance and staff morale.

Key issues currently facing the organisation are recruitment and retention of staff, sustainable management of the vessel assets, maintenance of core science capability, and commitment to fundamental science in areas where there is declining public sector funding. NIWA has strategies in place to address these issues.

NIWA's primary means of leveraging its research knowledge for the wider benefit of New Zealand is by way of expert consultancy on environmental issues, but there are several areas of NIWA's research where greater benefit would be derived if the company were an active participant in the application of that knowledge. These include marine natural products, aquaculture, and innovative wastewater treatment systems. Such research has wealth creation potential for New Zealand, but the realisation of this potential can be limited by failures in market uptake. This market failure is usually related to an unwillingness of the private sector to invest in new ventures at the critical pre-seed, seed, and start-up phases, where risks are perceived as high,

the technology appears complex, unfamiliar, and unreliable, and the returns are uncertain and some way into the future. To overcome these barriers to commercialisation, the Board has committed to increasing NIWA's involvement in the pathway from research to start-up through the creation of a wholly owned subsidiary company, called *NIWA Natural Solutions*. The development of this company will be a key focus for the 2003–04 year.

The only change to the Board during the year was the appointment of John Spencer on 16 June 2003.

I would like to thank the staff, the Executive, and the Board for the superb commitment they have to the company – their efforts are fundamental in delivering excellence in science and strong financial performance.

Sue Suckling
Chair

Actual performance versus Statement of Corporate Intent (SCI)

Years ended 30 June	Actual 2003 $'000	SCI 2003 $'000	Actual 2002 $'000
Revenue	84,200	84,070	81,312
Operating expenses and depreciation	76,811	77,645	73,847
Operating surplus before tax	7,216	6,129	7,465
Net surplus	4,726	4,290	4,730
Average total assets	64,838	65,106	69,403
Average shareholders' funds	44,414	43,788	49,275
Profitability			
Operating surplus (%)	8.6	7.5	8.6
Return on average equity after tax (%)	10.6	9.8	9.6
Return on assets (EBIT/average total assets) (%)	11.2	9.7	10.1
Liquidity and Efficiency			
Current ratio	1.1	0.9	0.8
Quick ratio	1.6	1.2	1.1
Financial Leverage			
Debt to average equity (%)	45	45	42
Gearing (%)	1	5	9
Proprietorship (%)	68	67	71

Dollars in thousands.

Chief Executive's report

Rick Pridmore

As this is my first report as Chief Executive, I am pleased to reflect on an outstanding year for NIWA. To achieve our goals during 2002–03, we have had to draw heavily on the three factors that have brought us so much success to date – we call them the three Gs – Great Science, Great Services, and Great Staff.

NIWA has achieved a group operating surplus before tax of $7.2 million in the year to 30 June 2003, against $7.5 million in the previous year. Net surplus after tax was $4.7 million ($4.7 million in 2001–02). Gross revenue from research, consulting, vessel operations, and all other business activities was $84.2 million ($81.3 million in 2001–02). A further $4.0 million has been transferred to our Vessel Replacement Reserve in accordance with the Board's policy, building this reserve to $10.8 million. Shareholders' funds at 30 June 2003 stood at $46.7 million. NIWA's after-tax return on average shareholders' equity was 10.6%. A total of $450,000 was allocated to NIWA's ongoing staff profit-share scheme before arriving at the surplus before tax.

Over the last year, NIWA has taken a number of significant steps forward. One of the most significant was the establishment of a new senior management structure and team. This new management structure has been of immense benefit in terms of uniting skill-bases and services that are widely distributed geographically. The new structure has also helped to facilitate access to our core capabilities. Now, it is possible to interact with NIWA on a topic basis (e.g., biosecurity, natural hazards, renewable energy) through our six General Managers and six National Centres, on a local basis through our seven Regional Managers, or on an individual basis through any of our 500 highly skilled scientific staff. In addition, we have increased our focus on external communication. During 2002–03, staff from NIWA gave over 580 presentations, were involved in 185 media releases, and produced more than 1000 scientific papers and reports. Our achievements were also communicated through the regular production of eight different newsletters, each targeted to meet the needs of specific stakeholder groups. Our website had more than 13.5 million pages viewed during the past year.

We have also significantly enhanced the number and strength of our relationships with other organisations, both to produce excellent science and to support New Zealand's economic growth. Our relationships have allowed us to expand our capabilities in the discovery of bioactive compounds, to bring new species into aquaculture, and to develop a better understanding of the health effects of air pollution. Through active and positive relationships with regional and local authorities, we have been able to help them plan how their communities will grow and to make best use of their land, water, and climate. We have assisted the Japanese National Institute of Polar Research and the Australian National Oceans Office to conduct research of high international profile through month-long charters of our research vessel *Tangaroa* (which spent 324 days at sea during the past year). We have worked closely with the energy sector on resource consents for several large hydropower schemes, the construction industry in documenting sand reserves and estimating levels of sustainable extraction, and the dairy sector in finding ways to optimise production whilst minimising environmental concerns. We have

helped the fishing industry to survey the abundance of selected stocks and to locate good fishing grounds by use of satellite technology.

Throughout the year, we have made major advances in all of our core science areas. For example, we have improved models for forecasting tides and floods, coordinated New Zealand's first remote sensing campaign for motor vehicle emissions, created environmental classification systems for rivers, lakes, and coastal environs, and developed new technologies to rear kingfish and treat dairy farm wastewater. These achievements, and more, are detailed later in this Annual Report.

Perhaps one of our biggest achievements has been the blossoming of Te Kūwaha, NIWA's Māori research and development unit. Over the last three years, Te Kūwaha has grown from two to ten people and has become a significant force in promoting and fostering Māori development. The unit now works with iwi on a diverse range of projects covering many different issues, from health and the development of nutraceuticals to biodiversity and energy supply. Te Kūwaha also oversees all of NIWA's interactions with iwi and provides cultural training for NIWA staff.

I am also particularly pleased with the progress we have made in Sustainable Development Reporting. We have worked hard to meet all commitments to date and have set ambitious targets for the future.

As for the future, NIWA is steadily evolving. We plan to keep doing well what we have traditionally done well, but we also plan to offer more. The establishment of *NIWA Natural Solutions* will help to overcome market failures that currently limit successful commercialisation of products generated by NIWA's research. We also plan to establish a new operational forecasting service. Over the last 20 years, huge advances in technology and in our understanding of aquatic and atmospheric processes and systems have made it possible to make sophisticated forecasts, on a regular basis, about a broad spectrum of environmental issues or concerns. NIWA is now poised to provide the environmental sector with a new range of products and services that match more closely the timescales of business and emergency or environmental management decisions.

In closing, I would like to thank our Board, staff, collaborators, and stakeholders for their valuable contributions throughout the year. Our achievements during 2002–03 have set a strong platform for a bright and exciting future.

Rick Pridmore
Chief Executive

NIWA Executive

NIWA Executive: (left to right) (front) Mark James, Rob Murdoch, Rick Pridmore (Chief Executive), Don Robertson; (middle) Neil Andrew, Charlotte Severne, Murray Poulter, Bryce Cooper; (back) Clive Howard-Williams, John McKoy, Dene Biddlecombe.

Rick Pridmore, *Chief Executive*

Rick became Chief Executive 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 he 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.

Dene Biddlecombe, *Chief Financial Officer & Company Secretary*

Dene is a chartered accountant with a Master in Business Administration from the University of Otago, majoring in marketing and corporate strategy. As well as holding a number of company secretary and treasurer roles within NIWA, Dene is a member of the Institute of Chartered Accountants of New Zealand (ICANZ) Public Sector Committee.

Neil Andrew, *General Manager, Marine & Aquaculture*

Neil holds a BSc and MSc (Hons) from the University of Auckland and a PhD from the University of Sydney. His research background is in fisheries science and marine ecology, particularly the relationships between subtidal ecology and related shellfish fisheries, such as paua and kina.

Clive Howard-Williams, *General Manager, Freshwater & Education*

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.

John McKoy, *General Manager, Fisheries & Bioactives*

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*

Murray graduated from the University of Canterbury and then 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, & Information Systems*

Don completed a PhD in marine biology at the University of Otago in 1973. He spent much of the last 30 years in marine fisheries research, particularly deepwater fisheries, and was a science manager for the last 15 years, and a Regional Manager in Wellington.

Charlotte Severne, *General Manager, Māori Development*

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 tūranga, 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.

Our core business

NIWA's research focus

Atmosphere & Climate

research and consultancy on the physical and chemical processes affecting the atmosphere and climate, including global effects, stratospheric research, and atmosphere-ocean interactions

- weather and related hazards
- climate monitoring and prediction
- air quality
- greenhouse gases and ozone
- renewable energy resources
- ocean climate
- Antarctic research
- environmental monitoring networks
- satellite remote sensing
- databases and software

Freshwater

research on the chemistry, physics, and biology of lakes, rivers, and wetlands; the complex interactions influencing these ecosystems; and their response to environmental disturbances

- hydrology and hydraulics
- aquatic pollution control and prediction
- biodiversity and biosecurity
- freshwater fish and fisheries
- fish population genetics
- aquatic plants and birds
- floods and scour in rivers
- rainfall runoff
- riparian management
- effects of wetland development and river flow or lake level variation
- effects of land-use change in catchments
- national monitoring and databases – river flow, water quality, and sediment

Coasts & Oceans

research on the geological, biological, and physical properties of oceans, coastal waters, estuaries, and harbours

- current, tide, and wave analysis and modelling
- ecological surveys and environmental assessments
- seafloor mapping and seismic surveys
- coastal erosion and marine sedimentary processes
- oceanography
- palaeoceanography
- ocean productivity and food chain processes
- biodiversity and biosecurity, taxonomy
- marine invertebrate museum and databases
- seabird biology and ecology
- biotechnology and marine natural products
- restoration of coastal and estuarine environments
- outfall dispersion and modelling

Fisheries

fisheries assessment and impacts

- fish abundance and productivity
- population modelling and risk analysis
- estimation of sustainable harvest levels
- fish biology and ecology
- biodiversity
- genetics and stock separation
- impacts of fishing on non-target species
- assessment of highly migratory species
- assessment of non-commercial catches

Aquaculture

research on breeding, early life history, growth and survival, hatchery technology, disease management, and stock enhancement – practical research for commercial development

- culture of eels, kina, kingfish, mussels, oysters, paua, rock lobsters, salmon, seahorses, seaweeds, snapper, and sponges
- research and technology for commercial application in partnership with industry
- recirculation technology
- ecological surveys and site selection, feasibility studies for new aquaculture ventures, water quality assessment and diagnosis
- sustainability and carrying capacity of shellfish aquaculture
- salmon ova and smolt supply to industry
- genetic improvement and disease diagnosis
- hatchery training and troubleshooting
- disease management

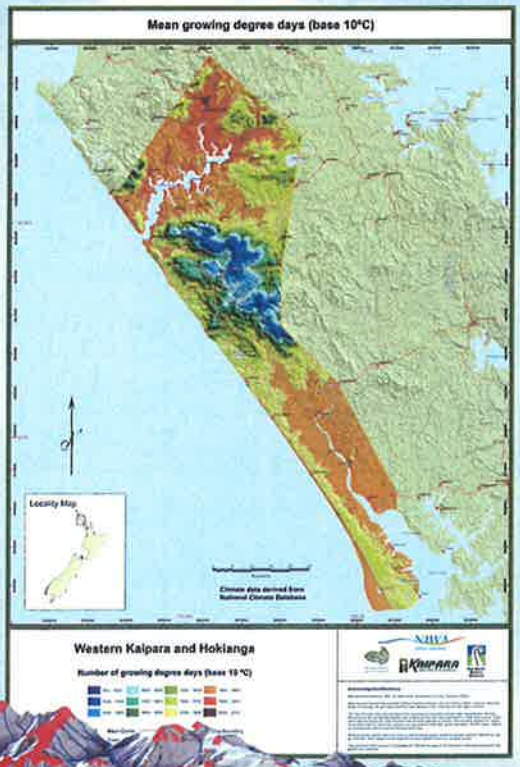
The following pages show some of the highlights of NIWA's research and consultancy during 2002–03

Just a second

Badly tuned vehicles are not only a cost to their owners, they are also a significant cost to society. About 400 people lose their lives prematurely in New Zealand each year through exposure to vehicle emissions. As part of the Auckland Regional Council's 'Big Clean Up' programme, NIWA staff used remote sensing equipment to measure the emissions of thousands of vehicles to help estimate emissions for the entire vehicle fleet. Scientists and engineers will use the information to assess the effect of vehicles on local air quality, and transport regulators and planners will use it for air quality and transport planning and emission control strategies.

An infrared and ultraviolet light beam is directed through the exhaust of each vehicle as it is driven past the testing point. The reading, which takes less than a second, measures the concentrations of carbon monoxide, carbon dioxide, hydrocarbons, nitrous oxide, and the opacity of the exhaust. A key feature of the programme, and a bonus for the drivers, was the large roadside sign which told drivers whether their vehicle's emissions were good, fair, or poor. This was designed to encourage owners to have or to keep their vehicles well tuned. Only 2.3% received a poor rating; most of the rest (84%) were good.

Atmosphere & Climate



Could you grow figs, or peanuts, or cherimoya?

One of the many uses for NIWA's climate maps is helping farmers and investors identify potential crops for their land. In the western Kaipara and Hokianga region, for example, climate maps were used with maps of soil properties and information on the growing requirements to identify suitable areas for crops as diverse as figs, peanuts, and hydrangeas. The project was funded by the Ministry of Economic Development to develop under-utilised land and to promote alternative land use. A number of research organisations were involved, with NIWA leading a team of scientists from Landcare Research, HortResearch, and Crop & Food Research.

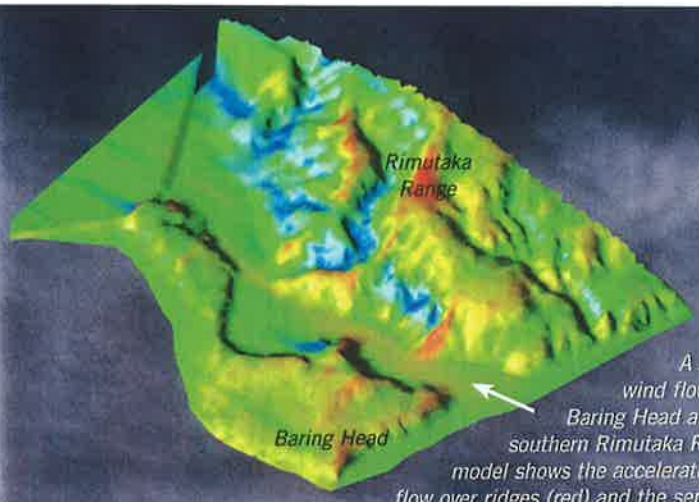
Another example is mapping the maximum air temperature for Transpower to enable them to maximise the amount of current they can send down their power lines while maintaining minimum line ground clearance (power lines sag as they heat up, which is a function of the amount of current running through them, air temperature, solar radiation, and wind speed).

The Ministry of Agriculture and Forestry is also interested in climate maps to help model how pests and diseases might spread. Energy companies are also very interested in climate mapping to help them assess wind power generation.

Tony Bromley during the Transpower survey.

This map shows the mean number of growing degree days for the western Kaipara and Hokianga region – a measure of the energy available for plant growth.

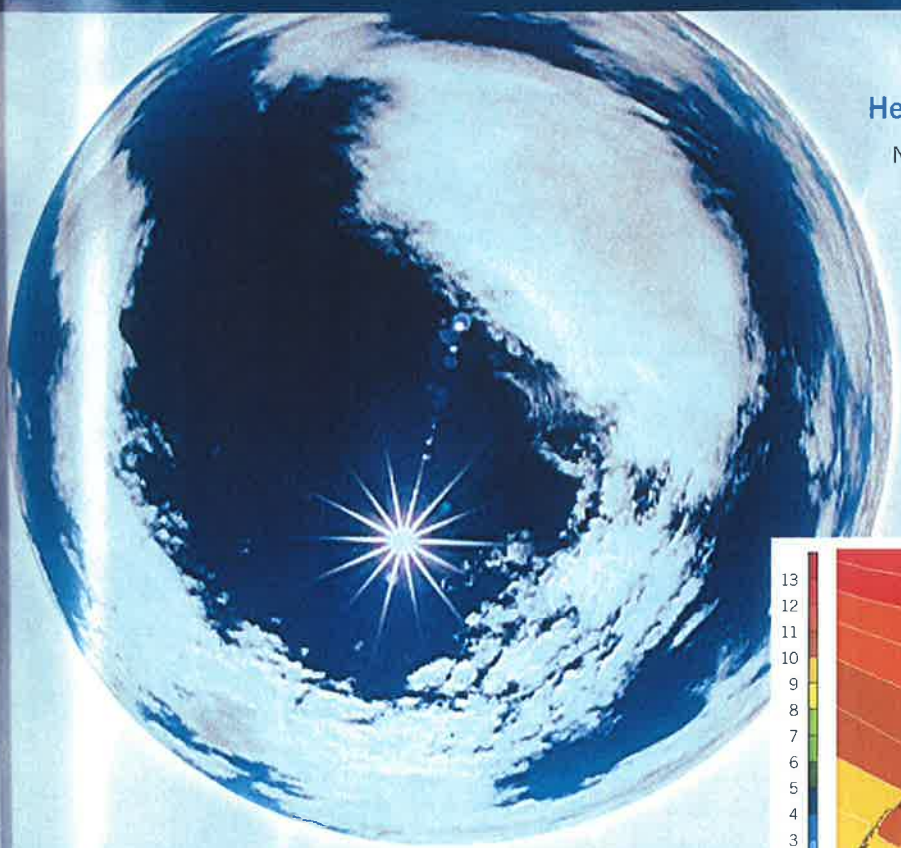
A third example is this map which shows areas (in red) where the mean annual wind speed is sufficient for wind power generation.



A southerly wind flows over Baring Head and the southern Rimutaka Range. The model shows the acceleration of the flow over ridges (red) and the separation of the flow which leads to sheltered valleys (blue).

Mapping the wind

Wind power is an attractive way of helping New Zealand meet its increasing energy requirements. However, we need to be able to accurately predict local wind patterns to fully evaluate planned wind farm sites. New Zealand's rugged topography presents a serious challenge, but NIWA scientists have developed an innovative numerical model to accurately and efficiently predict detailed three-dimensional flow over complex terrain. The model gives information on average wind speeds as well as peak wind speed and wind gusts. This is vital for safe and efficient design and operation of wind farms. There are many other applications for this type of information, including air traffic control and the design of high-rise buildings.

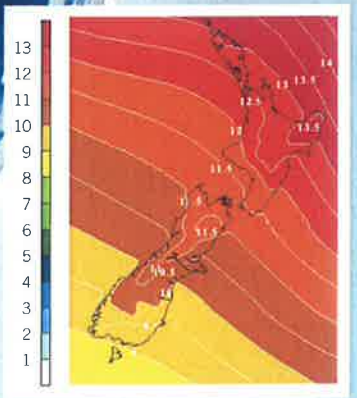


Clouds can lead to reductions or increases in UV radiation. The photograph, taken at NIWA's atmospheric research laboratory at Lauder, Central Otago, shows sky conditions (partly cloudy, sun not obscured) which enhance UV radiation through scattering from clouds.

Helping reduce skin cancer

New Zealanders experience relatively intense levels of UV radiation, and this is thought to be an important factor leading to one of the world's highest rates of skin cancer. About 300 New Zealanders die every year from skin cancer, and the annual medical bill for the treatment of skin cancers is more than $33 million.

In response to this problem, NIWA provides UV information to the public through the internet in the form of daily maps (see www.niwa.co.nz/services/uvozone) and through ongoing contracts with MetService. Daily maps of clear-sky UV are calculated using satellite-derived ozone measurements. The example shown is for a day when the UV is close to its annual maximum. The lower values in the south arise because of the longer path of solar rays through the atmosphere. On the day shown, ozone amounts were lower in the east of the country.



The last line of defence

The strip of land alongside a river or stream is known as the riparian zone. This strip provides a last line of defence for freshwater ecosystems from degradation by intensive land uses. Forested streamside buffers, for example, protect streams from a dramatic habitat change such as clearing the land for agriculture or housing. Buffers also greatly reduce the effects of logging by trapping materials in runoff. NIWA research has shown that forested riparian areas can also protect streambanks from erosion, maintain natural inputs of leaf litter, and provide suitable conditions for aquatic insects to complete the terrestrial phase of their life cycle. These influences protect biodiversity. Small, unshaded streams receive over 20 times more sunlight than those with forested riparian areas, which often results in nuisance blooms of algae and high water temperatures which eliminate sensitive invertebrates.

In pastoral areas, fencing out stock eliminates their direct faecal input, while litter layers and plant roots of riparian buffers filter sediment and nutrient contaminants from runoff. NIWA is developing packages to help assess the health of streams and the effects of riparian strips on water quality. These tools will underpin the widespread and effective use of riparian management to protect our aquatic ecosystems through projects such as Environment Waikato's 'Clean Streams' initiative.

Freshwater

Uncovering the secrets of lake health

Mention LakeSPI (pronounced 'Lake Spy') and one may be forgiven for conjuring up thoughts of scientists with magnifying glasses sneaking about in the shallows of lakes. But LakeSPI is a valuable tool used to determine the health of a lake. Many New Zealand lakes are threatened by the effects of changes in land use and invasions by alien aquatic plants. LakeSPI – 'Lake Submerged Plant Indicators' – is based on the principle that a lake can be characterised by the composition and depth of its native and invasive plants. Submerged plants are used as clues to lake ecological condition because they are easy to observe and they reflect the environmental conditions of a lake over an extended period of time. Thus, LakeSPI helps lake managers monitor trends in lake condition over time, so they can assess how effective their management practices are.

Invasive weed species in Lake Taupo. The taller of the two is Lagarosiphon major *(common oxygen weed), which has been the main weed in Taupo for many years, and the shortest plant is a recent and more serious invader called* Ceratophyllum demersum *(hornwort).*

Mary de Winton recording submerged vegetation.

A fen wetland near Okarito on the West Coast in the early stages of recovery after severe damage by a major fire.

Measuring photosynthesis in a native rush. If we understand how different nutrient levels and water regimes affect photosynthesis and growth, we can better predict the survival and development of plants in restoration projects.

Creating and restoring wetlands

Most of New Zealand's original wetland area was destroyed by the late twentieth century; drained and burned for urban and rural development. Today, less than 10% of the original wetland area remains. The benefits of wetlands in providing habitat for a wide range of organisms – plants, invertebrates, fish, and birds – are well understood, and wetland creation and restoration projects have become essential for re-establishing at least a small echo of what was lost.

Although government agencies, community groups, and private individuals are enthusiastically tackling wetland restoration, we still know very little about how to manage wetlands. How much water is needed, and how should the depth vary over the year? What plants are suitable for the site, and how much water fluctuation can they tolerate? What is the nutrient input, and how will it affect the health of the wetland?

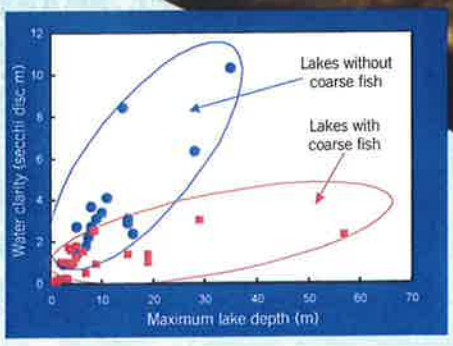
NIWA and Landcare Research have been collaborating in a FRST-funded project to determine how water management and nutrient enrichment control the community composition of wetlands, and how the physical and biological processes that occur in natural wetlands can be mimicked to improve the success of wetland restoration projects. By understanding more about how water should be managed for the benefit of wetland fauna and flora, our research is helping reach the goal of having more healthy wetlands in the landscape.

Exotic fish threaten lakes

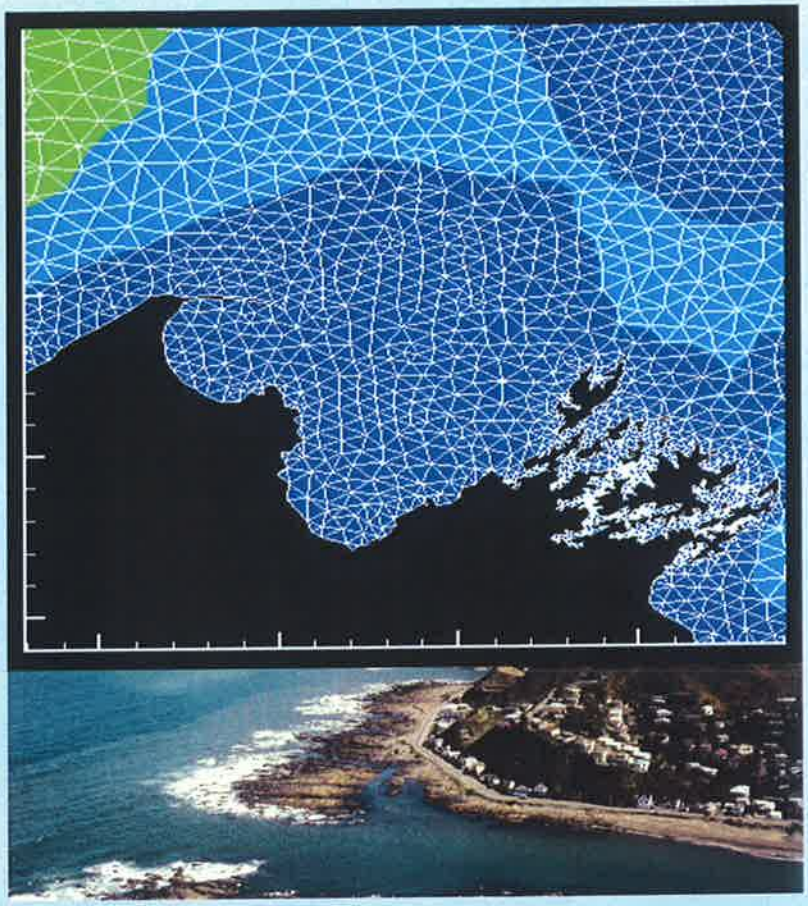
Many small New Zealand lakes are now cloudy, and the spread of exotic fish may be to blame. Koi carp are a major problem in Australia, and recent European studies show that other coarse fish species now in New Zealand (e.g., rudd, goldfish, gambusia, perch, catfish) can damage lakes. These fish can disturb lake sediments and increase siltation. They can alter planktonic foodwebs and increase algal growth. Some fish reduce rooted plants, which results in erosion and siltation. They may also mobilise plant nutrients, which increases algal growth.

In New Zealand, many coarse fish populations are not kept in check by natural predators, but when they are reduced or removed, water quality improves. NIWA is increasing its work with regional councils and FRST to determine which species cause problems. This will help with fish control and lake restoration, and with educating the public to prevent the spread of these fish.

Koi carp and other coarse fish are a major biosecurity concern.



Large lakes are generally less vulnerable to water quality decline than small ones, but, even when we take this into account, the water clarity of lakes containing coarse fish is lower than in lakes without them.



Tide forecast at the click of a mouse

Instead of scanning the tide tables in the newspaper, you can now visit NIWA's website, dial in the exact location you are interested in, and get the tide details on the spot. NIWA's new tide model is being used extensively to forecast the heights of tides and currents for a wide variety of applications. These include all sorts of recreational purposes, such as boating, fishing, and swimming, correcting for the tide during hydrographic surveys, and looking for potential sites for tidal power generation. The model has even been used to help kayakers and swimmers crossing Cook Strait plan their departure times so they made use of the tidal currents rather than fought them.

The model was used to calculate the strength and timing of the 13 most important tides for New Zealand at 32 000 locations in the Exclusive Economic Zone. For the site you are interested in we get the information from the nearest three locations and combine that with the contributions from all 13 tides to give the tide height or current.

For tide forecasts anywhere in the EEZ, go to www.niwa.co.nz/services/tides

Coasts & Oceans

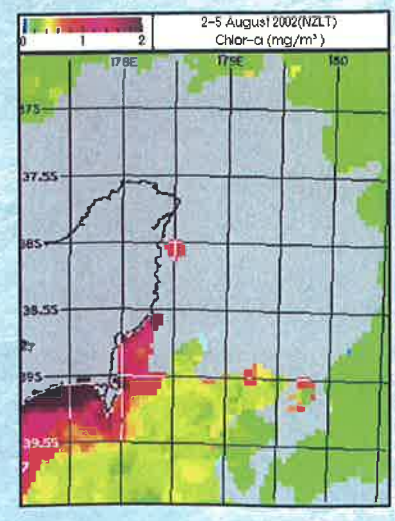
Small waves can have big effects

The small waves kicked up each afternoon by sea breezes may appear harmless, but that is not always the case. NIWA scientists studying sediment transport in Auckland's Tamaki River estuary have shown that these waves can generate currents as strong as those produced on open coastlines by decent-sized ocean waves just before they break.

This research will help us predict the movement of sediment in shallow sandy bottomed coastal waters and mudflats. It is part of a new focus on the very shallow waters around estuary fringes, which are valuable sources of kaimoana and are frequently threatened by pollution and the spread of mangroves.

Satellite shows flood's muddy path

The Waiapu and Waipaoa Rivers on the east coast of the North Island have the highest and third highest rates of sediment discharge in New Zealand. They rank among the world's muddiest rivers. They also attract widespread attention because of the effect their muddy discharges have on the ocean and seabed. In extreme floods these rivers carry so much mud that the water is forced beneath the sea surface, and forms a fluid mud layer on the seabed. This layer, which can be up to 2 m thick, smothers plants and animals, and substantially alters the ecosystem.



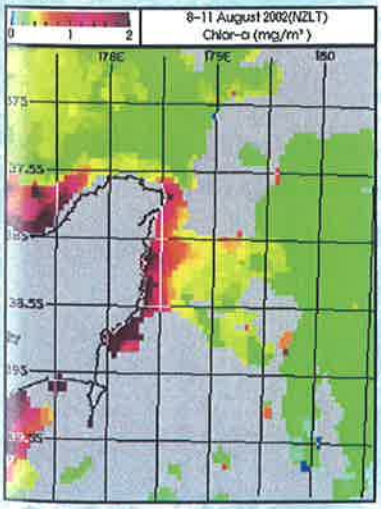
Tagging the ocean

Scientists have long struggled to get meaningful information about the ocean surface. The ocean is in a constant state of motion, so how can you be sure you are measuring the same piece of water? NIWA has overcome this problem by developing a new technique that uses the gas sulphur hexafluoride, instead of a dye, to trace a patch of water in the ocean. The gas is dissolved and spread over an area of ocean up to 50 km^2. The evolving tracer patch is then mapped at the surface and at different depths. Conditions in the patch can be manipulated, and the resulting biological and chemical changes can then be monitored and compared with the water outside the patch.

NIWA used this technique very successfully in the ocean northwest of Bounty Island to examine what influences the availability of nutrient iron for the growth of phytoplankton, and how it affected productivity in the Southern Ocean. Future uses of the gas tracer include studying the production of gas from living organisms in the oceans, and the exchange of gas between ocean and atmosphere. It will also be used in coastal waters to determine how long water remains around mussel farms, and how this affects water quality.

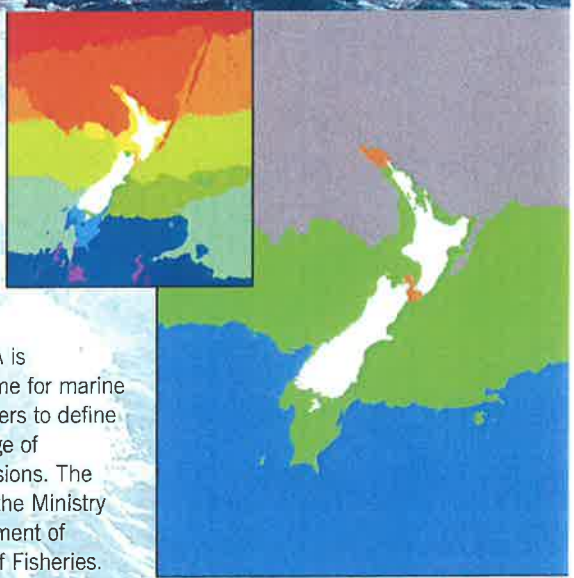
Cliff Law analysing a trace of SF6 in a seawater sample.

These events can be detected by satellite, which is what happened during the flood of 6–8 August 2002. NASA's SeaWiFS ocean colour sensor is designed to measure the concentration of chlorophyll (and therefore phytoplankton) in the open ocean. In this coastal situation, however, NIWA scientists expect that the apparently high chlorophyll levels the satellite recorded near the mouths of the two rivers were probably caused partly by sediment from the flood rather than chlorophyll. Further research using more advanced processing of SeaWiFS data to determine both sediment and chlorophyll concentrations will explore the potential of using satellites to help understand how sediment from floods disperses.



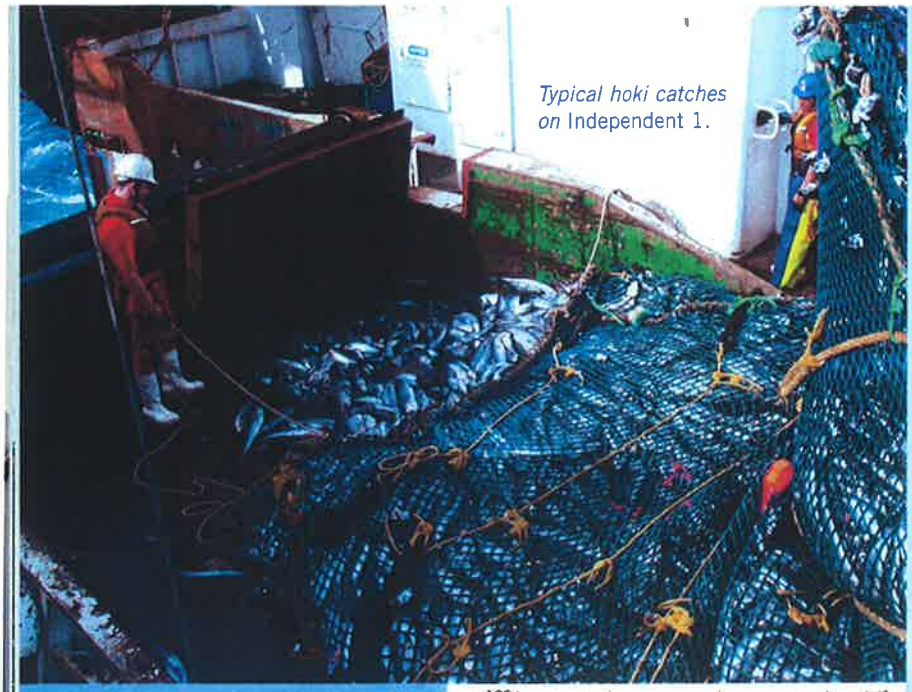
Mapping the marine environments

Managing the seas around New Zealand presents a unique set of challenges, not least of which is that the detailed maps we take for granted on land simply are not available for the sea. To overcome these difficulties NIWA is developing a classification scheme for marine environments that allows managers to define regions within the EEZ for a range of planning and management decisions. The system has been developed for the Ministry for the Environment, the Department of Conservation, and the Ministry of Fisheries.

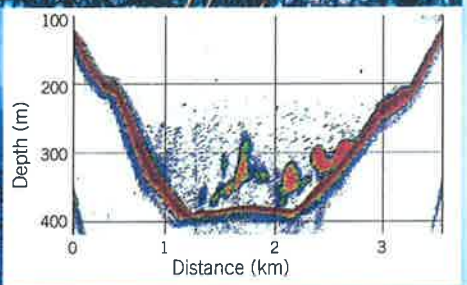


When we classify the marine environment by 20 different characters instead of 5, the complexity of the EEZ increases substantially.

The classifications are based on physical attributes of the environment, such as sea surface temperature, depth, tidal mixing, freshwater input, bottom type and shape, ocean fronts, upwelling, and eddies. For example, the figure shows the distinct environment in the Cook Strait region that is associated with high tidal velocities. Biological resources of interest to managers are broadly correlated with these attributes. The particular scheme used depends both on the amount of information available and its application – more detailed information allows us to subdivide environments into smaller and more distinctive regions.



Typical hoki catches on Independent 1.



Collaborating to count hoki

The Hoki Fishery Management Company, NIWA, and individual fishing companies have been developing collaborative research projects, including a recent acoustic survey off the east coast of the South Island. This survey was the first of its kind conducted in the New Zealand hoki fishery.

Spawning hoki in Pegasus Canyon were surveyed in September 2002 from *Independent 1*, a modern 46 m stern trawler. The survey was fitted into time between trawls, without compromising fishing operations. Acoustic data were collected using the vessel's commercial sounder and later analysed using NIWA software. Biological data were also collected from hoki caught during commercial trawls.

There were dense marks from spawning hoki schools in Pegasus Canyon throughout the survey, and the size of the aggregations indicated that Pegasus Canyon might be a significant secondary spawning area for the eastern hoki stock, which also spawns in Cook Strait.

An echogram of hoki schools in Pegasus Canyon on 7 September 2002.

Fisheries & Aquaculture

Helping sustain the toothfish fishery

NIWA research on toothfish biology and the exploratory longline toothfish fishery in the Ross Sea for MFish has contributed to knowledge of catch sampling methods, genetics, age and growth, abundance, and bycatch and seabird mitigation measures. NIWA staff also contribute to the annual Commission for the Conservation of Antarctic Marine Living Resources fish stock assessment meetings.

The Ross Sea fishery is the southernmost fishery in the world. The catch steadily increased from about 40 t in 1998 to over 1350 t in 2002. The Ross Sea region is unusual because there is considerable overlap in the distribution of Patagonian toothfish and Antarctic toothfish. Both are found down to depths of over 2000 m.

We have developed a validated method for ageing Antarctic toothfish – the first for any toothfish species. The maximum age recorded is 39 years, but there are few fish older than about 30 years caught in the fishery. The fish mature at about age 10.

Most of the diet of adult toothfish is other fish, with rattails and icefish predominating. Other unusual stomach contents included penguins, numerous skate egg cases, and a large quantity of rocks.

Skin care from seafood

The consumer demand for natural products in the lucrative skin care market continues to grow. Estimates of the market for 2000 were US$6.6 billion in the USA, US$1.1 billion in the UK, and US$1.6 billion in France.

NIWA's Te Whatukura a Takaroa: nutraceuticals from seafood programme aims to identify and develop nutraceutical products based on bioactives derived from the New Zealand seafood industry for the skin care market. The programme is a partnership between NIWA and Ngāi Tahu Seafood. The strong research skills of NIWA and the excellent commercialisation and marketing capability of Ngāi Tahu Seafood provide a partnership that will ensure rapid development and commercialisation of new products. NIWA will identify the products, Ngāi Tahu Seafood will commercialise them.

Cara Brosnahan and Els Maas

Sally Anderson

The search is focused on antioxidants, which help prevent skin ageing, and vasodilators, which help increase blood flow in the skin and thus help remove toxins. The same screen will also identify compounds that decrease blood flow – potentially useful for people who have red skin and wish to reduce their colour. Yet another screen will target compounds which help repair skin.

Ngāi Tahu Seafood provides the raw material primarily in the form of fish byproducts and bycatch. This material is currently thrown away or used for low value products such as fish meal, so its use for skin care products will add considerable value.

The door opens for kingfish farming in New Zealand

More than 30 000 kingfish fingerlings were produced by NIWA during the last summer breeding season. The hatchery success means that kingfish can be commercially farmed in New Zealand, and many of this year's fish were supplied to ongrowers. To come this far in a only a few years of research is an outstanding result for the team at Bream Bay Aquaculture Park because it usually takes many years of research on finfish species before large numbers of fingerlings can be produced economically. The research will now focus on increasing hatchery production and developing ongrowing techniques with industry partners.

Further extensions are being made to Bream Bay Aquaculture Park to help meet demands, and a new 1000 m^2 nursery building has just been completed. In its first year of operation Bream Bay has supported research on paua, lobsters, kingfish, groper, eels, mussels, Pacific oysters, and Bluff oysters. The site is the base for the largest commercial paua farm and mussel hatchery in New Zealand, and the production also includes Pacific oyster and Bluff oyster seed for the aquaculture industry.

A collaborative project with the Tasmanian Aquaculture & Fisheries Institute (TAFI) is examining skeletal development in larval kingfish. This is a 16 day old larva.

A pristine atmosphere

The Antarctic atmosphere is physically and chemically unique. It allows us to determine global trends of atmospheric trace gases at sites far from direct human activity. NIWA's research is on the role of the atmosphere in global change, its response to that change, and the effect on New Zealand. We also contribute substantially to international global change research through close collaboration with other national institutions investigating the Antarctic atmosphere.

The Arrival Heights laboratory on Ross Island is the centre for our research, which includes work on ozone depletion in spring. When seasonal changes in air circulation bring depleted ozone levels to mid latitudes in summer, UV radiation in New Zealand increases. Although ozone-destroying chlorine has begun to decline, the speed of ozone recovery will depend on how ozone chemistry responds to a changing, or variable, global climate. For instance, the size and extent of the ozone hole in 2002 was severely restricted by a major warming event, the first ever seen in the Antarctic, and the largest polar stratospheric warming recorded in either hemisphere.

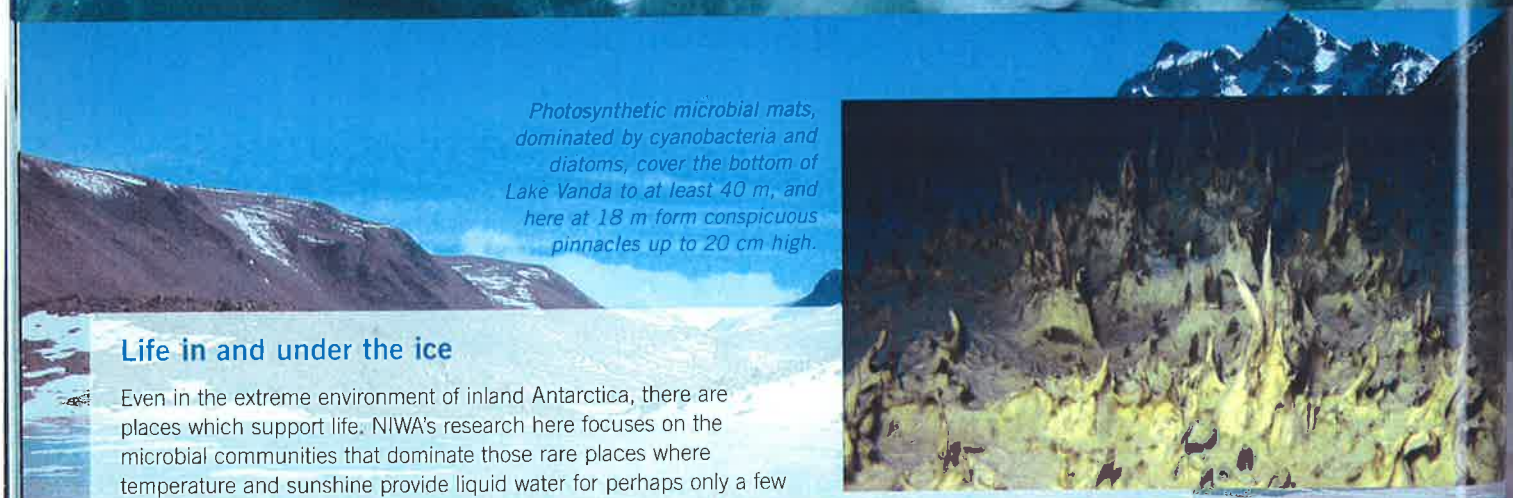
Life in the sea

The marine environment around Antarctica faces many threats, particularly from climate change, tourism, and fishing. NIWA coastal ecologists initiated an exciting and extensive research programme using strategic NSOF investment, with substantial funding from MFish, and in collaboration with researchers from Italy and the USA.

We are carrying out the first comprehensive comparison of coastal benthic habitats and their associated biodiversity in the Ross Sea. The information from this programme will increase our understanding of the coastal zone in McMurdo Sound and how the life in it might be affected by any changes in the environment.


Ian Hawes

Antarctica



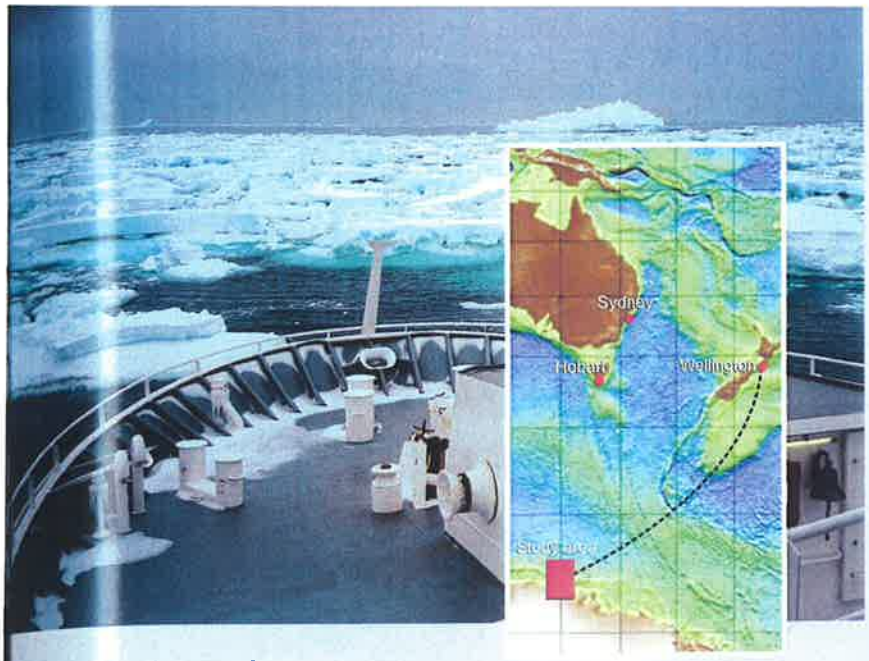
Photosynthetic microbial mats, dominated by cyanobacteria and diatoms, cover the bottom of Lake Vanda to at least 40 m, and here at 18 m form conspicuous pinnacles up to 20 cm high.

Life in and under the ice

Even in the extreme environment of inland Antarctica, there are places which support life. NIWA's research here focuses on the microbial communities that dominate those rare places where temperature and sunshine provide liquid water for perhaps only a few weeks each summer. Here, the very existence of life depends on the climate-driven change from solid to liquid. We are examining how the biological communities cope with these extreme conditions and how susceptible they are to natural and human-induced change.

Liquid water does, however, exist throughout the year in some parts of Antarctica. The lakes of the McMurdo Dry Valleys, close to Scott Base, have a cover of ice up to 5 m thick all year, but they have liquid water underneath. Lake Vanda, for example, is 75 m deep and has a 3–4 m thick ice cover. NIWA scientists are involved in an international study of what is one of the world's most extreme catchments, and our focus is to determine the role of the microbial mats that cover much of the lake's bed.

These lakes are very sensitive indicators of climate change. They are mostly in sealed basins, so the level of the lake depends only on the inflow and evaporation. As the climate has changed, so has the level of the lake. Over the last 5000 years, Lake Vanda, for example, has ranged from over 120 m deep to less than 5 m. Such changes have enormous consequences for biological systems, and understanding their responses is a key part of the international research programme.



In the sea ice

Nineteen scientists from the National Institute of Polar Research of Tokyo, Japan, joined NIWA technicians and the crew of *Tangaroa* for JARE 44 – a 25 day voyage to the sea-ice zone of Antarctica. JARE 44 (the Japan Antarctic Research Expedition 44) followed on from the successful JARE 43, in which *Tangaroa* had been chartered for a similar survey in the same area.

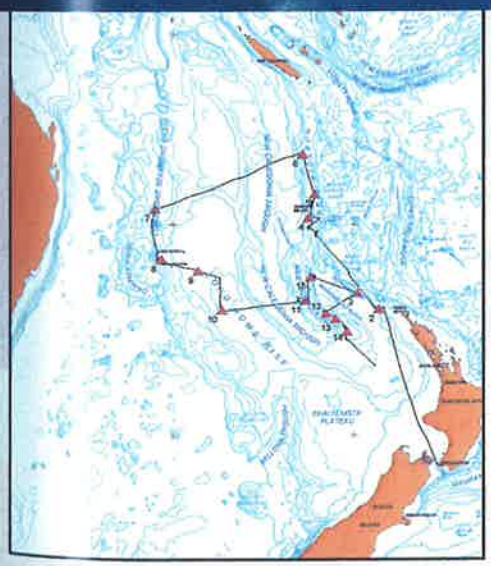
It was the fifth year in succession that *Tangaroa* had successfully completed voyages in Antarctic waters. The main aims of JARE 44 and 43 were to evaluate the production of greenhouse gases during the biological processes of primary and secondary production, to study the growth of zooplankton and krill, and to evaluate sedimentation from the surface production layer.

Counting scampi by camera

NIWA has developed a digital photographic system to assess scampi stocks and, potentially, other deepwater invertebrates. Scampi have been fished commercially since 1988, but no reliable estimates of biomass were available until photographic surveys began in 1998, despite commercial catch rate data and much other information. At first we used a film-based camera, but we changed to digital images as soon as suitable technology was available and could be modified for use on *Kaharoa*. During these surveys we typically take 600 to 1000 photographs of the seabed at scampi depths (200–600 m). Each photograph is then examined independently by three experienced readers who count the scampi and their characteristic burrows.


Scampi at burrow.

Research vessels



'The best in the southern hemisphere'

'*Tangaroa* – the best research vessel in Australasia, probably in the southern hemisphere', so said Dr Clive Roberts, Curator of Fishes at Te Papa and Chief Scientist for NORFANZ, at a public seminar to mark the end of the pioneering survey. NORFANZ was a 4-week *Tangaroa* survey of deepsea habitats in the Tasman Sea, from northern New Zealand to Lord Howe and Norfolk Islands. The main aim was to provide information on the composition, nature, and potential vulnerability of unique and unexplored habitats; information which is essential to ensure these ecosystems are soundly managed. The survey was funded mainly by MFish and Australia's National Oceans Office, with scientific support from NIWA and CSIRO, and the 24 scientists on board represented more than 11 research organisations around the world.

More than 500 species of fish and 1300 species of marine invertebrates were recorded and photographed; many of them were new to science, new records for the region, or thought to be rare or endangered. In total, the survey covered more than 5000 nautical miles, providing the first accurate maps of the seafloor, with imagery and samples from 14 seamounts and 168 stations down to depths of 2000 m.

'It is the end of an amazing voyage,' wrote scientist Dr Mark Norman from Museum Victoria, in the last journal entry of the voyage. 'It has been a ground-breaking survey – the most complex and multifaceted marine research expedition ever conducted in Australasia.'


Stone crab

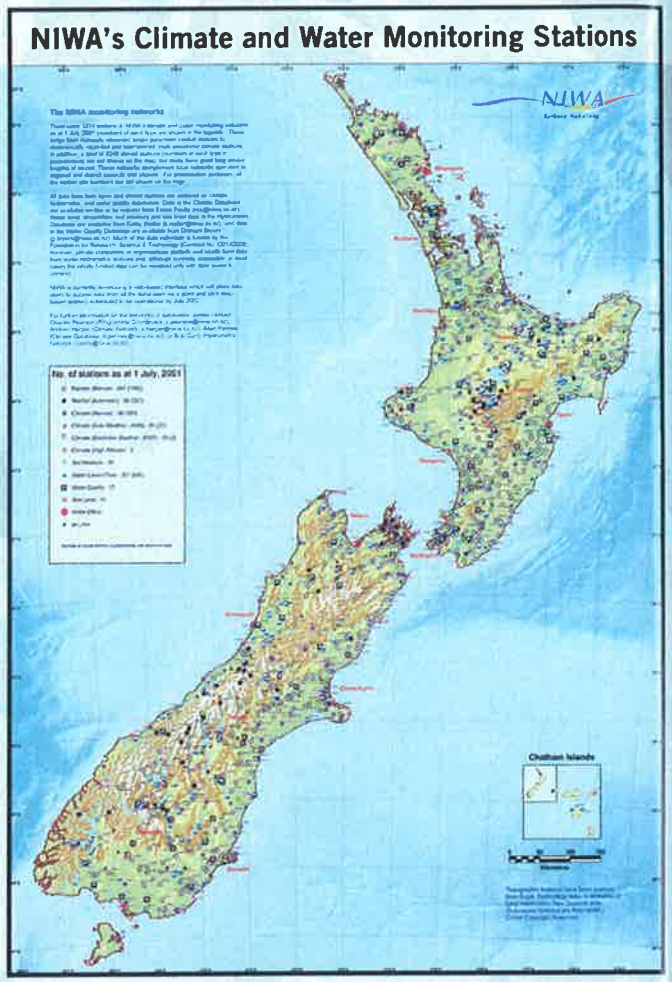

Deepsea batfish


Blob fish


Tangaroa *underwent a full survey in November 2002 and was fully compliant with international maritime requirements. The hull was blasted back to bare steel before it was repainted. No material damage was found. The vessel was used for 324 days last year in surveys ranging from Antarctica to the Norfolk Ridge.*


10 000 m of conducting cable can be fed out of the new winch on Tangaroa, *which means that we can now deploy equipment down to depths of 5000 m.*

NIWA's Climate and Water Monitoring Stations



Climate and water resources

NIWA operates the Water Resources and Climate Archives, both 'Nationally Significant Databases'. The Archive comprises three main databases – climate, water quantity, and water quality. The databases are regularly updated with rainfall, air temperature, barometric pressure, wind speed and direction, soil moisture level, lake and river water level, river flow, river sediment load, and river water quality data, collected from more than 1000 locations nationwide. The earliest records extend back to the mid 1800s. The data are provided to a wide spectrum of users for many different purposes, including the sustainable management of air and freshwater resources and ecosystems, flood control, hydropower operations, resource management, freshwater and climate research, forecasting, hazard warning, and education.

Freshwater Biodata Information System

With support from DoC's Terrestrial and Freshwater Biodiversity Information System programme fund the following four freshwater databases are being integrated into a single data management system which will hold New Zealand freshwater biodiversity and biosecurity data and provide an expanded online service complete with data viewing and searching via web-maps.

1. Freshwater fish

The New Zealand Freshwater Fish Database, also a Nationally Significant Database, is the national repository for data collected by a wide variety of agencies. It currently holds data from more than 20 000 sites throughout New Zealand. The database is available without cost online to registered users and NIWA staff. Last year, 125 registered users made over 1000 connections to the web site to query the database. Information from the database is used in resource consent applications, catchment management plans, and for a variety of research projects, such as establishing the relationship between common freshwater fish communities and physical attributes of streams.

Inanga

Databases

NIWA manages a number of databases, either as nationally significant databases with FRST support, as repositories for numerous research data sets, or by managing data under contract to various clients. Some of them are discussed here.

2. Freshwater plants

The NIWA Aquatic Plant Database holds plant survey records for 155 New Zealand lakes. The database has more than 16 000 species records, incorporating ecological information on depth, cover, and height. In the last year, 5000 records were added from current and historical survey information. The data are available to NIWA researchers and outside agencies who use them to establish relationships between submerged vegetation habitat and physical lake conditions, and to assess plant species as indicators of lake trophic status.

Rice grass

3. Freshwater algae

The NIWA Freshwater Algal Database includes some 2000 samples from rivers, lakes, and wetlands throughout New Zealand.

Diatom

4. Freshwater invertebrates

NIWA holds about 8500 invertebrate records for freshwater sites throughout New Zealand.

Ministry of Fisheries Research Databases

NIWA manages more than 30 databases for the Ministry of Fisheries. These cover a wide range of fisheries research datasets collected from the New Zealand Exclusive Economic Zone over the last 40 years. They are used widely by marine fisheries researchers for the assessment of New Zealand's fish stocks and the effects of fishing.

Land Information New Zealand

NIWA is currently building a digital data repository for Land Information New Zealand to manage large data sets of hydrographic bathymetry data collected by swath multibeam systems.

How we communicate our science

There are many ways in which we interact with you, but the key avenues are through our National Centres:

Aquatic Biodiversity & Biosecurity

Climate

Climate–Energy Solutions

Fisheries & Aquaculture

Water Resources

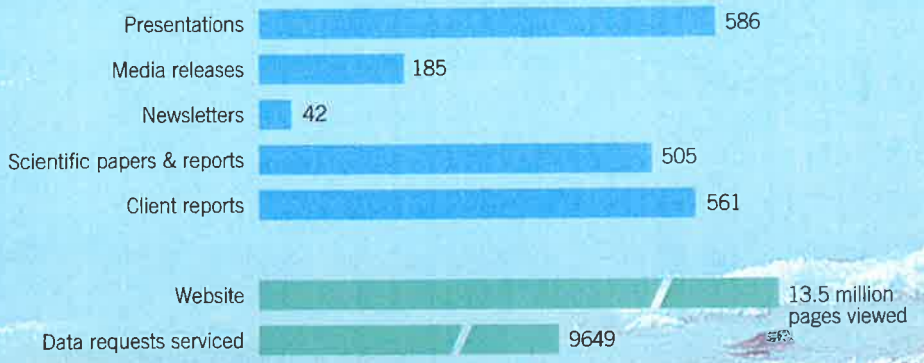
Natural Hazards

Each centre has a regular newsletter published in print form and online, produces regular media releases, schedules frequent meetings with major stakeholders, and has its own webpage.

- our Māori research and development unit Te Kūwaha
- education and training
- policy advice
- international research and services
- commercialisation

Some examples of our science communication are shown on the following pages.

NIWA communications at a glance



National Centre for Aquatic Biodiversity & Biosecurity

protecting our natural heritage

Over the past 100 years foreign species have become established in New Zealand waters at a rate of about one every 9 months. Not all these species have become pests, but a few have caused significant problems for human health, native plant and animal species, and the fishing and aquaculture industry. The National Centre for Aquatic Biodiversity & Biosecurity is working with the Ministry of Fisheries to develop a national surveillance programme for marine pests so that pests can be detected soon after they arrive in the country.

Non-indigenous species can have negative effects on New Zealand's native aquatic communities, sometimes with severe environmental and economic consequences. A thorough knowledge of our native plants and animals is the best protection against alien invaders because it ensures that new arrivals can be accurately distinguished before they become established and cause problems. The Centre is contributing significantly to our biosecurity defences by addressing information gaps in freshwater and marine environments through taxonomic studies, baseline surveys, and the production of identification guides and other publications to help central and local government, communities, and other sectors protect and restore biodiversity. The Centre's free quarterly newsletter, *Aquatic Biodiversity & Biosecurity*, which is also available on our webpage, helps provide information to stakeholders about new research, not only from NIWA, but also from other research providers and funders.

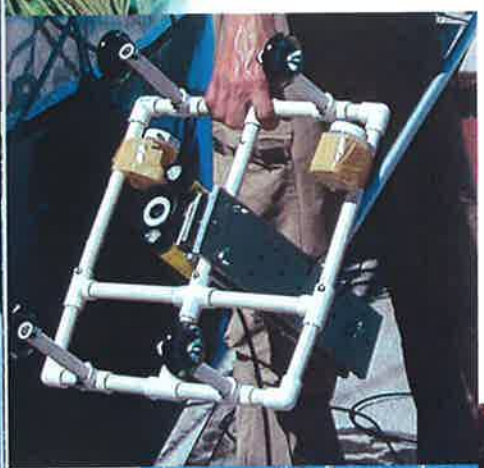
Identification workshops

Hoe Chang

The Centre carries out research around New Zealand and in the Southern Ocean and the Ross Sea to support the government's biodiversity and biosecurity strategies. It helps bring research results to the community, including industry, iwi, councils, and government agencies. It also enhances access to NIWA's aquatic biodiversity and biosecurity expertise, increases awareness of issues facing New Zealand, fosters collaboration and cooperation between research organisations here and overseas, and provides new tools and services.

Scientists are still discovering and describing new species from many different groups as they carry out the essential task of documenting New Zealand's marine and freshwater aquatic environments. The research being done by the Centre is helping us understand the distribution of plants and animals in and around New Zealand. By doing this, we are not only documenting our biological heritage, but also providing the baseline of knowledge that is critical for understanding our diverse aquatic environments. This knowledge is essential if we are to protect and restore our environment for the enjoyment and use of future generations.

www.niwa.co.nz/ncabb



Hullcam

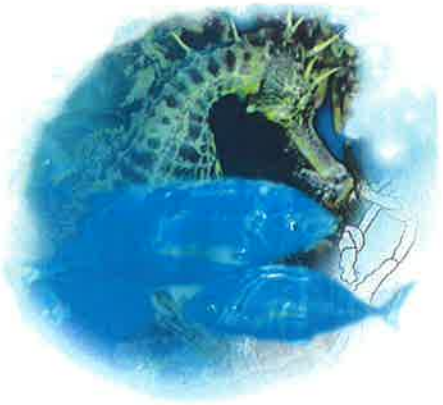
All New Zealand's 13 major trading ports will be surveyed for marine pests, as will three northern marinas which are the main points of entry for international yachts and launches.

Chrispin Middleton and Oliver Floerl.

Te Papa Chief Executive Dr Seddon Bennington and NIWA Chief Executive Dr Rick Pridmore sign the new agreement that will provide stronger research and public education links between the two organisations. NIWA and Te Papa will work more closely together to increase public awareness and appreciation of the natural environment and its protection, restoration, and management. The focus will be on issues of aquatic biodiversity and biosecurity, sustainability, climate change, and natural hazards.

National Centre for Fisheries & Aquaculture

generating wealth for New Zealand



Fisheries and aquaculture industries contribute about $1.3 billion annually to the New Zealand economy in exports and domestic sales. NIWA has very strong capabilities in fisheries and aquaculture planning, development, and research that benefit from the wide blend of scientific skills in New Zealand. Our goal is to use the unique set of skills available within NIWA to help New Zealanders with the further development and sustainable management of marine resources. The National Centre for Fisheries & Aquaculture was established to enhance access to this expertise.

Over the past year we have strengthened our expertise in eel aquaculture, bioactive chemistry, and microbiology. Our newly established bioactives team is developing probiotics (the use of good bacteria to exclude or replace bad bacteria) for use in the aquaculture industry, and is involved in two significant FRST-funded programmes focusing on non-steroidal anti-inflammatory drugs for the pharmaceutical market, and nutraceuticals for the skin-care market. Further developments and partnerships have been a key feature at NIWA's Bream Bay Aquaculture Park, including the first pilot-scale commercial production of yellowtail kingfish in New Zealand. The Centre now supplies paua, salmon, and kingfish juveniles on a commercial scale to help develop these industries in New Zealand.

We have worked closely with fishing industry groups in a number of research projects, including the survey, assessment, and modelling of Bluff oysters with the Bluff Oyster Management Company, commercial vessel-based acoustic surveys with the Hoki Management Company, and the assessment of scallops with the Challenger Scallop Enhancement Company. These arrangements have been complemented by an increasing number of requests from stakeholder groups for help with the development of fisheries, contributions to regional strategic plans (e.g., the Northland regional aquaculture study), and the facilitation of a regional collaborative approach to the surveys required for marine farming licences. NIWA also became SITO-registered assessors – formal registration as a training provider offering courses in general aquaculture, paua farming, recirculation and reticulation, and disease management in aquaculture.

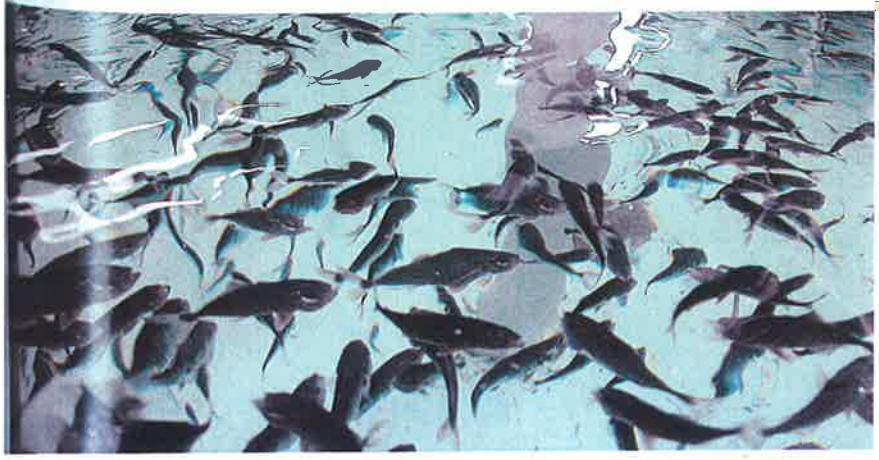
Joint research with the Hoki Management Company.

We help bring fisheries and aquaculture developments to the attention of stakeholders across the industry through our free quarterly newsletter, *Fisheries & Aquaculture Update*, which is also available on our webpage.

www.niwa.co.nz/ncfa

Consumer demand for natural products in the lucrative skin-care market is continuing to grow. Estimates for 2000 put the value at NZ$15 billion in the USA alone. NIWA's bioactives team is researching the potential for byproducts and bycatch from the fishing industry (which are currently discarded or used for low-value products such as fishmeal) to be used in the production of skin-care products. The FRST-funded programme, Te Whatukura a Takaroa: nutraceuticals from seafood, is a partnership between NIWA and Ngāi Tahu Seafood. The team is focusing on antioxidants which help prevent skin ageing, and vasodilators which help increase blood flow in the skin.

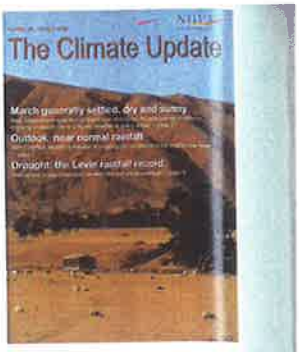
Debbie Hulston



NIWA produced more than 30 000 kingfish fingerlings during the 2002–03 spawning season – the first pilot-scale commercial production of yellowtail kingfish in New Zealand. Future kingfish R&D is planned to capitalise on the gains made this year in larval-rearing and nursery technologies. Other developments will include the use of probiotics, optimisation of feeding strategies, and manipulation of environmental variables to achieve optimal growth and survival.

National Climate Centre

guiding responses to global change



One of the National Climate Centre's main aims is to help New Zealanders manage for climate extremes, including droughts. Dry conditions occurred throughout much of the country from January to the beginning of May in 2003. These led to public concern about dwindling water storage in hydroelectricity dams, stress on farmers, water restrictions for irrigation and urban supply, and algal blooms in some lakes and rivers. The dry conditions were some of the most widespread seen in the last 25 years, although it was still rather wet in Northland and the Coromandel.

Lake Tekapo

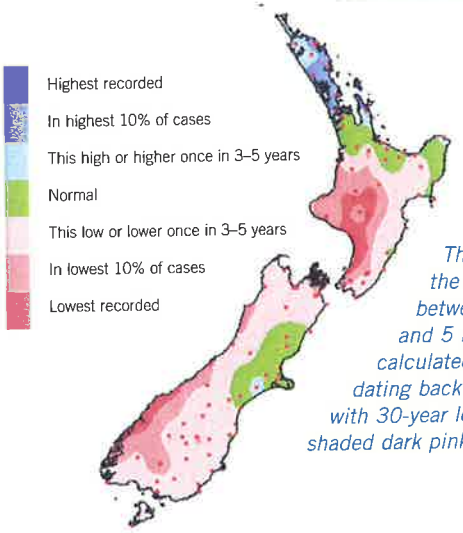
The Centre kept people informed about conditions during this period through climate maps and articles in the monthly newsletter *The Climate Update*, public talks, media interviews, and material on the website. We briefed government and industry policy analysts on seasonal climate outlooks, and correctly predicted the end of the dry conditions in early May.

Keeping people informed about the present climate and likely seasonal developments is only one aspect of the Centre's work. We spend a lot of time providing data, maps, and advice about climate extremes in particular locations, and how often they occur. This helps companies and individuals plan developments, infrastructure, and land-uses that are resilient to climate and its variation. Our work ranges from helping people pick new areas with low frost risk for niche horticultural crops to advice on heavy rainfall frequencies for urban stormwater drainage design.

Andrew Tait

The Climate Update, a free monthly newsletter which is also available on our webpage, summarises the previous month's air temperatures, rainfall, soil moisture, and river flows. It also provides regional seasonal climate outlooks, and updates the public on matters of interest, such as the development of El Niño conditions across the Pacific. The Centre also prepares the monthly *The Island Climate Update* in collaboration with staff from weather and climate agencies from Australia and the Pacific Islands. We produce regular media releases on climate conditions and outlooks. We travel regularly through the country, giving talks to groups of farmers, local government officials, and others. We also provide quarterly climate briefings to agricultural sector representatives and government officials through the Ministry of Agriculture and Forestry, and information for regional assessment of climate hazards, including advice on how these might vary in the future because of climate change.

www.niwa.co.nz/ncc



This map shows the rainfall anomaly between 1 January and 5 May 2003, calculated from records dating back to 1972. Areas with 30-year low rainfalls are shaded dark pink.

The drought caused severe restrictions on water use on the Kapiti Coast.

National Centre for Climate–Energy Solutions

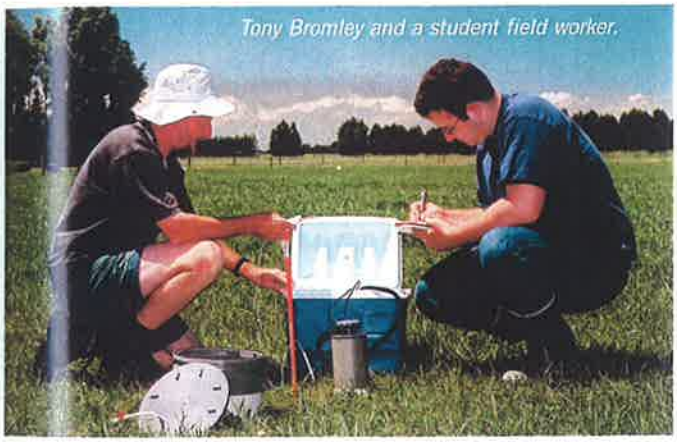
finding the energy to move New Zealand forward

How can we solve the energy requirements of remote communities? The National Centre for Climate–Energy Solutions has been working with two remote Māori communities in Northland and Taupo to assess their current and future energy needs, the energy efficiency of their homes and communal buildings, and their potential to tap into new and emerging sources of renewable energy. Through a series of hui and household energy audits, we have developed a shared understanding of the unique energy requirements for each community, and identified where energy savings can be made. Staff from NIWA's Māori development unit, Te Kūwaha, and other staff have completed renewable energy assessments at each site and installed equipment to monitor wind, solar, wave, and hydrological energy.

Waipoua (Northland).

The Centre is also helping create new economic, social, and environmental opportunities associated with climate change and energy reform. Although the debate has centred on climate change, the main driver for global warming is the release of carbon dioxide into the atmosphere through the burning of fossil fuels. Because of the adverse environmental effects and the finite lifetime of this energy source, we need to look closely at alternative sources of energy and maximise the efficiency of national energy use, particularly in transport. We discuss these issues in our free quarterly newsletter, *Climate–Energy Matters*, which is also available on our website.

www.niwa.co.nz/ncces



Tony Bromley and a student field worker.

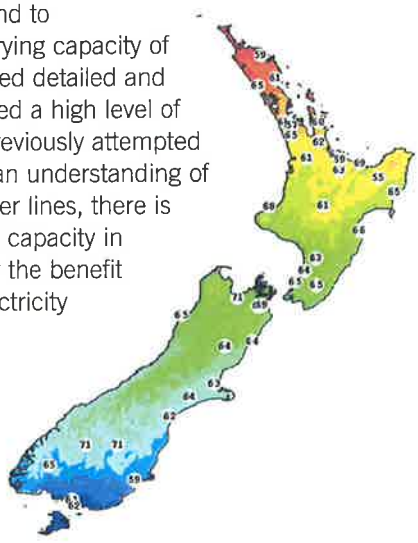
Kyoto Protocol

New Zealand will be required to reduce its greenhouse gas emissions between 2008 and 2012 to 1990 levels when the Kyoto Protocol comes into force. We already compile and report annual 'emission inventories' under our obligations to the United Nations Framework Convention on Climate Change. Our obligations under the Kyoto Protocol, which we ratified on 19 December 2002, emphasise the need for accurate and quality-assured inventory estimates, not only for 1990, but also for subsequent years. Our annual inventories are also subject to international scrutiny and review.

New Zealand is unique because our greenhouse gas emissions (e.g., methane, nitrous oxide) mainly come from agriculture and are difficult to estimate accurately. For many other developed countries the major emission is carbon dioxide from the combustion of fossil fuels, which can be estimated relatively accurately from fuel consumption. Our agricultural emissions vary depending on the climate and the way animals are managed and fed. We are researching how we can better quantify New Zealand's agricultural emissions and develop ways to reduce these emissions cost-effectively, while maintaining or improving agricultural productivity.

How much electricity can power lines handle?

The amount of electricity power cables can carry depends not only on the electric current, but also on the air temperature and the strength of the wind across the cable. To enable Transpower to maximise the amount of current they can send down their power lines while maintaining minimum ground clearance (power lines sag as they heat up), we surveyed more than 15 000 transmission line spans. To do this we used laser radar to map the exact position of the cable and recorded climate data such as maximum air temperature for each position. The project covered about half of Transpower's national high voltage transmission line network, and the aim was to determine the precise location of the lines in relation to the ground and vegetation, and to estimate the true current-carrying capacity of the lines. Our models produced detailed and realistic results, which provided a high level of meteorological support not previously attempted anywhere in the world. With an understanding of the microclimate around power lines, there is potential to free up additional capacity in existing transmission lines for the benefit of national grid users and electricity consumers.



Tapping into solar energy. The map shows the amount of solar energy available to New Zealand in 2000 (the values in circles show the percentage correction required to account for cloud cover). A solar panel in Nelson would produce 77 kWh of electricity a year, while the same solar panel would produce 69 kWh a year in Auckland.

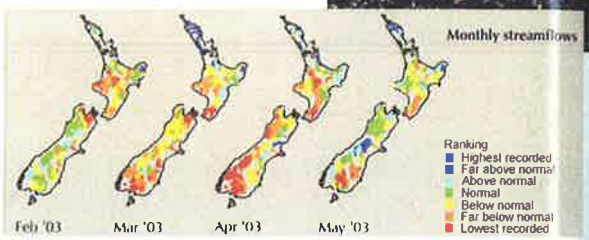
National Centre for Water Resources

making every drop count

As far as water was concerned, one of the most significant events this year was the widespread drought in summer and autumn. The Target 10% campaign was initiated to reduce demand for electricity as hydro reservoir levels fell. With the very low river flows and groundwater levels there were widespread restrictions on irrigation pumping in Canterbury and Otago, and on domestic water use on the Kapiti Coast. High temperatures also played havoc with ecosystems, with algal blooms plaguing Waikato and Bay of Plenty rivers. The National Centre for Water Resources recently developed a national hydrological model in association with the Ministry for the Environment, Statistics New Zealand, and Landcare Research for use in a variety of national assessments, including water accounts and carbon budgeting.

Peter Mason

The Centre publishes summaries of river flows, river water quality, lake levels, and groundwater levels in its free quarterly newsletter, *Water Resources Update*, which is also available on our website, in collaboration with the Institute of Geological & Nuclear Sciences, Lincoln Ventures, the Ministry for the Environment, hydropower companies, and regional councils. The Centre also operates as a focal point for media and resource managers to contact scientists with technical queries and problems relating to water resources. Our webpage includes a variety of tools and references for use by water managers, including stream health monitoring, lake health monitoring, classification of rivers, stream sampling protocols, and estimates of sediment yield. We are working with a wide variety of clients to implement these tools to help resolve local issues.

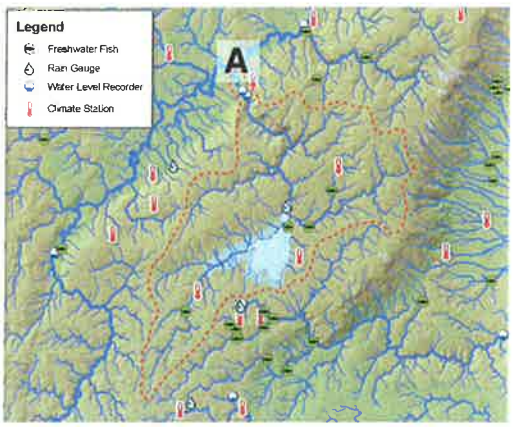


Record low river flows for much of New Zealand, including inflows to key hydropower lakes (Pukaki, Tekapo, Taupo) (data: NIWA, regional councils, energy companies).

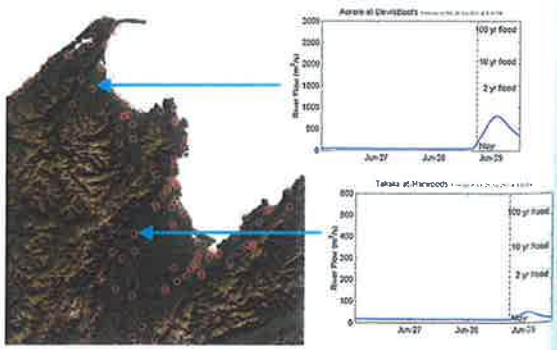
The Centre has also developed two major projects – one to unify New Zealand's diverse freshwater databases, and one to build a national flood-forecasting capability. The Freshwater Information New Zealand project (FINZ), which builds on the River Environment Classification, links freshwater data from a wide variety of sources to a common map database. This makes it easier to access when using the Internet and geographic information systems, and enables water managers to make sophisticated spatial queries that recognise the special network structure of freshwater systems.

www.niwa.co.nz/ncwr

This hydrological model shows details of the sub-catchments, lakes, and streams around Lake Taupo.



A study of site A on the map above would automatically find the catchment upstream of A (the red line) and then search out data from a wide variety of databases, including fish sampling sites and climate records for that catchment. FINZ can also provide basic geographic data on the catchment, including topography, vegetation, and geology.

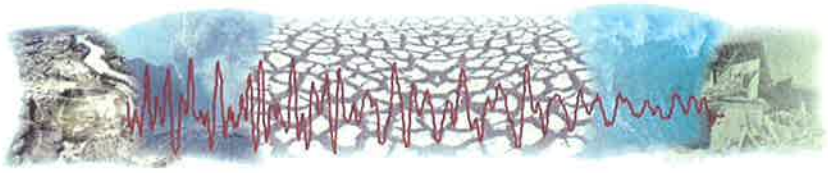


Trial flood forecasts for rivers in the Tasman Bay and Golden Bay region

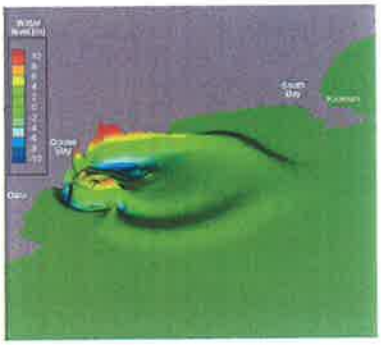
Our pilot flood forecasting models are running every day in collaboration with Otago Regional Council, Gisborne District Council, and Environment Bay of Plenty. We are also testing hundreds of locations in nine other catchments, and developing a web-based interface with automatic detection and warning of impending floods for these sites. The flood forecasting models can predict the flood flows in rivers up to 2 days ahead by linking weather model predictions developed in collaboration with MetService to detailed models of water movement in catchments and rivers and real-time measurements of river flow.

Natural Hazards Centre

setting the foundation for a safer future



Tsunami are underrated hazards in New Zealand. We have experienced damaging tsunami from both remote and local sources, but a generation has passed since the last major tsunami, caused by an earthquake in Chile in May 1960, hit our shores. How prepared are we? NIWA recently assessed the potential effect of tsunami on the Kaikoura coast for Environment Canterbury. Our results showed that one of the major threats comes from a tsunami generated by a submarine landslide in Kaikoura Canyon. A wave from this source would hit Goose Bay in a matter of minutes, reaching about 10 metres high, and would strike South Bay about 7 minutes later at a height of about 4 metres. These results show the need to make the public 'tsunami aware' to the same degree as coastal residents in Peru, Chile, and Japan.



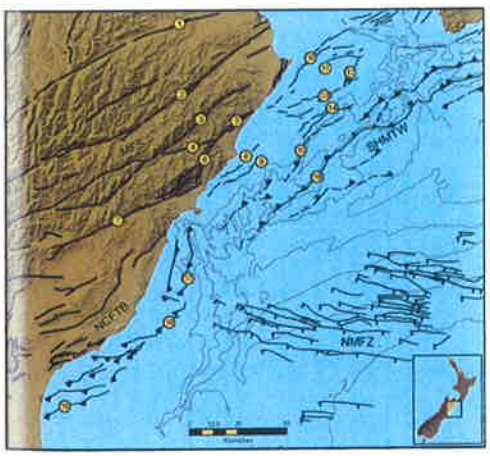
The model shows the landslide-generated tsunami arriving at Goose Bay.

NIWA and the Institute of Geological & Nuclear Sciences (GNS) established the Natural Hazards Centre to strengthen the links between scientists, policy makers, planners, and emergency managers by providing a focal point for science-based information on natural hazards. The Centre's key role is to communicate research results, seek feedback to help formulate future research, and provide services to ensure that hazards research is responsive to the needs of end users. It provides integrated research-based information and tools to organisations and communities to help improve their resilience to natural hazards and better manage the risk through informed choice.

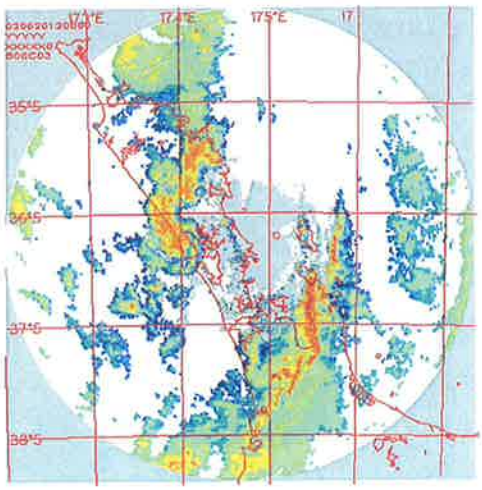
Warren Gray

NIWA and GNS have significant public good hazard research programmes and individual links with a range of end users. Our complementary research activities cover the spectrum of New Zealand hazards – storms, floods, droughts, landslides, earthquakes, volcanoes, storm surges, waves, coastal erosion, and tsunami. The research is supported by national monitoring networks, including the climate network, hydrological network, sea-level network, the EQC-funded GeoNet network of seismic and volcanic recorders, and the GPS deformation network, part-funded by LINZ. By working together through the Centre, we can make better progress towards increasing the resilience of New Zealand communities.

www.naturalhazards.net.nz



◂ ***Understanding earthquake hazards***
One of the tools we've developed should make estimating the likelihood of future earthquakes and shaking in New Zealand easier. The national seismic hazard model is based on combining the 160-year historical record of earthquakes with prehistoric earthquake information from over 300 active faults in New Zealand. With GNS and NIWA joining forces to link the onshore and offshore marine faulting, it will be possible to produce a much better model of the seismic hazard for New Zealand.



Predicting extreme weather ▸
The 'weather bomb' that caused extensive flooding and damage in the Coromandel in 2002 and the loss of one life was a rapidly deepening storm which affected many northern areas. NIWA is currently studying the processes that lead to the formation of extreme weather systems like this. We use sophisticated computer simulations of the weather to model the uptake of heat and moisture from the ocean surface and compare this with theoretical data. We then analyse radar data to determine the scale, intensity, and predictability of the rain bands formed.

Every issue of the quarterly NHC newsletter, Natural Hazards Update, *includes maps of the significant natural hazards recorded over the previous 3 months: floods & droughts, weather extremes, coastal hazards, landslides, and earthquakes & volcanic activity.*

Te Kūwaha

promoting Māori development

Kia hiwa rā, kia hiwa rā!

Tēnei te manu o Taihoronukurangi e korihi nei, ki ngā topito e whā, ki ngā tini kārangatanga maha, kia tahuri mai ki ngā pitopito kōrero e whai ake nei. E mahara ana ki te tini, ki te mano kua takiwātia. Huri atu te pō, nau mai te ao. Ka kuikui, ka koakoa, ka rere te karere ki ngā hau e wha, ki ngā tai e ngunguru, ki ngā wi katoa o te motu, tūturu whakamaua kia tina, tina. haumi e, hui e – Tāiki e!

NIWA is committed to building effective partnerships and conducting relevant research with Māori. We are doing this through our Māori Research and Development Unit – Te Kūwaha, a team of 10 Māori researchers and scientists.

Erica Williams and Erina Watene assess eel stocks in the Whirinaki River, Murupara.

Improving Māori health

One of Te Kūwaha's projects is looking at Māori relationships with aquatic environments – how these have changed, and what have been the effects on spiritual and physical health. The aim is to find ways to improve access and revitalise aquatic environments for Māori. The project is led by Te Kūwaha in collaboration with Crop & Food Research and urban and rural Māori from Papatipu Rūnaka o Awarua of Ngāi Tahu, Bluff, and Ngāti Hokopu ki te Hokowhitu, of Ngāti Awa, Whakatāne.

Focus group meeting at Te Rau Aroha marae (Awarua).

Renewable energy for remote communities

Te Kūwaha are collaborating with two remote Māori communities (Te Roroa and Tūwharetoa) to identify how energy use can be improved and to assess the potential for developing renewable energy sources. The project has looked at energy use and future needs, including energy efficiency in homes and communal buildings (local marae). Through hui and household energy audits the team have identified where energy efficiency can be improved, and they are managing the retrofitting process. Monitoring equipment has also been installed to assess the wind, solar, wave, and hydrological resources at each site.

Te Mahau, Waihi Village.

Fattening tuna

Successful feeding trials in heated water have resulted in tuna (eels) of a size that would have taken more than 25 years to reach in the wild. The research was carried out in a commercial processing plant and involved three iwi (Muaūpoko, Ngāti Raukawa, and Ngāti Kahungunu), and three non-Māori commercial organisations (Levin Eel Trading Co. Ltd, Wiptec Ltd, and Fenwick-Stuart Co. Ltd). Iwi representatives working alongside factory staff and the researchers gained valuable experience in aquaculture. The ultimate goal is to maximise the return from the existing tuna fishery for both customary and commercial use.

Improving the treatment of wastewater

There are many unresolved issues relating to the treatment and disposal of wastewater. In a pilot dialogue project, NIWA scientists and University of Waikato staff will work with four iwi groups from Taupo (Ngāti Tūrangitukua) and Gisborne (Rongowhakaata, Ngāi Tāmanuhiri, and Te Āitanga a Mahaki) where there are significant issues and significant differences in tikanga and kawa relating to wastewater treatment. The programme will also look at cost-effective models of wastewater disposal that are acceptable to iwi.

www.niwa.co.nz/rc/maori

Education & Training

NIWA continues to be strongly committed to the advancement of science education and knowledge in schools, universities, and the wider public. Our school sponsorship programme in 2002–03 targeted three areas: the Sea & Learn programme, regional school science fairs, and Kelly Tarlton's Discovery Room. This year our sponsorship was strengthened by our association with Royal Society of New Zealand Science, Mathematics, and Technology Teacher Fellows Keith Hartle and Allan Mundy, working in the areas of lake and marine research.

Kings High School pupils Brad Collins (left) and Roman Fraser hold up crabs found during their day trip on Kaharoa.

Sea & Learn

NIWA's 2002–03 Sea & Learn programme provided pupils from each of 18 schools with a 1-day hands-on science voyage on our coastal research vessel *Kaharoa* from the ports of Picton, Nelson, Lyttelton, Timaru, and Dunedin. The teaching resource for the programme was developed jointly by NIWA and school science teachers and is linked to the New Zealand school curriculum. In Nelson the Sea & Learn programme linked up with the international education programme 'GLOBE' to collect data for comparison for school students in Golden Bay, New Zealand, Mobile Bay, USA, and Taganaog Bay, Russia.

School science fairs

NIWA is the major sponsor of regional school science fairs, including those in Auckland City, Waikato, Bay of Plenty, Nelson, and Wellington. We also provide additional sponsorship of the Central Northland, North Harbour, Taranaki, Nelson, Marlborough, Central South Island, South Canterbury, and Otago Science Fairs. These sponsorships promote science in secondary and intermediate schools and to the community at large.

Queen Margaret College seventh former Elizabeth Carr's model catapult helped her win the top prize at the Wellington Regional Secondary Schools Science and Technology Fair, of which NIWA is a major sponsor, in August 2002. Her project, 'The Physics of the Trebuchet' (French for catapult), looked at how a 2 kg projectile flew, depending on its angle of release.

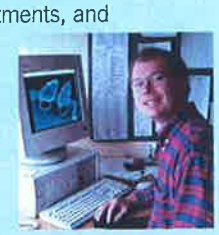
NIWA Discovery Room

NIWA sponsor the marine educational facility at Kelly Tarlton's Underwater World in Auckland. This is known as the 'NIWA Discovery Room', and is designed to help primary and intermediate age children discover the magic of science. More than 37 000 children visit it each year.

NIWA staff and a Royal Society Science, Mathematics, and Technology Fellow (hosted by NIWA) have been developing a **teaching resource on marine science** for South Pacific Island schools based on the ARGO programme. ARGO is a major ocean-observing system consisting of a global array of temperature and salinity floats.

Our links with New Zealand universities continue to strengthen. The joint NIWA and University of Auckland Institute of Aquatic and Atmospheric Sciences has run successfully for two years. We also support three postgraduate Centres of Excellence with Victoria University of Wellington, the University of Otago, and the University of Canterbury to attract the best students and train them at postgraduate level in areas of growing demand. NIWA staff supervised more than 60 postgraduate students across six universities last year. We currently provide seven NIWA PhD scholarships in key areas, including coastal ecology, aquaculture, freshwater ecology, greenhouse gas production, and the ecology of eels (linked to Māori cultural values). Several of our students have received funding from the FRST's Enterprise Fellowships, Tuapapa Putaiao Māori Postgraduate Fellowships, or Bright Future's Fellowships.

We offered 13 sponsored and self-funded **training courses** in 2002–03 to assist in the professional development of staff in regional councils, government departments, and consultancy organisations. These included our popular freshwater biodiversity courses on topics such as native freshwater fish, wetland plants, and aquatic invertebrates.



Postdoc Martin Haase

NIWA also provided funding for 18 **postdoctoral fellowships** in 2002–03 in areas where we need high quality expertise, including marine biosecurity (2), biodiversity (3), aquaculture (2), and simulation modelling (4). We also provided internal educational opportunities for NIWA staff, with 1 **sabbatical leave** grant for senior staff, and 3 **technical training** awards in overseas institutions.

International research & services

NIWA overseas

NIWA continues to extend its reach in the global science community with the ongoing development of its subsidiary companies in the USA – NIWA (USA), Incorporated and NIWA Environmental Research Institute (NIWA ERI) – and its subsidiary company NIWA Australia based in Brisbane. NIWA also carries out substantial research for a variety of clients elsewhere, and some examples of this research are given below.

NIWA Australia has tailored its services to provide for natural resource managers and users, and environmental science organisations and businesses. Its senior staff are based in Queensland and have experience working in both government agencies and the private sector. NIWA (USA) concentrates on commercial consultancy services, and NIWA ERI is a not-for-profit organisation specialising in multidisciplinary public good research involving management systems, environmental risk assessment, design issues, policy development, and social impacts.

All three companies focus on core skills held by NIWA in New Zealand, including skills in atmospheric physics and chemistry, oceanography, aquaculture, environmental modelling, aquatic chemistry, hydrology, and freshwater ecology.

NIWA Australia

Research has focused on southeast Queensland through contracts for key state and local government agencies, including the Queensland EPA, Department of Natural Resources and Mines, Brisbane Water, and the Brisbane City Council. Collaborative research links are being developed with a number of universities, including The University of Queensland, Griffith University, James Cook University, Southern Cross University, and The University of Melbourne.

www.niwa.com.au

A NIWA Australia and University of Queensland project looking at the impacts of sand dredging on nutrient enrichment in Moreton Bay, Queensland.

NIWA in the USA

Projects undertaken in the USA during 2002–03 included the development of a dataset of global satellite and radiosonde observations, modelling sediment movement in large rivers, measuring stratospheric ozone concentrations, and assessing the toxicity of contaminated sites. NIWA has a longer-term contract with the University of Massachusetts to calibrate and maintain two microwave sensors designed to measure the vertical distribution of ozone in the stratosphere, and environmental engineer Ian Boyd has been based in Amherst, Massachusetts, since August 2000. The microwave instruments are at Mauna Loa Observatory in Hawaii and NIWA's atmospheric laboratory at Lauder in Central Otago. The ozone measurements from these instruments form part of an international network assessing ozone depletion and searching for signs of ozone recovery as nations implement the Montreal Protocol.

Mike Kotcamp calibrating the ozone microwave radiometer at Lauder.

NIWA at sea

Protecting the Ross Sea toothfish fishery. NIWA has been carrying out research on toothfish biology and the exploratory longline toothfish fishery in the Ross Sea for several years, initially as a PGSF project, but more recently under contract to the Ministry of Fisheries. We have provided advice and carried out analyses on a wide range of topics, such as catch sampling methods, genetics, age and growth, abundance, and bycatch and seabird mitigation. Each year, NIWA scientists travel to the fish stock assessment meetings of CCAMLR (Commission for the Conservation of Antarctic Marine Living Resources) held in Hobart to estimate sustainable yields for the main Antarctic finfish stocks of toothfish and icefish.

Fishery resource assessment in the UAE. The fishery resources of the very warm and very salty waters of the southern part of the Arabian/Persian Gulf were surveyed by a New Zealand-based consortium with a major science input from NIWA. The year-long survey of demersal and pelagic resources was commissioned by the Environmental Research and Wildlife Development Agency in Abu Dhabi, United Arab Emirates.

Random trawl surveys and acoustic surveys covered an area of 37 000 km^2 along a 700 km coastline. NIWA staff provided survey design, sampling and data collection systems, ageing of fish, data entry, and trawl survey and acoustic analysis. A series of training sessions and seminars contributed to the capability of local fisheries research and management staff, and NIWA staff were stationed in the UAE for up to 2 months to provide technical support and training.

Neil Bagley training UAE staff.

Yellowtail snapper. The assessment of the yellowtail snapper fishery was reviewed for the US National Marine Fisheries Service. This provided a valuable opportunity to broaden NIWA's understanding of international practice in fisheries assessment techniques.

Pelagic fisheries. NIWA scientists with expertise in pelagic fisheries for tunas continue to provide scientific and technical support to New Zealand delegations to major international fisheries management conventions. These include the Commission for the Conservation of Southern Bluefin Tuna, and the Western and Central Pacific Fisheries Convention.

NIWA in the desert

As part of an assessment of the effects of discharges from numerous petrochemical industries in Saudi Arabia, NIWA carried out an atmospheric tracer study at a large oil refinery. This involved field work and sample analysis in a specially set-up gas chromatograph with advanced equipment shipped from New Zealand. The result was very successful and NIWA has received a 5-year environmental monitoring contract, involving atmospheric, freshwater, and marine assessments.

The Rabigh Oil Refinery

NIWA in South-East Asia and the Pacific

NIWA is engaged in a wide variety of research with countries from South-East Asia and the Pacific.

Training overseas hydrologists. NIWA has for many years provided hydrological training throughout the Southwest Pacific and South-East Asia, for water supply, hydropower, and catchment management schemes. More recently, NIWA staff provided work experience training for water resources staff from Papua New Guinea, Solomon Islands, and Vanuatu, and conducted projects designed to develop water resources assessment capabilities in Malaysia, Indonesia, Vietnam, Lao PDR, Cook Islands, and Samoa.

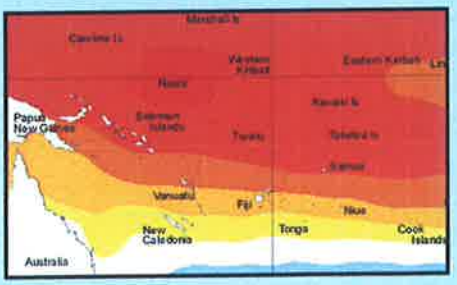
In Cambodia a system was developed for the Mekong River Commission in Phnom Penh to convert all the hydrological data into Tideda format for CD-ROM, replacing the old printed yearbooks. Commission staff were trained to use the system so they could update the CD-ROMs as new data were received.

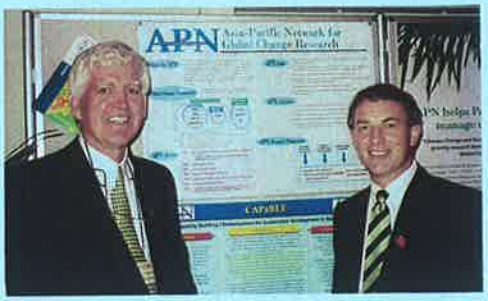
Richard Ibbitt

Bob Curry

Keeping an eye on the Pacific's climate. *The Island Climate Update* is a monthly newsletter prepared by NIWA's National Climate Centre in collaboration with weather and climate agencies from Australia and the Pacific Islands. It provides an overview of the climate in the tropical South Pacific, is distributed throughout the Pacific, and is made possible with support from the New Zealand Agency for International Development (NZAID) and South Pacific Regional Environment Programme (SPREP). It is also available free on the web.

www.niwa.co.nz/ncc



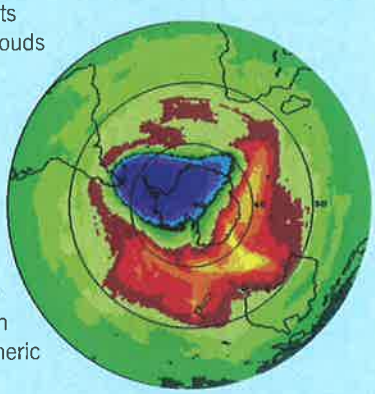


Dr Andrew Matthews and New Zealand's Minister of Foreign Affairs and Trade Phil Goff at the leaders' meeting.

Helping Pacific Island states manage climate change. NIWA Business Development Manager (Pacific) and Asia-Pacific Network (APN) Scientific Planning Group Co-chair Dr Andrew Matthews was one of the key speakers at the third Japan and Pacific Islands Forum (PIF) summit meeting in Okinawa, Japan. He introduced the APN to leaders and members, including Japanese Prime Minister Junichiro Koizumi, and highlighted how APN helps Pacific Island states manage climate change. He also announced the launch of the 'Scientific Capacity Building/Enhancement for sustainable development in developing countries (CAPaBLE) programme.

Key sites internationally for atmospheric research

What is driving climate change? NIWA's atmospheric research laboratory at Lauder in Central Otago is there because it is a clean air site, far from industrial pollution, and it has many cloudless days – a prerequisite for a lot of the remote sensing measurements made at Lauder. Staff at Lauder measure ozone, the trace gases and aerosols affecting its concentration, UV radiation, and the clouds that affect UV radiation.



Lauder is one of five sites around the world in the international network designed to observe and understand the physical and chemical state of the stratosphere. The measurements are used by researchers at Lauder and elsewhere in New Zealand and by the international community working on understanding what is driving stratospheric change and climate change.

As a result of the strict limitations imposed on the production of CFCs, the Antarctic ozone hole is expected to recover, but this recovery may be delayed by up to 15–20 years because of greenhouse gas increases.

Measuring greenhouse gases. NIWA makes high precision measurements of the three main greenhouses gases (carbon dioxide, methane, and nitrous oxide) at its Baring Head atmospheric research station, at Scott Base in Antarctica, and from ships and aircraft in the Pacific and Southern Oceans. Baring Head has been used since 1972 to detect large increases in atmospheric greenhouse concentrations in the New Zealand region. It provides the international community with the longest continuous record of atmospheric carbon dioxide measured in the southern hemisphere as well as unique isotopic measurements of methane. This information is widely used by the scientific community and policy makers.

The Baring Head station and lighthouse.

Contribution to New Zealand's international obligations

NIWA contributes substantially to New Zealand's commitments under international conventions and obligations, such as the Vienna Convention for the Protection of the Ozone Layer (and Montreal Protocol), the UN Framework Convention on Climate Change (and Kyoto Protocol), the Antarctic Treaty System, and the Rio Convention. NIWA provides scientific expertise, and supplies the New Zealand representative for a wide variety of international bodies. NIWA has particularly important links with the Ministry for the Environment (MfE), Ministry of Agriculture and Forestry (MAF), Department of Conservation (DoC), Ministry of Fisheries (MFish), and Ministry of Foreign Affairs and Trade (MFAT).

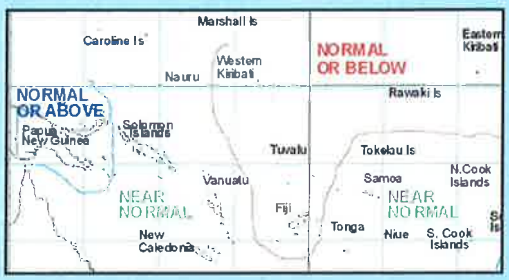
Selected examples of NIWA's contribution include:

IPPC Chair visits NIWA. Dr Rajendra Pachauri, the Chair of the Intergovernmental Panel on Climate Change with NIWA Principal Scientist Dr David Wratt, New Zealand's representative for the IPCC Working Group. Dr Pachauri gave a talk on the science and impacts of climate change when he visited NIWA in Wellington last year.

Membership of international committees. NIWA scientists are members of a large number of international committees and panels relating to New Zealand's obligations under international agreements. Notable among these is the Bureau of the Intergovernmental Panel on Climate Change (IPCC), which guides planning for the IPCC scientific assessments used by governments and the UN for policy development. Others include the WMO Commission of Agricultural Meteorology, the International Global Atmospheric Chemistry project, the Ocean Biogeochemistry & Ecosystems programme, the IGBP/LOICZ, and the International Geosphere-Biosphere programme.

Emission reductions. In collaboration with MfE, NIWA contributed to a UNFCCC/SBSTA investigation into the Brazilian proposal to distribute the burden of emission reductions among developed countries, in preparation for negotiations before the second commitment period for the Kyoto Protocol.

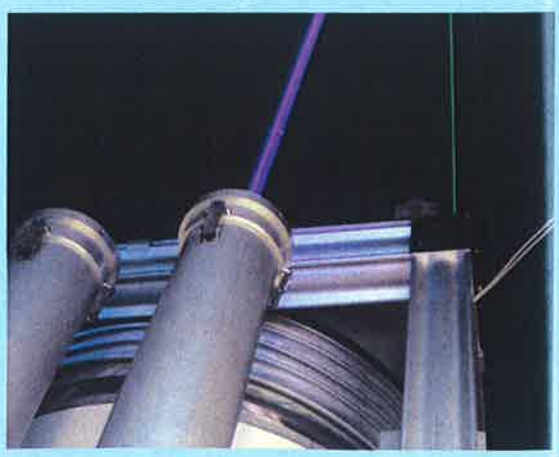
This rainfall outlook map, published in The Island Climate Update, *is an example of the sort of climate information provided to Pacific Island nations.*



Climate outlooks. NIWA supplies seasonal climate outlooks for Southwest Pacific Island nations, in collaboration with meteorological agencies in 17 countries and with support from the New Zealand Agency for International Development and the South Pacific Regional Environment Programme.

Ozone depletion. NIWA contributed to the WMO/UNEP scientific assessment of ozone depletion. Measurements at NIWA's Lauder laboratory are one of the primary time series used to confirm whether stratospheric chlorine levels are responding to the emission reductions enforced by the Montreal Protocol. They confirm the effectiveness of the Protocol, and NIWA models predict that chlorine levels in 2010 will have dropped by 12–14% relative to the peak.

Laser radar (lidar) beams at Lauder probe the atmosphere up to altitudes of more than 100 km to examine the distribution of ozone and aerosols.



Validating measurements. NIWA regularly contributes to measurement validation, in part so the effects of policy implementation can be accurately defined. This includes the instruments on the EOS Aura satellite, measurements of ozone and other trace gases for the European Space Agency, differences between ILAS-II measurements and ground-based measurements, and the atmospheric chemistry experiment run by the Canadian Space Agency.

International databases. NIWA makes an important contribution to international databases which support policy development. Substantial amounts of data are regularly deposited in databases such as NDSC, JGOFS, WOUDC, and SOLAS under the auspices of the WMO and other agencies. Conversely, NIWA has data supply agreements with international agencies where New Zealand benefits from overseas research.

Antarctica. NIWA has a substantial research presence in Antarctica in support of New Zealand's commitment to the Antarctic Treaty and Antarctic issues. NIWA research has been used in the development of environmental management plans. For example, NIWA was the New Zealand agency invited to a US-sponsored meeting of scientists and managers to help assess and plan the mitigation of a significant hydrocarbon spill in the environmentally sensitive dry valleys. NIWA contributes to international committees on the management of science and other activities in the Ross Sea, and has contributed to Antarctica New Zealand's development of environmental and science policy.

Biodiversity. NIWA has provided biodiversity knowledge and tools to help meet New Zealand's international biodiversity reporting obligations (such as the Rio Convention, under which governments are required to develop indicators of sustainable development which take into account biological diversity).

Blue skates and a humpback angler fish – examples taken from the huge number and variety of fish and invertebrates sampled by scientists on Tangaroa *during the NORFANZ biodiversity survey of the mid Tasman Sea.*

Other international research. NIWA makes a considerable contribution to many other international research programmes in line with government policy. These include the World Climate Research Programme's CLIVAR (Climate Variability) programme, the international collaborative ARGO programme to deploy ocean floats, the SOLAS (Surface Ocean Lower Atmosphere) programme, and the JGOFS (Joint Global Ocean Flux Study). NIWA is the first modelling agency in the world to begin century-long climate model runs as part of the Climate of the 20th Century (C20C) project, an international effort to better understand the reasons behind climate variability. NIWA research has also resulted in New Zealand being recognised as an important site for hydrothermal vent and seep research under the auspices of the international CHESS (Chemosynthetic Ecosystems) programme.

NIWA scientists on Kaharoa *made the first collections of marine hydrothermal vent fauna from New Zealand.*

Contribution to government policy & operations

NIWA provides substantial input to New Zealand government bodies, at a national, regional, and territorial level, to help them evaluate costs and benefits of alternative strategies, assess the relative risks and impacts of different human activities on the environment, and improve decision-making.

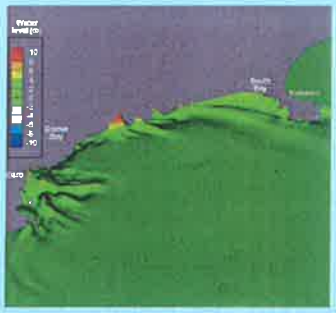
At a national level, we work closely with the Ministry for the Environment (MfE), Ministry of Agriculture and Forestry (MAF), Department of Conservation (DoC), Ministry of Fisheries (MFish), Energy Efficiency and Conservation Authority (EECA), New Zealand Treasury, Ministry of Foreign Affairs and Trade (MFAT), Te Puni Kōkiri, Ministry for Economic Development (MED), Land Information New Zealand (LINZ), Ministry of Civil Defence and Emergency Management (MCDEM), Ministry of Transport (MoT), Land Transport Safety Authority (LTSA), and Maritime Safety Authority (MSA). We continued to work with all regional and unitary authorities and most city and territorial authorities across the country.

Other specific areas of contribution to local, regional, and central government activities include:

Energy. NIWA seasonal outlooks were used by energy providers and government policy analysts in their planning and policy development to cope with low inflows to hydro lakes and to relax the energy savings targets once it was clear we were returning to a more normal rainfall regime. A mentor group involving EECA, MfE, and Te Puni Kōkiri was established to guide research on energy issues and the implementation of renewable energy technologies for small, rural Māori communities.

Climate. Regular briefings for MAF were used to develop outlooks and projections of rural production for Treasury. Additional collaboration with MAF and Treasury looked at the economic effects of climate. Other work included the development of climate-soil-crop potential land-use information; e.g., the NIWA-led study for the Kaipara and Far North District Councils. NIWA also contributed to national policies to mitigate global climate change and greenhouse gas emissions.

Brochures for the Kaipara and Far North District Councils identified land-use options.



Model of a tsunami generated by a submarine landslide arriving at South Bay, Kaikoura.

Natural hazards. Predictive models, risk evaluation tools, and warning or forecasting systems have been incorporated in land-use policy and plans and to mitigate against natural disasters. A new flood forecasting system has been trialled on the Clutha River with Otago Regional Council and is being extended to other areas. Climate hazards identified and mapped using procedures developed by NIWA have been incorporated by regional and district councils into lifelines and emergency management plans.

Biodiversity. NIWA ran identification courses for regional councils. Research helped DoC select marine and coastal protected areas and map areas of global or national significance for marine biodiversity for the WWF Global 200 Marine Ecoregions project. NIWA provided significant input into policy, particularly the National Policy. A new tool for lake assessment is being adopted by regional councils and will help agencies identify Water of National Importance and provide cost-effective biodiversity protection.

Biosecurity. Information on a major population explosion of a bryozoan in Kaipara Harbour and another alien bryozoan in Golden Bay was reported to MFish, and responses are being formulated. Other work included collaboration on containment and eradication strategies for aquatic weeds, border control assessment, weed surveillance strategies, and weed control in lakes.

Dennis Gordon holding Golden Bay bryozoa.

Fisheries & aquaculture. NIWA provided tools and information on the state and causes of ecosystem change in the Marlborough Sounds which were used by regulators and the Environment Court to plan marine farming growth. Other research results are being used to set environmental guidelines for sustainable marine farm development in northern New Zealand. NIWA research contributed to MFish's decision to reduce quotas for commercial eel fishers in the South Island so that stocks and the fishery could be managed sustainably.

Air quality. NIWA provided significant input to MoT and regional council policies on fuel specifications, vehicle inspection, emission reduction, greenhouse gas emissions, and health effects of air pollution, as well as to Ministry of Health policies on indoor air quality. A new greenhouse gas emissions inventory was developed for all regions to allow local governments to determine optimum mitigation strategies.

Databases. NIWA provides access to Nationally Significant Databases on Freshwater Fish, Water Resources, Marine Benthic Biodiversity, and Climate.

Catchment management. Auckland Regional Council are using NIWA research results for sustainable development. NIWA collaborates with DoC and regional councils in a test site. Contributions to the 'Dairying and Clean Streams Accord' and the 'Clean Streams' project help farmers protect stream margins from the impacts of intensive farming.

Sustainable freshwater and estuarine waters. A NIWA model was used by Environment BOP to evaluate options for controlling nutrient inputs from farmland to the Rotorua lakes. Collaboration with MfE and Environment Waikato on Lake Taupo water quality modelling will support decisions on increases in dairy farming in the lake catchment. A NIWA risk-assessment scheme is used by regional councils for resource consent, and ecosystem-based environmental targets and guidelines are being implemented by regional authorities. NIWA research has been used to assess the impacts of forestry and the dredging and dumping associated with marinas. River management tools were provided, with support from MfE, stream restoration projects were designed, regional water plans were revised, and rules or guidelines for resource management (e.g., discharges to streams) were developed.

Public health. New approaches to calculate risk were used to develop the freshwater component of the Water Quality Guidelines for Marine and Freshwater Recreational Areas, issued by the Ministries of Environment and Health.

Water treatment. NIWA developed treatment methods for agricultural wastewaters with Fonterra, Environment Waikato, and DoC, and designed wetlands for stormwater treatment with city councils. NIWA research is the basis for the Auckland Regional Plan: Coastal to evaluate applications for resource consents to discharge stormwater from urban catchments.

Commercialisation

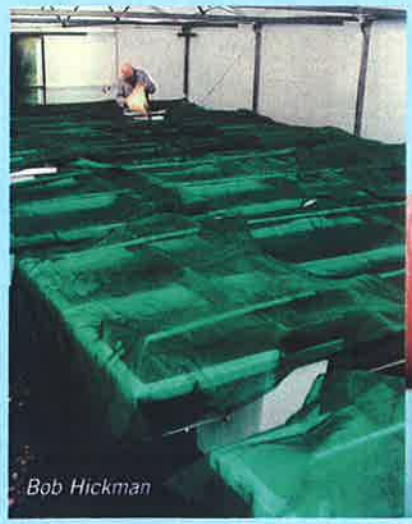
Ecological engineering eliminates wastewater

NIWA's Advanced Pond Systems (APS) are a series of wastewater treatment ponds, each designed to optimise a natural treatment process using clever ecological engineering. As well as providing excellent treatment of conventional pollutants, APS also achieves near-tertiary treatment (in terms of nitrogen and phosphorus removal) and superior removal of pathogens and indicator bacteria. The technology is particularly suitable for the treatment of municipal sewage from small to medium sized communities and for farm dairy shed wastewater because it is simple to operate, cost-effective, and, as well as producing reusable water, also produces recoverable nutrients and enough energy (in the form of methane) to power the farm. There is an acute need for this technology because many existing wastewater treatment plants (mainly conventional oxidation ponds) are not meeting the requirements of the Resource Management Act, and need to be upgraded.

www.niwa.co.nz/aps

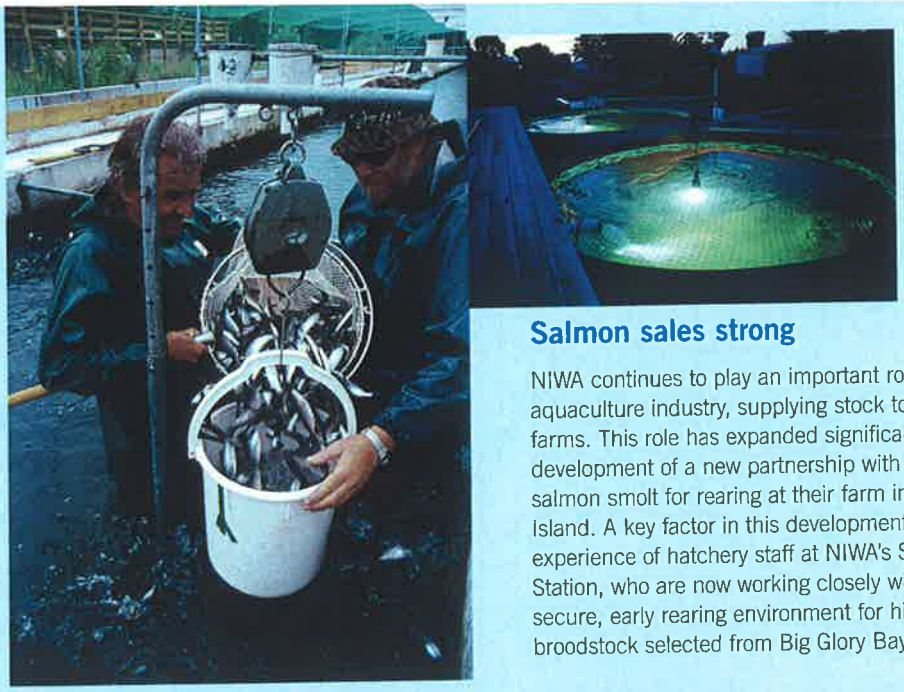
Commercial kingfish

Kingfish production at NIWA's state of the art hatchery at Bream Bay reached new heights this year with 30 000 juvenile fish being produced and sold to Island Aquafarms Ltd in Crail Bay, Marlborough Sounds – the first commercial kingfish aquaculture in New Zealand. NIWA also gained valuable experience in transporting fish, using our salmon transporter, which took more than 20 hours, but resulted in mortality of only 0.7%. These hatchery and transportation successes form the basis for a rapid commercialisation of the species through aquaculture.



Seed shortage solved

One of the main obstacles to cultivating paua is the shortage of seed. Last year the NIWA hatchery at Mahanga Bay was possibly the largest seed supplier in New Zealand, rearing and selling over 170 000 high quality seed and 20 million larvae to five commercial paua farms. For 2003–04 the production target is over 300 000 seed. One of the notable sales was the supply of 25 000 seed to a new venture near Gisborne. This operation is remarkable because it is 8 km from the sea and relies on a high technology water recirculation system, designed by NIWA scientists, to provide the optimum environment for growth while using less than 0.01% of the water used by conventional farms. The seed are currently growing in the system at more than twice the rate normally achieved by the industry.



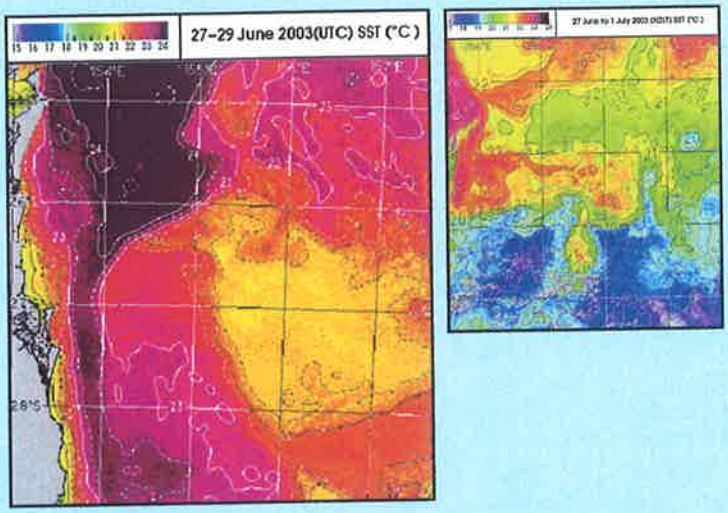
Salmon sales strong

NIWA continues to play an important role in the salmon aquaculture industry, supplying stock to many New Zealand farms. This role has expanded significantly this year with the development of a new partnership with Sanford Ltd to produce salmon smolt for rearing at their farm in Big Glory Bay, Stewart Island. A key factor in this development was the expertise and experience of hatchery staff at NIWA's Silverstream Research Station, who are now working closely with Sanford to provide a secure, early rearing environment for high performing broodstock selected from Big Glory Bay.

Satellite services to fishers

More than 1000 New Zealand and Australian fishers use NIWA web-based products to guide their fishing operations. High-resolution, sea surface temperature, catch targeting analyses and satellite imagery are generated in real time for users via the web or through *Sat-View*, an email-based system designed for use on vessels at sea. This service uses science developed in the FRST-funded 'Remote Sensing of Fisheries' research programme, and, since its inception in 1997, many New Zealand fishers have come to rely on it for planning vessel movements. More recently, Australian east coast tuna fishers have begun using it. They report that NIWA's services are more flexible, accurate, and cost-effective than those provided by Australian and US suppliers.

www.niwa.co.nz/services/sat/



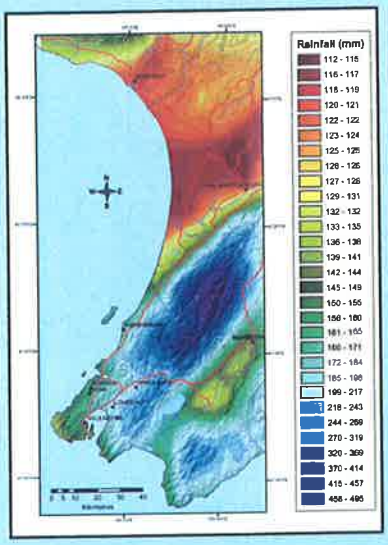
There are nine bacteria colonies on this agar plate. The colony with the clear zone of exclusion is producing an antagonistic substance which prevents growth of a pathogenic bacteria.

Beneficial bugs

An exciting range of beneficial bacteria for aquaculture have been identified through NIWA research. The good bacteria are known as probiotics and are useful in promoting good health, high settlement, and improved digestion in aquaculture species. The probiotic bacteria can crowd out disease-causing bacteria in hatchery cultures of, for example, paua larvae, and provide strong cues for the larvae to settle on ideal culture surfaces. Aquaculture probiotics have excellent global market prospects, with their use becoming increasingly common overseas, and NIWA aims to commercialise its first aquaculture probiotics within the next two years.

Better maps, better decisions

If you need to know more about your part of New Zealand, to help you decide, for example, whether you can grow and ripen riesling vines, whether there is potential for generating wind power, or whether you need to upgrade your flood protection scheme, we can map it for you. In fact, NIWA can map any aspect of climate for any part of New Zealand. We build our maps by use of a Geographic Information System (GIS) with information from the extensive national climate database, satellite data, and information from global-scale and local-scale climate models. We can even set up temporary climate stations to supplement the permanent station network. The results are attractive, highly visual images which provide essential climate information as a base for your specific project.



The map shows the 100-year return period 24-hour rainfall total, which is used, for example, in river flood estimation or to assess the frequency of storms.

What we want to do as a company & How we are going to do it

Sustainable Development Report

Background

Commitment to sustainable development

As an active member of the New Zealand Business Council for Sustainable Development since 2000, NIWA has a representative on the Executive Committee and is Project Champion for the Council's major project on climate change. We are committed to assisting the development of 'Forms of progress that meet the needs of the present without compromising the ability of future generations to meet their own needs'. This fits closely with NIWA's mission statement 'To provide a scientific basis for the sustainable management and development of New Zealand's atmospheric, marine, and freshwater systems and associated resources'.

NIWA's social and environmental contribution

Under the Crown Research Institutes Act 1992, the principles of operation of CRIs include undertaking research for the benefit of New Zealand, promoting the application of the results of research and technological developments, being a good employer, exhibiting a sense of social responsibility, and maintaining financial viability. Since 1997 NIWA's annual reports have included reports on the achievement of targets for non-financial performance measures which cover CRIs' principles of operation. These are agreed with the shareholding ministers in our Statement of Corporate Intent (SCI) each year. In 2000 this section of our annual report was expanded from 'Non-financial Performance' to 'NIWA's Social and Environmental Contribution'.

Sustainable development reporting

The concept of sustainable development is not new to NIWA, but this year we are making the transition to presenting a sustainable development report as part of our annual report.

This includes some of the non-financial performance measures on which we have routinely reported each year by commentary, plus additional performance measures which have been developed for implementing and reporting on NIWA's contribution to sustainable development. From the 2003–04 financial year, all NIWA's non-financial performance measures will be incorporated into our sustainable development report, with performance assessed against targets set in our SCI at the beginning of each year.

Our performance against the relevant targets in NIWA's SCI for the 2002–03 financial year was as follows:

Non-financial performance measures as proposed in the SCI	Actual 2003	Target 2003	Actual 2002
Benefit to New Zealand	commentary in next section		
Research output*			
Papers in international, externally refereed journals	278	280	269
Papers in local, internally, or editor–refereed journals	132	150	184
Conference papers and other presentations	675	500	583
Research monographs and books	64	75	91
Popular books	2	2	3
Client reports	487	430	723
** measured for a calendar year.*			
Application & promotion of science			
Value of consultancies to NZ users	$23M	$20M	$24M
Achievement of technology transfer objectives in FRST contracts	99%	95%	100%
Value of TBG and Technet contracts	$312k	$750k	$115k
Requests serviced for information from NIWA's nationally significant public-good databases	9649*	4150	3680
Magazine and newspaper feature articles plus TV and radio interviews	185	100	265
** Includes 7000 automatic updates to regional council websites.*			
Good employer			
Policies to meet provisions of CRI Act	commentary in next section		
No. of days lost due to work-related accidents	3	<100	38
Social responsibility	commentary in next section		
Staff composition			
Research teams	450	430	428
Research support	51	50	49
General support	97	92	84
Marketing and promotion	6	6	5
Management	23	22	22
Total	627	600	588
% Male:female	74:26		
Turnover	8%	<5%	3%

Age profile (%) by 10 year age groups

Category	<20	20–29	30–39	40–49	50+
Research teams	0.4	8.9	31.3	30.9	28.4
Research support	0.0	2.0	19.6	31.4	47.1
General support	1.0	14.4	28.9	23.7	32.0
Executive/Managers	0.0	0.0	17.4	47.8	34.8
Marketing, promotion, and liaison	0.0	0.0	0.0	50.0	50.0
Total	0.5	8.8	29.2	30.6	30.9

Staff numbers, turnover, and age composition for the year ended 30 June 2003

Category	No. of staff	No. of FTEs	Turnover (%)	Average age (years)
Research teams	450	442.1	8.0	40.1
Research support	51	50.5	4.0	45.9
General support	97	92.6	12.2	44.7
Marketing, promotion, and liaison	6	6.0	0.0	48.8
Management	23	23.0	0.0	46.8
Total	627	614.2	8.1	45.3

Sustainable Development Report

This initial sustainable development report focuses on NIWA's core business and does not generally include our subsidiaries, NIWA Vessel Management Ltd, NIWA Environmental Research Institute, NIWA (USA), Incorporated, or NIWA Australia Pty Ltd. We plan to include these subsidiaries in future years.

Benefits from NIWA's science to New Zealand's sustainable development

(What we do)

Many aspects of NIWA's core business contribute directly to the sustainable development of New Zealand, e.g., through the provision of environmental management tools and advice which are aimed at ensuring the maintenance and development of economic, environmental, and social sustainability. Examples include:

- **Sustainable management of marine resources** – our National Centre for Fisheries & Aquaculture is using the unique set of skills within NIWA to assist with the sustainable development and management of New Zealand's marine fisheries and other marine resources.
- **Sustainable land use** – our National Climate Centre provides monthly climate summaries and regional outlooks which are improving New Zealand's ability to manage for climate variations such as droughts. Detailed mapping of climate conditions and the frequency of climate hazards for specific regions, in collaboration with expertise from soil scientists and agricultural specialists in other CRIs and universities, is helping New Zealanders to manage their land sustainably and to identify new land-use opportunities.
- **Sustaining New Zealand's indigenous biodiversity and improving biosecurity management** – our National Centre for Aquatic Biodiversity & Biosecurity is developing tools and services, such as the Freshwater Fish Database, web-based species/habitat tools such as Freshwater Information New Zealand, and identification guides to help central and local government, industry, iwi, and other communities protect and restore New Zealand's unique marine and freshwater biodiversity.
- **Improving the quality of life in our cities, towns, and rural areas** – our National Centre for Climate–Energy Solutions is creating new economic, social, and environmental opportunities associated with climate change and energy reform, including the evaluation of alternative forms of energy in areas such as transport. Our National Centre for Water Resources and the joint NIWA–GNS Natural Hazards Centre are providing information and tools to improve New Zealand's management of its aquatic resources and mitigate the impacts of atmospheric and water-related hazards, such as floods and coastal storm surges.

NIWA's organisational commitment

(How we do it)

In addition to the major contribution which our research makes to New Zealand's sustainable development, NIWA is also committed as an organisation to operating in a manner which minimises the consumption of resources, minimises waste, and takes all practicable steps to minimise the adverse effects of our own activities on the environment. NIWA recognises the connections between economic, environmental, social, and cultural performance. We are continually striving to improve our contribution to sustainable development though our performance in these interrelated areas.

For the 2002–03 year we are reporting on the areas described below, including performance measures and benchmarks where these are appropriate or available. While these measures are listed under economic, environmental, or social and cultural sustainability, we recognise that some are relevant to more than one of these areas. In future years we may expand and modify our reporting to include additional areas or performance indicators, to reflect the realisation of our commitment to sustainable development.

Economic sustainability

We have selected three key measures of NIWA's economic performance. These reflect the shareholders' requirement for CRIs to be financially viable and to undertake research for the benefit of New Zealand:

Financial viability

Operating surplus before tax ($)

NIWA Group, for the year ended 30 June

Return on equity (%)

NIWA Group: Net profit after tax/average shareholders' funds

Total revenue ($)

NIWA Group, for the year ended 30 June

NIWA has exceeded its financial targets for the year ending 30 June 2003. Operating surplus before tax decreased slightly in comparison with previous years due largely to increases in the use of subcontractors. Return on equity and total revenue have continued to increase. Full details and commentary are provided elsewhere in this annual report.

Environmental sustainability

Resource use

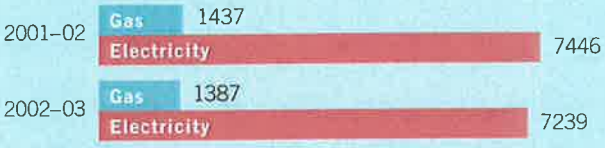
NIWA is a foundation member of the Energy Wise Government Programme, which is administered by the Energy Efficiency and Conservation Authority (EECA). We are committed to practising energy efficiency throughout all our premises, plant, and equipment wherever it is cost-effective. An energy audit conducted at our largest site, Greta Point (Wellington), and subsequent energy efficiency improvements through upgrades to the hot water, lighting, and air conditioning systems and their management resulted in substantial savings in electricity and gas use between 1999 and 2001. As a result, NIWA received an EECA Energy Wise Award in 2001 in the small energy user section.

We have carried out energy audits at all major NIWA sites and made improvements through upgrades to lighting and air conditioning systems and have installed building management systems at major sites. This, along with greater staff awareness, has contributed to savings in 2002–03 in line with requests from EECA. Baselines of current energy use and potential energy-saving mechanisms have been established. *Our objective is to achieve at least a 15% saving per fulltime staff equivalent in NIWA's energy use (from the baseline for the 2001–02 financial year) over the 5-year period to 30 June 2007.* We aim to achieve this reduction without compromising NIWA's service, productivity, or staff comfort.

Energy use (electricity and gas) (kWh)

Per full-time staff equivalent

Year ended 30 June

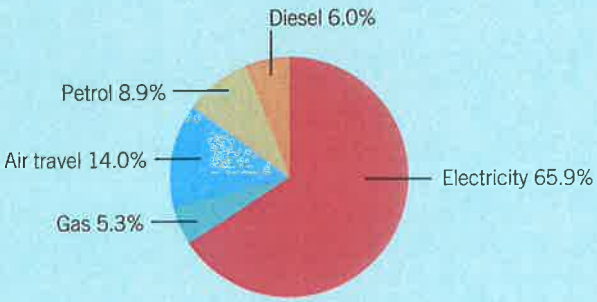


In addition to auditing NIWA's use of electricity and gas, we have gathered data on our use of motor vehicles, taxis, and air travel to enable assessment of the greenhouse gas emissions produced by NIWA's activities. The consumption of fossil fuels to support NIWA's activities (excluding NIWA Vessel Management Ltd) was estimated to have emitted 2933 t of carbon dioxide in the year ending 30 June 2002 and 3034 t for the year ended 30 June 2003, using the protocol from the New Zealand Business Council for Sustainable Development. The use of motor vehicles, taxis, and air travel is essential to NIWA's business. Although we will continue to minimise travel where possible, NIWA's use of these resources is likely to increase as our business grows. We will attempt to balance this through energy savings, so that *NIWA's total annual contribution to carbon dioxide emissions based on fulltime staff equivalents does not increase above its current level (as at 30 June 2002) in the 5-year period to 30 June 2007.*

Electricity is a significant resource used by NIWA. It accounts for 66% of the total carbon dioxide emissions. NIWA's major resource use in 2002–03 was:

Resource use

Year ended 30 June



Based on the number of full-time staff, the emission of carbon dioxide for the year ended 30 June 2003 has reduced in comparison with that in the year ended 30 June 2002:

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

(Excludes research vessels)

NIWA Vessel Management Ltd

NIWA Vessel Management Ltd manages two research vessels – *Tangaroa* (deepwater) and *Kaharoa* (inshore and coastal). Both operate on diesel fuel, and the levels of carbon dioxide emissions for the past two financial years have been estimated as:

Year ending 30 June 2002	6682 t or 11.9 t per sea-day
Year ending 30 June 2003	6091 t or 10.1 t per sea-day

To ensure the level of emissions for diesel is minimised, work scheduling plans are continuously reviewed, servicing plans constantly updated, and *Tangaroa* is on a three year maintenance plan. The most recent dry-docking for the vessel overhaul occurred in November 2002 (cost over $300,000).

Waste management and recycling

NIWA is increasing its strategic focus on waste management and recycling. This includes items such as paper, glass, plastics, metal, and liquid and hazardous waste. NIWA has always recycled items; however, there has never been a comprehensive plan to our approach. Goals for increasing recycling and minimising waste will be set during 2004. Our progress towards achieving these goals will be reported in subsequent annual reports, beginning in 2005. Current (baseline) levels of recycling of paper and other wastes will be assessed, and toxic and other waste disposal procedures will be documented at all sites by 30 June 2004.

Our recycling programmes will emphasise the need to increase recycling. This will involve procedures such as weighing and recording recycled products. This information will then be used as a benchmark for measuring the performance against that in future years. Total solid waste will be measured from 2003–04. We have taken initiatives to reduce the effects of our operations on the environment wherever possible through initiatives like installing bioswales to treat runoff, minimising discharges, and increasing staff awareness of the need to minimise disturbance to the natural environment during field activities.

Paper use

Paper has been identified as the most significant area of waste production for NIWA. We plan to take further steps to reduce the amount of paper purchased and used. We are implementing procedures to have all computers print double-sided as default and encourage staff to copy double-sided in photocopiers and to print only essential documents. Paper purchased and used will be recorded in 2003–04 as a benchmark to measure performance against in future years.

National Sustainable Development Committee

From 1 July 2003, a National Sustainable Development Committee has been established to focus on the national significance of sustainable development for NIWA. It will set the aims and mission statement of NIWA in fulfilling its obligation under the SDR framework, and will take responsibility for policy setting, regional initiatives, the outputs generated, and preparing the SDR for the annual report.

Use of animals in research

NIWA maintains a high regard for animal welfare. We use animals in environmental research for purposes such as understanding the ecological requirements of indigenous species and assessing the effects of proposed developments on environmental health. All manipulations must be approved by our Animal Ethics Committee (AEC), in accordance with the Animal Welfare Act (1999).

Our AEC meets regularly and conducts some of its business by email. It ensures that all our animal-based research is conducted in accordance with NIWA's Code of Ethical Conduct for the Use of Live Animals in Research, which has ministerial approval as required by the Act. Animal usage is reported annually to the Ministry of Agriculture and Forestry.

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

Social and cultural sustainability

Benefits to New Zealand: helping New Zealand meet its international obligations

NIWA's expertise is made available to various Government departments to provide policy advice and meet New Zealand's obligations to international conventions to which this country is a signatory. This commitment is substantially elaborated in 'Contribution to New Zealand's international obligations' on page 30 of this annual report.

Benefits to New Zealand: education

NIWA continues to be strongly committed to the advancement of science education and knowledge in schools, universities, and the wider public. NIWA provides pupils with a hands-on science experience on *Kaharoa*, is a major sponsor of regional school science fairs, and sponsors the marine education facility at Kelly Tarlton's Underwater World. NIWA has strong links with New Zealand universities; for example, through the joint NIWA–University of Auckland Institute of Aquatic and Atmospheric Sciences and the postgraduate Centres of Excellence with Victoria University of Wellington, the University of Otago, and the University of Canterbury. NIWA supervised more than 60 postgraduate students, provided 7 PhD scholarships, offered 13 sponsored and self-funded training courses for staff in regional councils, government departments, and consultancies, and provided funding for 18 postdoctoral fellowships. Additional details are provided in 'Education and Training' on page 27 of this annual report.

Working with Māori
NIWA is committed to building strong relationships with Māori through the continued development of collaborative research partnerships at 'flax roots' level with iwi, hapū, and Māori organisations. Our Māori Research and Development Unit, Te Kūwaha, is working mainly on research that underpins Māori aspirations for business development and sustainable resource management. A key objective for Te Kūwaha is to raise awareness of the Māori tikanga within NIWA to improve our interactions with Māori and thus make NIWA an attractive place for Māori researchers to work.

Te Kūwaha comprises a General Manager with 10 key Māori scientists and technicians. Examples of the unit's research and development are given in 'Te Kūwaha' on page 26 of this annual report.

Number of staff in Te Kūwaha

Good employer
NIWA is committed to providing a safe working environment which promotes innovation and excellence in science, enhances professional and career development, and rewards staff within the financial constraints of the company.

Facilitation of science
Retention of key staff through the facilitation of effective science is a major objective of NIWA's management. This includes a strong capital investment programme to purchase state-of-the-art science equipment, and a project management system which gives staff the opportunity to lead and manage research projects with a high level of responsibility for both scientific and financial performance. We also have a substantial overseas travel programme for staff, technical training and sabbatical awards for staff, and a visiting scientist programme. These play a vital role in maintaining and enhancing NIWA's extensive international research networks, which ensure that NIWA's research is at the forefront of global atmospheric and aquatic science.

Staff benefits and entitlements
The terms and conditions of employment of our staff are specified in NIWA's current Collective Employment Agreement (CEA), which has a 3-year term expiring on 1 July 2004. The CEA was negotiated with the Public Service Association (PSA), which is the only union representing our staff. Membership is voluntary, and 49% of our staff are currently members. The terms and conditions of employment of staff who choose not to join the PSA are identical to those of union members, except for two clauses in the CEA which are exclusive to the PSA. These clauses cover a healthcare insurance subsidy and the NIWA–PSA Partnership Forum, which was established to maintain harmonious employment relations by promoting partnership, openness, trust, and involvement. This forum meets quarterly.

Benefits available to all permanent staff include an annual review of remuneration and discussion of progress towards career goals, unlimited sick leave for cases of genuine illness or accident, annual leave of 3 weeks a year, increasing to 4 weeks a year after 3 years of service, NIWA-subsidised superannuation, life insurance of up to twice an annual salary, disability insurance, 4 weeks long service leave after 20 years continuous service, parental leave of up to 1 year with payment of up to 6 weeks, training leave of 3 days per year which may be accumulated up to 15 days, and various other entitlements. These benefits reflect NIWA's strong commitment to fair and equitable treatment of staff.

Our Human Resources Policy and Procedures Manual, which was developed and is added to as required by a staff working group, addresses a wide variety of issues from staff training and equal employment opportunity to recruitment and remuneration. This manual is available online to all staff.

Staff satisfaction
Since 1996 independent surveys of the New Zealand science sector have consistently shown that NIWA's staff have a more positive attitude about working for NIWA than that shown by staff towards their employer in other science organisations included in the survey (mainly CRIs).

Staff satisfaction

(Percentage of staff positive about working for NIWA)

(Average scores across 15 questions in independent surveys of staff in the science sector, mainly CRIs; benchmark is average score for all participating organisations.)

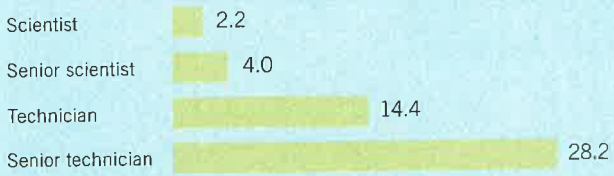
Sustainable Development Report

Rewarding staff

NIWA has a performance management system and performance-based remuneration policy that pays for the range, depth, and type of skills of our staff, recognises an individual's worth to NIWA and the value of each staff member's contribution, and allows for career development of staff. In addition, we have a profit-share scheme, which allows for the distribution to all staff of a proportion of NIWA's post-tax operating surplus when this exceeds our profit target for the year. Our consistent financial success has enabled us to raise staff remuneration to a level significantly above the market median for the New Zealand science sector.

Market relativity – total remuneration

(Percentage above market median)



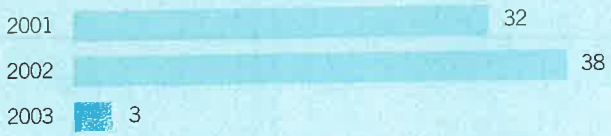
Health and safety

NIWA has developed and implemented a comprehensive Health and Safety Plan with strong participation from staff. Since July 2000, NIWA has been part of the ACC Partnership Programme under the full self-cover option. Annual audits conducted under the Partnership Programme have resulted in premium discounts of 15% for each of the last two years, in recognition of safe workplace practices at a secondary level. The latest audit (July 2002) assessed NIWA's occupational health and safety as achieving the highest (tertiary) performance level in seven of the eight critical elements considered. Our workplace injury rate has remained extremely low for the last three years, with less than 0.02% of total working days per annum lost because of workplace accidents. Only one accident resulted in lost days in 2003.

Safety

Number of work days lost because of workplace accidents

NIWA Science, for the year ended 30 June (excludes vessel company)



Our Health and Safety Plan includes the appointment of laboratory managers in all our facilities and the development of a code of practice as required under health and safety legislation and the Hazardous Substances and New Organisms Act. The code of practice is being developed in conjunction with other CRIs, universities, and ERMANZ.

Deloitte Touche Tohmatsu
Deloitte House, 8 Nelson Street
PO Box 33, Auckland
New Zealand

Deloitte Touche Tohmatsu

9 September 2003

The Directors
National Institute of Water and Atmospheric Research Limited
Private Bag 99 940
Newmarket
AUCKLAND

Dear Directors

LIMITED INDEPENDENT VERIFICATION STATEMENT TO THE SHAREHOLDERS OF NATIONAL INSTITUTE OF WATER AND ATMOSPHERIC RESEARCH LIMITED

As auditors of National Institute of Water and Atmospheric Research Limited (the 'Group'), appointed by the Auditor-General, we have provided statutory audit opinions under New Zealand law and New Zealand auditing standards for the financial periods ending 30 June 2001, 30 June 2002 and 30 June 2003.

We report on the following financial information, presented as part of the Group's Sustainable Development Report:

- Financial Viability and Return on Equity on page 37
- Sector Revenues on page 38
- Staff satisfaction on page 40
- Safety on page 41

These disclosures are the responsibility of the Board of Directors with whom the objectives and terms of the engagement were agreed. It is our responsibility to express an independent opinion on the Sustainable Development disclosures set out on pages 36 to 41 for the financial year ended 30 June 2003, prepared and presented by the Board of Directors, and report our conclusions and findings based on the terms of engagement as agreed.

We take no responsibility for, nor do we report on, any part of the Sustainable Development Report disclosures not specifically mentioned in this report.

Basis of Opinion

We have undertaken procedures to provide reasonable assurance that the calculations of the financial information set out in the Group's Sustainable Development Report on pages 37, 38, 40 and 41 (as detailed above) of this report, have been correctly calculated and that the inputs to the calculations have been correctly taken from the Group's records for the financial years ended 30 June 2001, 30 June 2002 and 30 June 2003. Our procedures did not involve verification of the trends disclosed in the information referred to above. We therefore have not performed an audit of these disclosures and therefore do not express an audit opinion on them.

Conclusion

In our opinion, the calculations of the financial information set out in the Group's Sustainable Development Report on pages 37, 38, 40 and 41 (as detailed above) of this report, have been correctly calculated, and the inputs to the calculations have been correctly taken from the Group's records for the financial years ended 30 June 2001, 30 June 2002 and 30 June 2003.

Yours faithfully

Deloitte Touche Tohmatsu

DELOITTE TOUCHE TOHMATSU

Report of the Directors to the Shareholders

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

Directors' profiles

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

Professor Carolyn Burns is Head of the Department of Zoology at the University of Otago and a distinguished limnologist. 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, consultant, trainer, and professional speaker. She is a former customary fisheries manager of Ngai Tahu Development Corporation and is currently director of FOLKUS Ltd, an environmental consulting company, and Futures by Design Ltd, a provider of training programmes using neurolinguistic techniques.

John Hercus has an MSc in physics from Victoria University 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 with 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 has also been a scientific computer software consultant for several overseas universities since 1990. He is an invited member of the International Astronomical Union and holds a PhD in astronomy from the University of Texas, an MA from the University of Minnesota, and a BSc from the University of Auckland. He is a Director of the Meteorological Service of 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 Limited from 1997 until September 2002 and Acting Chief Executive pending the arrival of the new CE. 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. He was the Chief Executive of New Zealand Dairy Group prior to the formation of Fonterra, 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 and a trustee of Workbase, the national centre for literacy.

Report of the Directors to the Shareholders

The Directors take pleasure in presenting the National Institute of Water & Atmospheric Research Ltd (NIWA) and Group Annual Report for the financial year ended 30 June 2003.

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 in the USA, Australia, and elsewhere.

Results

This financial year the NIWA Group has exceeded its Business Plan objectives with a net surplus of $4.7 million (2002: $4.7 million) against a budgeted net surplus of $4.3 million. This was achieved on a turnover of $84.2 million (2002: $81.3 million), against budgeted revenue of $84.1 million.

Shareholders' equity at 30 June 2003 totalled $46.7 million (2002: $42.1 million), an increase of 10.9%. Total assets increased 5.8% to $66.7 million (2002: $63.0 million).

Donations

No donations were made during the year.

Dividends

No dividend was declared or paid during the year.

Directors

The appointment of John Spencer on 16 June 2003 was the only change to Directors during the year.

Remuneration of Directors

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

	Parent	
	2003 $'000	2002 $'000
Directors of the National Institute of Water & Atmospheric Research Ltd and NIWA Vessel Management Ltd		
S H Suckling (Chair)	42	42
C W Burns	21	18
M K Cassidy	21	20
J D Hercus	21	24
G Hill	21	1
T W Newton	27	–
D C Sharp	21	20
New appointees during the 30 June 2003 year		
J Spencer	–	–
Retired during the 30 June 2002 year		
P T Morgan (Deputy Chair)	–	28
P A Nicholas	–	17
B L Rhoades	–	9

No fees were paid in respect of directors of the subsidiaries NIWA Vessel Management Ltd, NIWA Environmental Research Institute, NIWA (USA), Incorporated, and NIWA Australia Pty Ltd.

Remuneration of employees

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

	Group	
$	**2003**	2002
100,000–109,999	8	6
110,000–119,999	10	7
120,000–129,999*	3	–
130,000–139,999	2	2
140,000–149,999*	3	–
150,000–159,999*	5	2
160,000–169,999	1	3
170,000–179,999	2	–
180,000–189,999	1	–
190,000–199,999*	1	–
220,000–229,999	–	1
240,000–249,999	–	1
250,000–259,999	–	1
280,000–289,999**	1	–

** Includes individuals who have received redundancy packages in 2003*

*** Chief Executive's remuneration band*

The redundancy provisions, which include retirement leave and severence, were calculated in accordance with Clause 31 of the NIWA Collective Employment Agreement in force from 1 July 2001 to 1 July 2004.

Report of the Directors to the Shareholders

Auditors

In accordance with Section 21(1) of the Crown Research Institutes Act 1992, the auditors, Deloitte Touche Tohmatsu 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 Group Financial Statements'.

Interests Register

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

Parent and Subsidiary Companies

Interested Transactions

Any business the NIWA Group has transacted with organisations 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.

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.

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.

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

For and on behalf of the Board:

Sue Suckling
Chair
3 September 2003

Troy Newton
Director

Corporate Governance Statement

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, and NIWA Australia Pty Ltd, which constitute the NIWA Group.

The Board comprised up to eight Directors (including the Chair) during the financial year ended 30 June 2003 and formally met ten times during that period.

Responsibility for the management and administration of the Group is delegated to the Chief Executive, who is responsible to the Board.

The Board has an Audit committee. During the financial year, the Audit Committee comprised all members of the Board and met formally twice.

The function of the Audit 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.

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. Internal control procedures are considered to be sufficient to provide reasonable assurance as to the integrity and reliability of these Financial Statements.
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 2003.

Sue Suckling
Chair
3 September 2003

Rick Pridmore
Chief Executive

National Institute of Water & Atmospheric Research Ltd and Group

Statement of Financial Performance

for the year ended 30 June 2003

	Note	**Group 2003 Actual $'000**	Group 2003 Budget $'000	Group 2002 Actual $'000	**Parent 2003 Actual $'000**	Parent 2002 Actual $'000
Revenue	3	84,200	84,070	81,312	82,090	78,550
Operating surplus before taxation	4	**7,216**	**6,129**	**7,465**	**5,688**	**5,762**
Taxation expense	5a	2,490	1,839	2,735	1,916	1,885
Net surplus		**4,726**	**4,290**	**4,730**	**3,772**	**3,877**

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

Statement of Movements in Equity

for the year ended 30 June 2003

	Note	**Group 2003 Actual $'000**	Group 2003 Budget $'000	Group 2002 Actual $'000	**Parent 2003 Actual $'000**	Parent 2002 Actual $'000
Net surplus		**4,726**	**4,290**	**4,730**	**3,772**	**3,877**
Foreign currency translation reserve movement	6b	(128)	–	(50)	–	–
Total recognised revenues and expenses		**4,598**	**4,290**	**4,680**	**3,772**	**3,877**
Dividends paid	7	–	–	(19,000)	–	(19,000)
Total contributions to shareholders		**–**	**–**	**(19,000)**	**–**	**(19,000)**
Total movements in equity during the year		**4,598**	**4,290**	**(14,320)**	**3,772**	**(15,123)**
Equity at the beginning of the year		42,115	41,643	56,435	33,951	49,074
Equity at the end of the year		**46,713**	**45,933**	**42,115**	**37,723**	**33,951**

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 Financial Position

as at 30 June 2003

	Note	**Group 2003 Actual $'000**	Group 2003 Budget $'000	Group 2002 Actual $'000	**Parent 2003 Actual $'000**	Parent 2002 Actual $'000
Equity						
Share capital	6a	24,799	24,799	24,799	24,799	24,799
Equity reserves	6b	21,914	21,134	17,316	12,924	9,152
Total equity		**46,713**	**45,933**	**42,115**	**37,723**	**33,951**
Non-current liabilities						
Employee entitlements	8a	1,960	2,102	2,096	1,881	1,982
Intercompany	18	–	–	–	7,631	5,136
Total non-current liabilities		**1,960**	**2,102**	**2,096**	**9,512**	**7,118**
Current liabilities						
Payables and accruals	9	10,742	7,727	8,310	9,679	7,864
Provisions	10	571	570	267	571	–
Short-term advance facility	11	600	2,500	4,300	600	4,300
Employee entitlements	8b	6,092	4,187	5,910	5,891	5,710
Total current liabilities		**18,005**	**14,984**	**18,787**	**16,741**	**17,874**
Total equity and liabilities		**66,678**	**63,019**	**62,998**	**63,976**	**58,943**
Non-current assets						
Property, plant, & equipment	12	46,393	47,967	46,978	30,989	30,484
Investments in subsidiaries	17	–	–	–	12,421	12,421
Future income taxation benefit	5b	1,322	1,411	767	3,580	2,957
Total non-current assets		**47,715**	**49,378**	**47,745**	**46,990**	**45,862**
Current assets						
Cash and short-term deposits		1,126	3,565	887	819	463
Receivables and prepayments	14	14,515	6,816	10,901	14,033	9,974
Taxation receivable		702	(450)	450	161	61
Contract work in progress		1,534	2,555	1,946	1,298	1,898
Inventories	15	1,086	1,155	1,069	675	685
Total current assets		**18,963**	**13,641**	**15,253**	**16,986**	**13,081**
Total assets		**66,678**	**63,019**	**62,998**	**63,976**	**58,943**

For and on behalf of the Board:

Sue Suckling
Chair
3 September 2003

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 Performance'.

National Institute of Water & Atmospheric Research Ltd and Group

Statement of Cash Flows

for the year ended 30 June 2003

	Note	**Group 2003 Actual $'000**	Group 2003 Budget $'000	Group 2002 Actual $'000	**Parent 2003 Actual $'000**	Parent 2002 Actual $'000
Cash flows from operating activities						
Cash was provided from:						
Receipts from customers		80,354	83,904	83,081	79,030	82,026
Interest received		132	131	447	105	446
		80,486	84,035	83,528	79,135	82,472
Cash was disbursed to:						
Payments to employees and suppliers		(64,222)	(69,211)	(68,362)	(66,725)	(68,495)
Interest paid		(173)	(296)	–	(173)	–
Taxation expense paid		(3,297)	(1,953)	(2,879)	(2,641)	(2,178)
		(67,692)	(71,460)	(71,241)	(69,539)	(70,673)
Net cash inflow from operating activities	16	**12,794**	**12,575**	**12,287**	**9,596**	**11,799**
Cash flows from investing activities						
Cash was provided from:						
Sale of property, plant, & equipment		209	300	394	209	204
Loans advanced from subsidiary company		–	–	–	2,494	181
Cash was applied to:						
Purchase of property, plant, & equipment		(9,064)	(7,770)	(11,486)	(8,243)	(11,233)
Net cash outflow in investing activities		**(8,855)**	**(7,470)**	**(11,092)**	**(5,540)**	**(10,848)**
Cash flows from financing activities						
Cash was provided from:						
Proceeds from short-term advance facility		–	–	4,300	–	4,300
Cash was applied to:						
Dividends paid to shareholders	7	–	–	(19,000)	–	(19,000)
Repayment of short-term advance facility		(3,700)	(3,500)	–	(3,700)	–
Net cash outflow from financing activities		**(3,700)**	**(3,500)**	**(14,700)**	**(3,700)**	**(14,700)**
Net increase/(decrease) in cash held		**239**	**1,605**	**(13,505)**	**356**	**(13,749)**
Add opening cash balance		887	1,960	14,392	463	14,212
Closing cash balance		**1,126**	**3,565**	**887**	**819**	**463**
Made up of:						
Cash		1,118	3,565	887	819	463
Short-term deposits		8	–	–	–	–
Closing cash balance		**1,126**	**3,565**	**887**	**819**	**463**

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

Notes to the Financial Statements

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 are for NIWA and its wholly owned subsidiaries, NIWA Vessel Management Ltd, NIWA (USA), Incorporated, NIWA Environmental Research Institute, and NIWA Australia Pty Ltd.

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

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.

(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' 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 with GST included.

(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.

Future income taxation benefits and provisions for deferred taxation are not offset if they arise in different taxation jurisdictions.

(e) Property, plant, and equipment

Property, plant, and equipment are valued at historical cost less accumulated depreciation to date. 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.

Property, plant, and equipment with a cost price less than $2,000 and computer software are fully depreciated in the year of purchase.

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.

(f) 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 EDP equipment	3 years
Furniture & fittings	10 years
Office equipment	5 years
Motor vehicles	4 years

(g) Receivables

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

(h) 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.

(i) 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.

(j) Leases

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

Operating lease payments are recognised evenly over the expected period of benefit to the Group.

(k) Statement of cash flows

Operating activities comprise the provision of research services. 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.

(l) Provision for dividends

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

(m) Changes in accounting policies

There have been no changes in accounting policies this year.

3 Revenue

	Group 2003 Actual $'000	Group 2003 Budget $'000	Group 2002 Actual $'000	Parent 2003 Actual $'000	Parent 2002 Actual $'000
Public Good Science and Technology	36,024	35,930	33,626	36,024	33,626
– Contract funding	3,756	3,680	4,243	3,756	4,243
– Non-specific output funding (NSOF)	16,705	16,700	16,260	16,705	16,260
Ministry of Fisheries	27,584	27,629	26,737	25,500	23,975
Commercial	131	131	446	105	446
Interest income					
	84,200	84,070	81,312	82,090	78,550

All revenue was derived from continuing activities.

4 Operating surplus before taxation

	Group 2003 Actual $'000	Group 2002 Actual $'000	Parent 2003 Actual $'000	Parent 2002 Actual $'000
The operating surplus before taxation is stated after charging/(crediting):				
Depreciation	9,548	9,318	7,666	7,515
Rental and operating lease costs	949	883	909	843
Remuneration of Directors	174	173	174	173
Net loss/(gain) on sale of property, plant, & equipment	(136)	(187)	(136)	(188)
Bad debts written off	3	5	2	5
Net realised foreign currency loss/(gain)	(148)	(97)	(150)	(116)
Survey and repair provisions	–	(184)	–	–
Donations	–	–	–	–
Interest expense	173	–	173	–
Remuneration of the auditors of these Financial Statements:				
– Audit fees	61	59	54	54
– Other services	48	47	12	37

4a. Depreciation

Land	–	–	–	–
Buildings & improvements	1,190	860	1,167	843
Vessels	758	758	–	–
Plant & equipment	4,324	4,084	3,367	3,209
EDP equipment	1,984	2,185	1,939	2,129
Office equipment	599	714	589	694
Furniture & fittings	84	151	46	113
Motor vehicles	467	434	454	426
Small boats	142	132	104	101
Total	9,548	9,318	7,666	7,515

5 Taxation

5a. Taxation expense

Operating surplus before taxation	**7,216**	**7,465**	**5,688**	**5,762**
Prima facie tax @ 33%	2,381	2,463	1,877	1,901
Add/(less) tax effect of permanent differences	19	18	19	18
Adjustment for tax losses not recognised	69	254	–	–
Under/(over) provision in previous year	21	–	20	(34)
Income taxation expense	2,490	2,735	1,916	1,885
The income taxation expense is represented by:				
– Current taxation	3,045	2,818	2,539	2,144
– Deferred taxation (FITB)	(555)	(83)	(623)	(259)
	2,490	2,735	1,916	1,885

5b. Future Income Taxation Benefit (FITB)

Balance at the beginning of the year	767	627	2,957	2,655
Prior period adjustment	3	57	2	43
Current year movement	552	83	621	259
Balance at the end of the year	1,322	767	3,580	2,957

5c. Taxation losses

Unrecognised taxation losses available for set-off against future assessable income:				
– Taxation losses	236	770	–	–
– Taxation savings thereon	78	254	–	–

The ability to utilise these taxation losses depends on the generation of sufficient assessable income in the respective taxation jurisdictions.

6 Equity

		Group 2003 Actual $'000	Group 2002 Actual $'000	Parent 2003 Actual $'000	Parent 2002 Actual $'000
6a.	**Share capital**				
	Issued and fully-paid capital 24,798,700 shares	24,799	24,799	24,799	24,799
6b.	**Equity reserves**				
	Equity reserves include:				
	Retained earnings	22,049	17,323	12,924	9,152
	Foreign currency translation reserve	(135)	(7)	–	–
	Total equity reserves	21,914	17,316	12,924	9,152
	Movements in reserves during the year were as follows:				
	Retained earnings				
	Balance at the beginning of the year	17,323	31,593	9,152	24,275
	add net surplus	4,726	4,730	3,772	3,877
		22,049	36,323	12,924	28,152
	less dividend payment	–	(19,000)	–	(19,000)
	Balance at the end of the year	22,049	17,323	12,924	9,152
	Foreign currency translation reserve				
	Balance at the beginning of the year	(7)	43	–	–
	add foreign exchange gain/(loss) on translation of independent foreign operations	(128)	(50)	–	–
	Balance at the end of the year	(135)	(7)	–	–

The total value of the retained earnings ($10.8 million) of NIWA Vessel Management Ltd has been reserved towards the replacement of the research vessel RV *Tangaroa*. The current insured value of RV *Tangaroa* is $40 million.

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

7 Dividend payments

Payments made to shareholder	–	(19,000)	–	(19,000)

Consistent with the 2003 Crown Research Institute operating framework, no dividend payment was made during the current financial year.

8 Employee entitlements

8a.	**Non-current**			
	Long service leave	124	455	124	450
	Retirement leave	1,633	1,455	1,559	1,346
	Annual leave	203	186	198	186
		1,960	2,096	1,881	1,982
8b.	**Current**				
	Long service leave	62	66	62	65
	Retirement leave	352	121	302	121
	Annual leave	3,209	3,317	3,110	3,170
	Accrued salaries	2,469	2,406	2,417	2,354
		6,092	5,910	5,891	5,710

Full recognition of employee entitlements is adopted for long service and retirement leave using actuarial valuations.

9 Payables and accruals

Trade payables	6,372	4,872	5,914	4,426
Revenue in advance	4,370	3,438	3,765	3,438
Total	10,742	8,310	9,679	7,864

10 Provisions

	Group 2003 Actual $'000	Group 2002 Actual $'000	Parent 2003 Actual $'000	Parent 2002 Actual $'000
Survey and repair	–	267	–	–
Redundancy	571	–	571	–
Total	571	267	571	–
10a. Survey and repair provisions				
Balance at the beginning of the year	267	497	–	–
Amount utilised	(267)	(46)	–	–
Additional survey provision made	–	100	–	–
Unused repair provision reversed	–	(284)	–	–
Balance at the end of the year	–	267	–	–
10b. Redundancy provision				
Balance at the beginning of the year	–	–	–	–
Additional redundancy provision made	571	–	571	–
Amount utilised	–	–	–	–
Balance at the end of the year	571	–	571	–

The survey provision was utilised when the RV *Tangaroa* went into dry dock in November 2002. A survey is required at least every three years for the vessels of NIWA Vessel Management Ltd. In future, the survey costs will be capitalised and depreciated over the vessel's useful life.

The repair provision was reversed in early 2002 and is longer provided for. It related to emergency repairs and maintenance carried out on the vessels.

11 Short-term advance facility

A short-term loan was drawn down from The National Bank of New Zealand Limited, as follows:

Advance facility	600	4,300	600	4,300

The loan was drawn against the New Zealand dollar short-term advance facility on an on-call basis, at an interest rate of 5.7%. The loan is unsecured, but subject to various covenants that were complied with during the year.

12 Property, plant, and equipment

	2003 Cost $'000	2003 Accum Depn $'000	2003 Book Value $'000	2002 Cost $'000	2002 Accum Depn $'000	2002 Book Value $'000
Group						
Land	2,217	–	2,217	2,217	–	2,217
Buildings & improvements	21,901	5,279	16,622	20,466	4,105	16,361
Vessels	18,868	5,947	12,921	18,868	5,190	13,678
Plant & equipment	37,562	27,100	10,462	33,404	23,546	9,858
EDP equipment	16,417	14,365	2,052	14,630	11,697	2,933
Office equipment	5,452	5,038	414	4,747	4,469	278
Furniture & fittings	1,891	1,599	292	1,877	1,516	361
Motor vehicles	2,884	1,804	1,080	2,696	1,815	881
Small boats	1,263	930	333	1,199	788	411
Total	108,455	62,062	46,393	100,104	53,126	46,978
Parent						
Land	2,217	–	2,217	2,217	–	2,217
Buildings & improvements	21,681	5,198	16,483	20,246	4,047	16,199
Vessels	–	–	–	–	–	–
Plant & equipment	31,721	23,185	8,536	28,122	20,572	7,550
EDP equipment	15,908	14,040	1,868	14,293	11,418	2,875
Office equipment	5,282	4,879	403	4,585	4,320	265
Furniture & fittings	1,511	1,295	216	1,497	1,250	247
Motor vehicles	2,787	1,741	1,046	2,599	1,767	832
Small boats	998	778	220	973	674	299
Total	82,105	51,116	30,989	74,532	44,048	30,484

Independent valuers, Tse Wall Arlidge Limited, undertook a valuation of Land and Buildings in June 2002. This valuation totalled $33.4 million. The Directors consider this value to be relevant still.

13 Heritage assets

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

NIWA has the following heritage assets:

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

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

14 Receivables and prepayments

	Group 2003 Actual $'000	Group 2002 Actual $'000	**Parent 2003 Actual $'000**	Parent 2002 Actual $'000
Trade receivables	13,913	10,100	13,518	9,217
Provision for doubtful debts	(21)	(21)	(21)	(21)
Prepayments	623	822	536	778
Total	14,515	10,901	14,033	9,974

15 Inventories

Consumables	411	384	–	–
Finished goods	674	593	674	593
Work in progress	1	92	1	92
Total	1,086	1,069	675	685

No inventories are pledged as security for liabilities, nor are any inventories subject to retention of the title clauses.

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

	4,726	**4,730**	**3,772**	**3,877**
Net surplus				
Add/(less) items classified as investing activities				
Net loss/(gain) on disposal of property, plant, & equipment	(136)	(187)	(136)	(188)
Add/(less) non-cash items				
Depreciation	9,548	9,318	7,665	7,515
Unrealised changes in the value of subsidiaries	(100)	(87)	–	–
Increase/(decrease) in employee entitlements	(136)	(98)	(101)	(108)
Increase/(decrease) in provisions	304	(230)	571	–
(Increase)/decrease in future income taxation benefit	(555)	(140)	(623)	(302)
	9,061	8,763	7,512	7,105
Add/(less) movements in working capital items				
Increase/(decrease) in payables and accruals	2,432	(3,985)	1,815	(2,571)
Increase/(decrease) in employee entitlements	182	1,524	181	1,572
(Increase)/decrease in receivables and prepayments	(3,614)	2,216	(4,058)	2,824
(Increase)/decrease in inventory and contract WIP	395	(771)	610	(829)
(Increase)/decrease in taxation receivable	(252)	(3)	(100)	9
	(857)	(1,019)	(1,552)	1,005
Net cash inflow from operating activities	12,794	12,287	9,596	11,799

17 Investments in subsidiaries

The investments represent shareholdings the parent company (NIWA) has in its 100% owned subsidiaries as follows:

	Parent 2003 Actual $'000	Parent 2002 Actual $'000
NIWA Vessel Management Ltd (Principal activity: vessel charters for scientific research)	12,421	12,421
	12,421	12,421

NIWA has an A$100 equity investment in NIWA Australia Pty Ltd, and a US$1 equity investment in NIWA (USA) Incorporated. Both these companies undertake scientific research and consultancy services within their respective countries. 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, in an advance ruling of the Internal Revenue Service, and as such is exempt from U.S. Federal income tax. This advance-ruling period is valid until 30 June 2004. NIWA Environmental Research Institute conducts scientific research with a Federal or State focus in the USA.

18 Intercompany

	Parent 2003 Actual $'000	Parent 2002 Actual $'000
NIWA non-current liability	7,631	5,136

An amount of $9.9 million relates to funds held by the parent company (NIWA) on behalf of NIWA Vessel Management Ltd. This is consistent with the Group policy that all investments are managed by NIWA. This amount is offset by parent company receivables and advances to NIWA Australia Pty Ltd of $1.2 million, NIWA Environmental Research Institute of $811,140, and NIWA (USA), Incorporated of $323,841.

During the year NIWA contracted vessel charters from its subsidiary NIWA Vessel Management Ltd totalling $9.9 million (2002: $9.8 million) and purchased workshop services totalling $113,006 (2002: $84,191).

NIWA subcontracted revenue of $344,049 from NIWA Vessel Management Ltd during the financial year (2002: $633,548).

NIWA also charges its subsidiaries for administration expenses and management services based on an independently prepared formula. This charge totalled $1.1 million during the financial year (2002: $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.

19 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 as follows:

	Group 2003 Actual $'000	Group 2002 Actual $'000	Parent 2003 Actual $'000	Parent 2002 Actual $'000
– Contract funding	36,024	33,626	36,024	33,626
– Non-Specific Output Funding (NSOF)	3,756	4,243	3,756	4,243
Ministry of Fisheries	16,705	16,260	16,705	16,260

20 Guarantees

Guarantees have been given by the National Bank of New Zealand Limited on behalf of NIWA. The National Bank of New Zealand Limited holds no guarantees (2002: $885,933) relating to Ministry of Fisheries contracts. There is an amount of $360,000 held in relation to a Land Information New Zealand contract (2002: $360,000). This money will be received by NIWA on completion of milestones to contract specifications.

21 Segment information

The Group operates predominantly in the environmental science research industry in New Zealand.

22 Financial instruments

(a) 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 risks as they arise, except for foreign currency risks 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:

	2003	2002
On call	5.7–6.2	–
Short term	6.3–6.4	5.3–6.6

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

	2003	2002
Cash (on call)	5.3–5.8	4.5–5.6
Short term	–	4.8–5.8

Short-term deposits have maturity dates less than 6 months. NIWA does 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 we deal 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.

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

23 Commitments

23a. Operating lease obligations

	Group 2003 Actual $'000	Group 2002 Actual $'000	**Parent 2003 Actual $'000**	Parent 2002 Actual $'000
Obligations payable after balance date on non-cancellable operating leases:				
Within 1 year	779	703	746	703
Between 1 and 2 years	606	667	606	667
Between 2 and 5 years	591	860	591	860
Over 5 years	2,807	2,945	2,807	2,945

23b. Capital commitments

Commitments for future capital expenditure:				
Approved, but not contracted for	–	334	–	100
Contracted, but not provided for	286	893	286	893
	286	1,227	286	993

24 Contingent liabilities

The 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 Company's. There are no other significant contingent liabilities that require disclosure in the Financial Statements.

Auditor's report

Deloitte Touche Tohmatsu

REPORT OF THE AUDITOR-GENERAL

TO THE READERS OF THE FINANCIAL STATEMENTS OF NATIONAL INSTITUTE OF WATER AND ATMOSPHERIC RESEARCH LIMITED AND GROUP FOR THE YEAR ENDED 30 JUNE 2003

We have audited the financial statements on pages 45 to 54. The financial statements provide information about the past financial performance of National Institute of Water and Atmospheric Research Limited ('the Company') and Group and its financial position as at 30 June 2003. This information is stated in accordance with the accounting policies set out on page 48.

Responsibilities of the Board of Directors

The Crown Research Institutes Act 1992, the Public Finance Act 1989, the Companies Act 1993 and the Financial Reporting Act 1993 require the Board of Directors ('the Board') to prepare financial statements which comply with generally accepted accounting practice in New Zealand and give a true and fair view of the financial position of the Company and Group as at 30 June 2003 and of the results of their operations and cash flows for the year ended 30 June 2003.

Auditor's Responsibilities

Section 15 of the Public Audit Act 2001, Section 43(1) of the Public Finance Act 1989 and Section 21(1) of the Crown Research Institutes Act 1992 require the Auditor-General to audit the financial statements presented by the Board. It is the responsibility of the Auditor-General to express an independent opinion on the financial statements and report that opinion to you.

The Auditor-General has appointed Mr A G Burgess of Deloitte Touche Tohmatsu, to undertake the audit.

Basis of Opinion

An audit includes examining, on a test basis, evidence relevant to the amounts and disclosures in the financial statements. It also includes assessing:

- the significant estimates and judgements made by the Board in the preparation of the financial statements, and
- whether the accounting policies are appropriate to the Company and Group's circumstances, consistently applied and adequately disclosed.

We conducted our audit in accordance with the Auditing Standards published by the Auditor-General which incorporate the Auditing Standards issued by the Institute of Chartered Accountants of New Zealand. We planned and performed our audit so as to obtain all the information and explanations which we considered necessary in order to provide us with sufficient evidence to give reasonable assurance that the financial statements are free from material misstatements, whether caused by fraud or error. In forming our opinion, we also evaluated the overall adequacy of the presentation of information in the financial statements.

Other than in our capacity as auditor acting on behalf of the Auditor-General, we carry out other assurance and taxation services for the Company. We have no other relationship with or interests in the Company or any of its subsidiaries.

Unqualified Opinion

We have obtained all the information and explanations we have required.

In our opinion:

- proper accounting records have been kept by the Company and Group as far as appears from our examination of those records; and
- the financial statements of the Company and Group on pages 45 to 54:
  - comply with generally accepted accounting practice in New Zealand; and
  - give a true and fair view of:
    - the financial position as at 30 June 2003; and
    - the results of their operations and cash flows for the year ended on that date.

Our audit was completed on 9 September 2003 and our unqualified opinion is expressed as at that date.

A G Burgess
DELOITTE TOUCHE TOHMATSU

On behalf of the Auditor-General
Auckland, New Zealand

Directory

National Institute of Water & Atmospheric Research Ltd

Directors

Sue Suckling *(Chair)*
Dr Carolyn Burns
Miranda Cassidy
John Hercus
Dr Graham Hill
Troy Newton
David Sharp
John Spencer *(Appointed 16 June 2003)*

Executive

Dr Rick Pridmore
Chief Executive Officer (Appointed 16 August 2002)

Dr Bryce Cooper
Director, Strategic Development

Dr Mark James
Director, Operations

Dr Rob Murdoch
Director, Research

Dene Biddlecombe
Chief Financial Officer & Company Secretary

Dr Neil Andrew
General Manager, Marine & Aquaculture

Dr Clive Howard-Williams
General Manager, Freshwater & Education

Dr John McKoy
General Manager, Fisheries & Bioactives

Dr Murray Poulter
General Manager, Atmosphere

Dr Don Robertson
General Manager, Biodiversity, Biosecurity & Information Systems

Dr Charlotte Severne
General Manager, Māori Development

Dr Rod East retired as Deputy Chief Executive (Operations) on 24 December 2002

Registered Office and Address for Service

269 Khyber Pass Road
Newmarket
Auckland
New Zealand

Corporate Office

369 Khyber Pass Road
Newmarket, Auckland
Private Bag 99 940
Newmarket, Auckland
NEW ZEALAND
Tel +64-9-375 2090
Fax +64-9-375 2091

National Centres

Aquatic Biodiversity & Biosecurity
www.niwa co.nz/ncabb

Climate
www.niwa co.nz/ncc

Climate–Energy Solutions
www.niwa co.nz/ncces

Fisheries & Aquaculture
www.niwa co.nz/ncfa

Natural Hazards
www.naturalhazards.net.nz

Water Resources
www.niwa co.nz/ncwr

Te Kūwaha
www.niwa co.nz/rc/maori

NIWA Vessel Management Ltd

301 Evans Bay Parade, Wellington
Tel +64-4-386 0550
Fax +64-4-386 0555

NIWA in the USA

Limno-Tec
501 Avis Drive, Suite 120
Ann Arbor
Michigan, 48108
USA
Tel +1-734-332 1208
Fax +1-734-332 1212

NIWA Australia Pty Ltd

Terrace Office Park, 527 Gregory Tce,
Bowen Hills, Brisbane
P O Box 359, Wilston, QLD,
Australia 4051
Tel +61-7-3257 0522
www.niwa.com.au

Auditors

Deloitte Touche Tohmatsu on behalf of the Auditor-General

Bankers

The National Bank of New Zealand Limited

Solicitors

Bell Gully Buddle Weir
Kaimai Law

Insurers

Marsh Limited

Communications Manager
Geoff Baird
g.baird@niwa.co.nz
Phone +64-4-386 0543
Fax +64-4-386 0574

Regional Offices

Auckland
Manager: Dr Gerda Kuschel
g.kuschel@niwa.co.nz
Cnr Mountain Road & Khyber Pass Road,
Newmarket
Private Bag 109695, Auckland
Phone +64-9-375 2050
Fax +64-9 375 2051

Hamilton
Manager: Dr Dave Roper
d.roper@niwa.co.nz
Assistant RM: Dr Terry Hume
t.hume@niwa.co.nz
Gate 10, Silverdale Road, Hillcrest
P O Box 11115, Hamilton
Phone +64-7-856 7026
Fax +64-7-856 0151

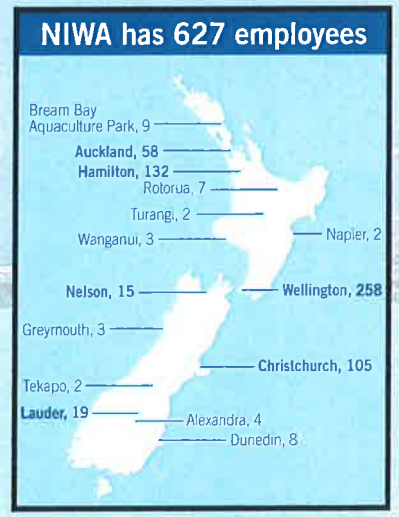
Wellington
Managers: Dr Rosie Hurst
r.hurst@niwa.co.nz
Dr Andrew Laing
a.laing@niwa.co.nz
301 Evans Bay Parade, Greta Point
Private Bag 14901, Wellington
Phone +64-4-386 0300
Fax +64-4-386 0574

Christchurch
Manager: Dr Barry Biggs
b.biggs@niwa.co.nz
Assistant RM: Charles Pearson
c.pearson@niwa.co.nz
10 Kyle Street, Riccarton
P O Box 8602, Christchurch
Phone +64-3-348 8987
Fax +64-3-348 5548

Nelson
Manager: Dr Ken Grange
k.grange@niwa.co.nz
217 Akersten St, Port Nelson
P O Box 893, Nelson
Phone +64-3-548 1715
Fax +64-3-548 1716

Lauder, (Central Otago)
Manager: Charles Pearson
c.pearson@niwa.co.nz
State Highway 85, Lauder
Private Bag 50061, Omakau,
Central Otago
Phone +64-3-447 3411
Fax +64-3-447 3348

NIWA Regional Managers: (left to right) (front) Andrew Laing, Rosie Hurst, Barry Biggs; (rear) Terry Hume, Dave Roper, Gerda Kuschel, Ken Grange, Charles Pearson.



NIWA on the web

www.niwa.co.nz

Photography

Cover: Rob Murdoch; IFC: Nelson Boustead; 2, 4, & 6: NIWA; 8: Lou Reddish, Alan Blacklock, Rowena Moss; 9: Alan Blacklock, NIWA; 10: John Quinn, John Clayton; 11: Brian Sorrell, NIWA; 12: Mal Green; 13: Rob Murdoch, Alan Blacklock (inserts); 14: Neil Bagley, Alan Blacklock; 15: Alan Blacklock; 16: Steve Woods, Rod Budd (top right & insert), Rob Murdoch, Ian Hawes (insert); 17: JARE, Martin Cryer, Greg Foothead, JARE, NORFANZ; 18: Cathy Kilroy, Bob McDowall, Northland Regional Council; 20: Michelle Kelly Shanks, NIWA, Alan Blacklock, NIWA, Alan Blacklock; 21: Neil Bagley (centre), Alan Blacklock; 22: Alan Blacklock; 23: NIWA, Alan Blacklock, Rowena Moss; 24: Ian Halstead, NIWA; 25: Alan Blacklock, Peter Marriott; 26: Nelson Boustead (top), NIWA; 27: Julie Hall, The Otago Daily Times, NIWA, The Dominion Post, Cindy Baker; 28: NIWA, NIWA, John McKoy, Greg Bodeker; 29: NIWA, Gavin Fisher (top left), NIWA; 30: Alan Blacklock, Greg Bodeker; 31: Rob Murdoch, NORFANZ, Malcolm Clark; 32: Bob Curry, Alan Blacklock, NIWA; 33: Alan Blacklock, Lou Reddish, John Quinn; 34: NIWA, Nelson Boustead, Alan Blacklock; 35: Nelson Boustead, Alan Blacklock; 42: NIWA; IBC: Alan Blacklock.

National Institute of Water & Atmospheric Research Ltd