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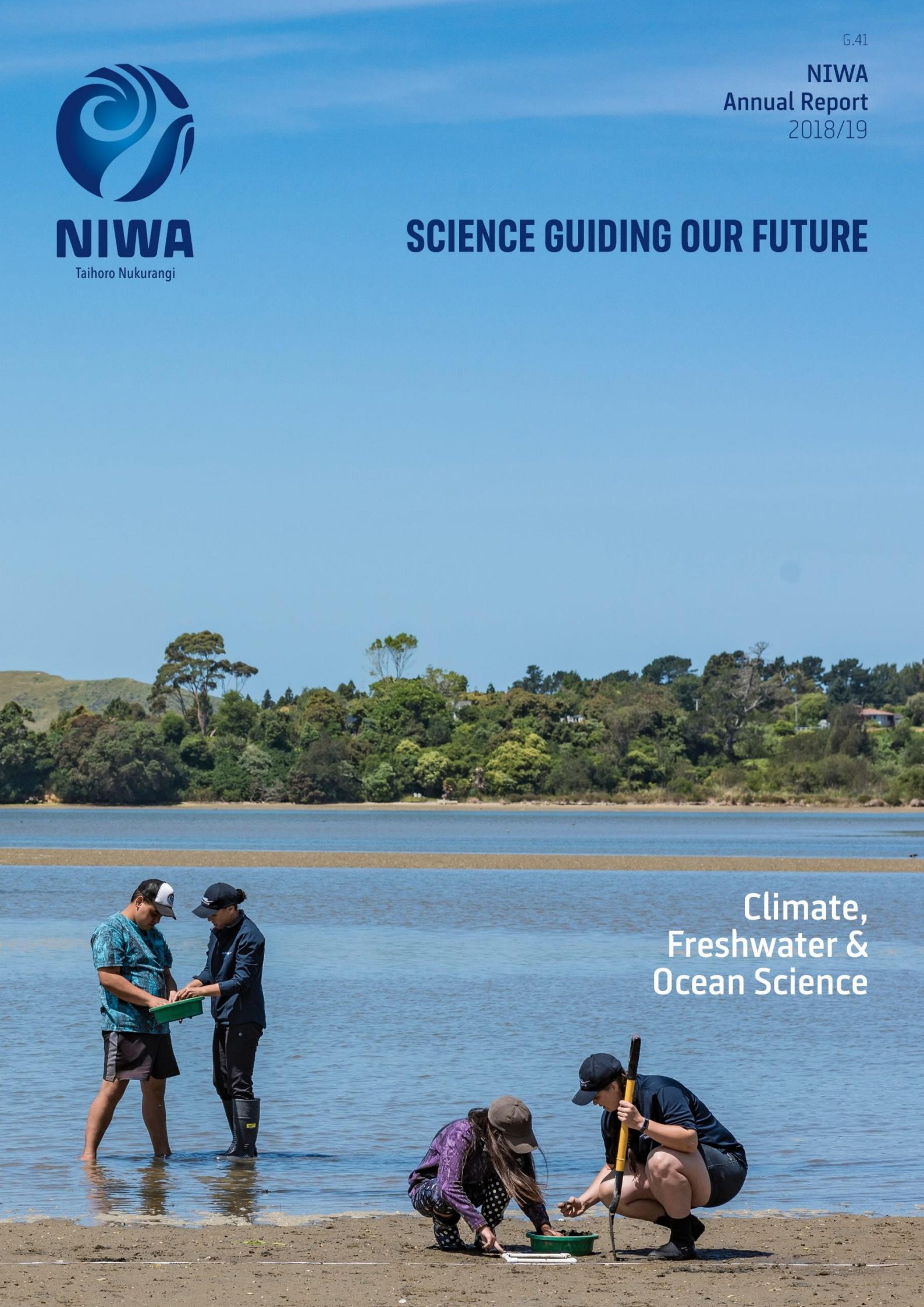
NIWA
Annual Report
2018/19

NIWA
Taihoro Nukurangi

SCIENCE GUIDING OUR FUTURE



Climate, Freshwater & Ocean Science

Taihoro Nukurangi

NIWA's Māori name Taihoro Nukurangi describes our work as studying the waterways and the interface between the Earth and the Sky. Taihoro is the flow and movement of water (from tai 'coast, tide' and horo which means 'fast moving'). Nukurangi is the interface between the sea and the sky (i.e., the atmosphere). Together, we have taken it to mean 'where the waters meet the sky'.

Cover

Understanding the environmental change taking place and the rate at which it's occurring is fundamental in managing estuarine environments.
Te Kūwaha team members utilising Ngā Waihotanga Iho – The Estuary Monitoring Toolkit.
(*Dave Allen*)

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SCIENCE GUIDING OUR FUTURE

Climate,
Freshwater &
Ocean Science

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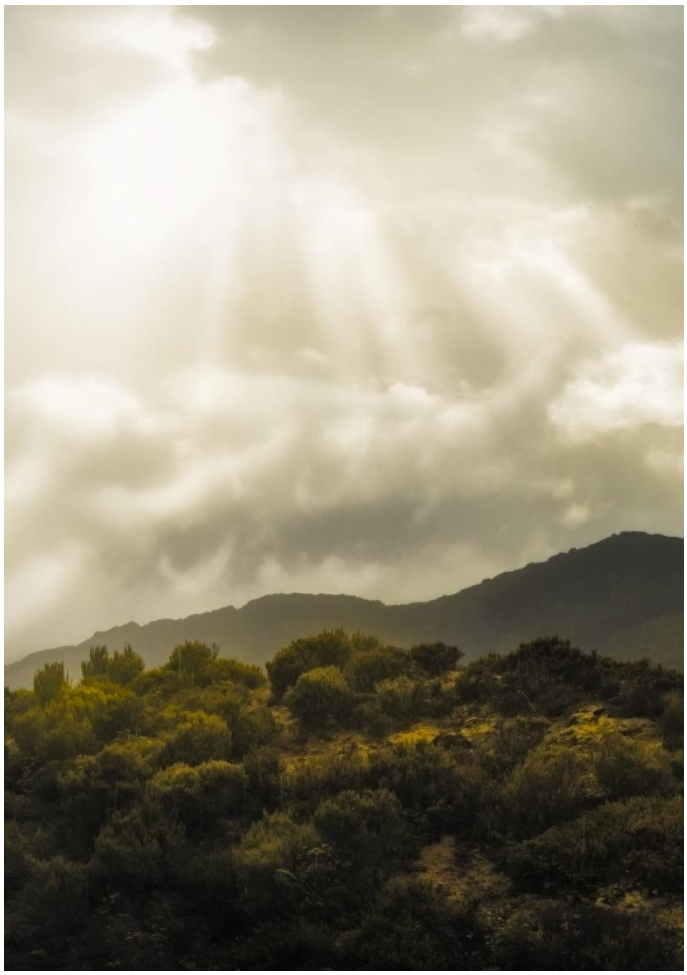


Top
A battle between the sun and a northwesterly storm over the Southern Alps. Winner of the Our Places category in the 2019 NIWA Photography Awards.
[Shannan Crow]

Right
NIWA forecasters provided continuous, highly detailed forecasts to FENZ during the Pigeon Valley fires, near Nelson in February 2019. *[Ned Dawson]*

SCIENCE GUIDING OUR FUTURE

When the first sparks flickered into life at Pigeon Valley near Nelson on 5 February, it hadn't rained for more than 40 days. The rapidly drying conditions in the Tasman region meant NIWA's forecasting team were already keeping a close eye on the area, so when Fire and Emergency New Zealand rang needing help fast, the team was ready.

Over the ensuing weeks as firefighters battled to control the blazes, NIWA forecasters were alongside the incident management team providing highly detailed forecasts, predicting wind changes hillside by hillside – and getting it right.

The devastating Nelson fires are just one example of how NIWA continues to provide high quality science, leadership and expertise where it matters most.

In the past 12 months the need for excellent environmental science has risen in public prominence, nationally and globally, to a level that is now unprecedented. Around the world this has largely been driven by ongoing extreme weather events and concern for the future of our oceans, but, at home, improving the quality of our rivers and streams has also gained momentum.

Under the spotlight of this public focus, NIWA has again had a successful and productive year. As the pre-eminent provider of climate, freshwater and ocean science, we have advised, responded, discovered and communicated vital information to equip New Zealanders for future environmental challenges.

This ability comes with the expectation that we foster strong international collaborations, work closely with other institutions within New Zealand and build on our diverse and inclusive workplace.

In our 2018/19 Statement of Corporate Intent, we acknowledged that the biggest challenge for NIWA lies in the rapid advance in digital technologies that are increasingly altering the way science is done and what is possible. We have addressed the need to accelerate building our digital capabilities and integrating that effectively with our science. This strategy will help provide an operating environment of expanding opportunities.

This year, as part of our response to a growing public focus on the impacts of climate change in New Zealand, we invited our stakeholders to Te Papa in Wellington for a national climate conversation we called *Climate Matters*.

The focus of this day-long event was to enable community, sector and government decision makers to engage with NIWA about the research, tools and information they needed to respond to the climate challenge. The results showed an overwhelming affirmation of NIWA's climate change research as well as revealing new opportunities as New Zealand looks to mitigate and adapt to a changing climate in the coming years. The development of NIWA's science strategy will see a greater emphasis on accommodating learnings from this successful engagement.

Just ahead of *Climate Matters*, NIWA hosted a conference to celebrate the first five years of the *Unified Model Partnership* – a collaborative effort that resulted in one of the world's most successful forecasting and climate prediction systems that draws on a wide range of science and high-performance computing capacity.

This partnership, in which NIWA is a foundation member and key player, demonstrates the power of international collaboration and has proved invaluable in forecasting tropical cyclones, floods, sea-level storm surges and fire risks across the world.

NIWA hosted many other national and international meetings of scientists over the year, building on important partnerships and setting the agenda for future projects.

In early January NIWA's flagship research vessel *Tangaroa* left Wellington for a six-week voyage to Antarctica, sailing as far south as 76° 30'S – just 30km short of its southernmost voyage.

Working among ice floes, strong winds and heavy swells, the 21 New Zealand and international scientists and 19-strong crew faced an imposing research schedule setting up long-term monitoring programmes for the Ross Sea Marine Protected Area (MPA).

Data collected on the voyage included whale, fish and plankton abundance; seabed samples; and oceanographic and atmospheric conditions. It will help establish the crucial baselines needed to assess the MPA's future impact.

Meanwhile, our workload continues to be high, necessitating the addition of 27 new positions during the year, taking our total staff to 697. During the year we maintained our focus on increasing staff understanding and awareness of the value and importance of diversity in the workplace, and we remain committed to continuing to promote inclusive work practices.

Revenue at $161.3 million for the year was equal to budget and materially better than the previous year. Earnings before interest, tax, depreciation and amortisation (EBITDA) was $27.4 million, and net profit after tax was $6.2 million – a pleasing financial result.

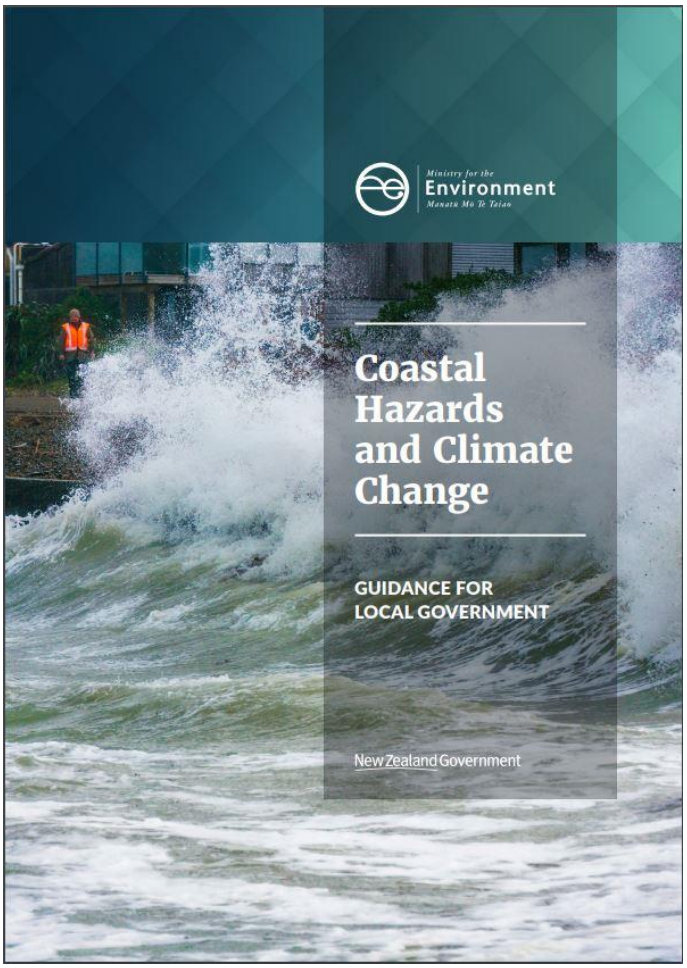
Science highlights

Climate, freshwater & ocean science

Overall, we achieved 50 of the 51 research and applied science Key Performance Indicators (KPI) we set for the year. The one KPI not fully achieved relates to a shift in approach in the development of a start-up 600 tonne per annum land-based recirculating aquaculture system (RAS) which we comment on below.

Climate science

The appointment during the year of Dr Andrew Tait as NIWA's Chief Scientist for Climate, Atmosphere and Hazards coincided with one of the most demanding years for our 230 strong climate science team.



Regular air sampling in Fiordland and the installation of the first flux tower in Central Otago to measure CO_2 were among the initial steps for the *CarbonWatch* programme, which aims to build the world's first complete national-scale picture of a country's carbon balance based on greenhouse gases in the atmosphere. This is an ambitious programme that is likely to inform policymakers working towards New Zealand's goal of being carbon neutral by 2050.

The project, which will give a bird's eye view of our carbon emissions and uptake, brings together researchers from Crown Research Institutes, universities, and inventory reporting agencies, including the Ministry for the Environment (MfE), the Ministry for Primary Industries, the Department of Conservation (DOC) and Māori groups engaged in forestry and land management. It is also being watched around the world as it may well provide a template for others to follow.

Overall, we achieved 50 of the 51 research and applied science Key Performance Indicators (KPI) we set for the year.

Top Left
Climate scientist Petra Pearce addressing the audience of 140 stakeholders at NIWA's *Climate Matters* conference, Te Papa, June 2019.
[Hamish McCormick]

Bottom Left
This year marked the thirteenth voyage of *Tangaroa* to Antarctica.
[Dave Allen]

Top Right
The Coastal Hazards and Climate Change guidance released by MfE, updated by a NIWA co-ordinated team.
[MfE]

Bottom Right
Emirates Team New Zealand launched their first AC75 boat in the America's Cup Village in Auckland, September 2019.
[ETNZ]

NIWA followed up its sizable contribution to the Coastal Hazards and Climate Change guidance for local government released by MfE by leading a roadshow and series of workshops at 13 locations around New Zealand. The guidance outlined a new planning approach to climate change adaptation, based on a 10-step decision cycle underpinned by community, iwi and stakeholder input. About 1000 people attended the workshops and seminars.

One of NIWA's largest citizen science projects was launched in October, seeking volunteers to key in information from handwritten weather logbooks in a computer database. These historic records are used to help understand future climate changes, but they require a massive digitising effort before they can be fed into models.

In other climate change science, the annual snowline survey was completed in March with a team of NIWA and Victoria University scientists capturing thousands of photographs, including thermal images. The findings indicate significant impacts from the 2018 marine heatwave and warm conditions over the summer of 2018/19. We estimate that at least 780 small glaciers have been lost due to our changing climate since 1978.

NIWA has also joined the 36th America's Cup campaign after being chosen to provide forecasting services to Emirates Team New Zealand for the 2021 event.

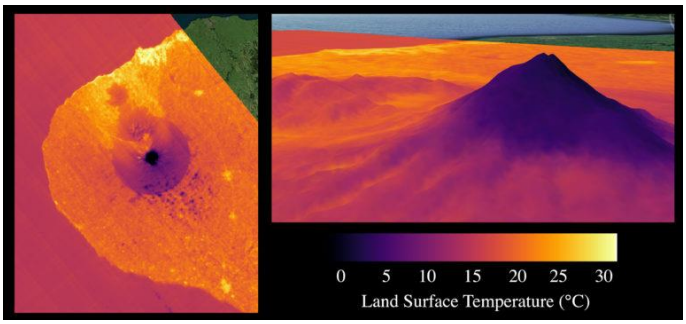
Freshwater science

Concerns about the quality of New Zealand's freshwater environment have continued to feature prominently in media headlines and been a focus for government reform.

NIWA's 240-strong freshwater science team has continued to work with policy and decision makers contributing our technical and scientific expertise, and we have also worked on practical benefits to help protect and enhance our waterways.

A *Best Management Practice for Aquatic Weeds* has been developed, which fits strategically within biosecurity and freshwater priority areas of regional council research and development. Of the more than 70 aquatic plant species naturalised in New Zealand, more than 75% have become problem weeds or are on their way to becoming problems. In 2010 the nationwide cost of managing aquatic weeds was estimated at $27 million annually. It is anticipated that the best management guidelines will result in greater legal compliance and economic benefits.

NIWA scientists have provided models and technical guidance to help regional councils set limits to control periphyton, sediment and nutrients in rivers.



NIWA also became a partner in a programme led by NASA and the New Zealand Centre for Space Science Technology, involving the International Space Station. Called ECOSTRESS, it is a scientific mission that captures temperature measurements of the Earth's surface. NIWA, along with other CRIs and the University of Waikato, provides ground measurements to validate those made in space as well as advancing scientific understanding of how plants use water.

Huge advancement has also been made with the completion and release to local government stakeholders of a prototype nationwide river flow forecasting system.

New Zealand river flow forecasts are produced with a complex model run on NIWA's High Performance Computing system. The model provides hourly forecasts, with 48 hours' lead time, for approximately 60,000 rivers across the country. The project aims to improve public safety and support and strengthen extreme weather predictions and response planning.

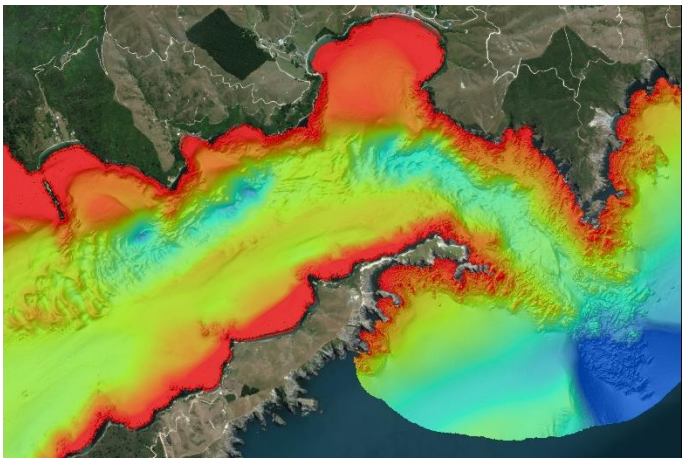
And we're also looking after our native fish – tagging tuna (eels) to learn more about their life cycle, looking at ways to encourage lamprey spawning and working with DOC to develop the New Zealand Fish Passage Guidelines to improve conditions for fish passage throughout our waterways.

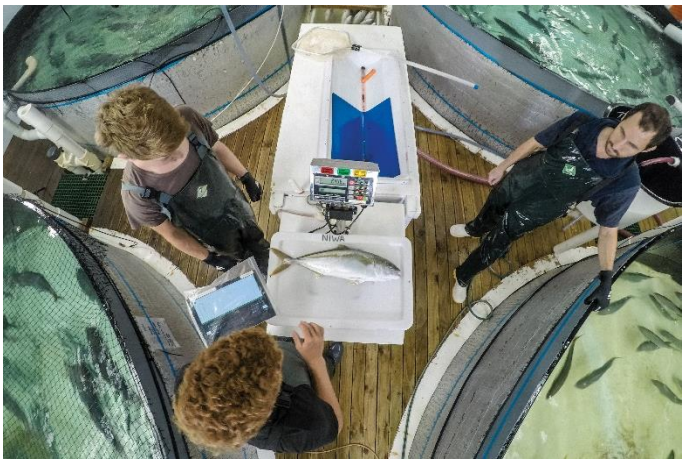
Ocean science

In August 2018 the findings of the most complex underwater coastal survey of the seafloor undertaken in New Zealand were presented to the Marlborough community.

This marked the culmination of an extraordinary project undertaken by NIWA in collaboration with Discovery Marine Ltd, Land Information New Zealand and Marlborough District Council. The project used the latest multibeam echosounder, satellite and camera technology to map the seafloor of the Queen Charlotte Sounds and Tory Channel.

New habitat charts were created, giving the Marlborough community the most detailed picture of the physical and biological features under the sea.





Top Left
ECOSTRESS captures land surface temperature images of areas like Mt Taranaki (pictured), from the International Space Station.
[CSST/NASA]

Middle
Commercial-scale hatchery production technology for kingfish has been developed at NIWA's Northland Marine Research Centre at Bream Bay.
[Stuart Mackay]

Top
Survey image shows the entrance to the Tory Channel, revealing seabed ridges and scars in unprecedented detail; scoured out by the strong currents surging in and out from Cook Strait.
[NIWA]

Bottom
Cabling work carried out on a Stevenson Screen in Vanuatu; a standardised housing for instruments to measure air temperature, humidity and atmospheric pressure.
[Dave Allen]

Since that work was carried out, NIWA has also videoed parts of Queen Charlotte Sound, Tory Channel and Cook Strait. Data programming, Structure in Motion and GIS software were then used to stitch together sequences of camera images from the video footage, creating 3D mosaics showing the shape, height and complexity of the seafloor and what's living there. This is an exciting new tool for marine scientists working with management agencies.

Meanwhile, NIWA took a lead role in an international meeting of experts in ocean acidification in Dunedin in February. The Commonwealth Ocean Acidification Action Group Workshop was held as part of New Zealand's commitment to solve ocean-related problems, and our globally-leading science in this field was showcased to a wide range of policy and science officials.

We have also developed a prototype web-based system to deliver satellite observations of water quality in our coastal zone to regional councils and other users.

Our research vessels continue to be in demand for fisheries research, conducting fish abundance surveys to underpin stock assessments and projections of future yields for a range of species. This has included re-establishing an inshore survey for snapper and associated species off the west coast of the North Island. We have also explored developing approaches to assess the status of low-information fish stocks.

NIWA also collaborated with other New Zealand researchers to develop a spatial risk assessment of threats to Hector's and Maui dolphins, used by DOC and Fisheries New Zealand as part of their Threat Management Plan for the species.

At our Northland Marine Research Centre at Bream Bay, we have made substantial progress working with Northland Regional Council and the Provincial Growth Fund on the development of a start-up 600 tonne per annum facility to determine the economic and technical feasibility of on-growing kingfish to market size at scale in a land-based recirculating aquaculture system (RAS).

RAS technology is a relatively new concept that removes a significant barrier to aquaculture growth in New Zealand – the environmental impacts (real or perceived) of sea-cage aquaculture, and the subsequent difficulties in obtaining the regulatory and social licenses to operate in coastal waters.

This project is viewed as a catalyst for other opportunities across Northland and other regions. The expertise built up in RAS technology and the demonstration of its feasibility in this project, when combined with NIWA's current finfish aquaculture research and development, will unlock significant economic growth opportunities for New Zealand. It will also pave the way for RAS facilities to be used for other finfish species such as hāpuku and salmon.

Technology and Innovation

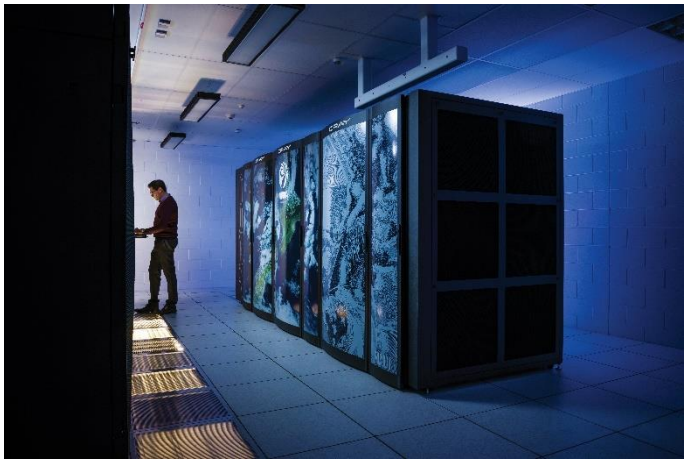
We made significant progress in the development of NIWA's Technology and Innovation portfolio to increase our focus on leveraging the extensive and sophisticated technology we employ, and the innovation we are constantly seeking.

During the year we reformed part of NIWA's structure and developed a new technology and innovation senior leadership team (including creating a new position of Chief Scientist – High Performance Computing and Data Science), and we initiated a NIWA Technology and Innovation Strategy to guide our future investment and skill development.

A strong initial focus has been the creation of technology hubs on NIWA's intranet to stimulate the development and uptake of innovative new technologies across all our science platforms.

These hubs will focus efforts on each major step of our science development and delivery pipeline: data/sample capture and transmission, sample analyses, data quality assurance and storage, modelling and forecasting, and information delivery.

We have also been working on a digital development programme for staff to enhance the rate of digital transformation within NIWA. Early achievements include in-depth workshops on: remote sensing (including satellites, drones and underwater vehicles); geospatial data analysis and modelling using NIWA's own world-leading capability blended with the latest international platforms; and big data analysis and artificial intelligence run by a team brought in from the US-based Cray supercomputing company.



Top
NIWA is one of five core members of the Unified Model Partnership, working together in developing world-leading weather and climate forecasting technology.
[Dave Allen]

Bottom
The High Performance Computing Facility (HPCF) is made up of three supercomputers named Māui, Mahuika and Kupe.
[Dave Allen]

NIWA is one of five core members of the Unified Model Partnership, working together in developing world-leading weather and climate forecasting technology.

Te Kūwaha works at the interface between mātauranga Māori, policy and freshwater, marine and climate science.

Partnering with Māori

NIWA's Te Kūwaha National Science Centre has continued to strengthen strategic partnerships with hapū and iwi, culminating in the signing of a refreshed memorandum of understanding with Tūwharetoa Maori Trust Board, and Wakatū Incorporation during the year. This is a continuous process with all our iwi partners.

Te Kūwaha works at the interface between mātauranga Māori, policy and freshwater, marine and climate science. Within NIWA, it plays a key role in strengthening Vision Mātauranga (VM) capability and has supported staff in brokering relationships with iwi and hapū partners for a range of NIWA projects, including lake mapping, stream health monitoring and assessment and biodiversity surveys. This also includes developing new models and frameworks for incorporating VM-led Māori research priorities into NIWA science planning.

NIWA has been successful in winning funding for all five of its VM Capability Fund proposals from the Ministry for Business, Innovation & Employment for two years running. This result is a credit to our Māori partnerships which are essential to co-development. NIWA is fully committed to connecting with whānau, hapū and iwi to co-design new research agendas, as well as bringing knowledge systems together to inform their unique responsibilities as kaitiaki and managers of natural resources, and developing the science capability and capacity of whānau, hapū and iwi, for the benefit of Aotearoa New Zealand.

Te Kūwaha has also been successful in developing NIWA's bicultural organisational capability. Three new Pou Ārahi roles have been established for this purpose, offering te reo and tikanga training, and providing cultural advice and support to our staff for many activities and events.

This commitment was also reflected in the appointment of Marino Tahi to the NIWA executive, in the role of General Manager, Māori Strategy and Partnerships.

Partnering in the Pacific

Every year NIWA attends and contributes technical expertise to a wide number of meetings in the Pacific region to maintain relationships and help implement work programmes. This year we have continued our commitment to building the resilience of Pacific Islanders to natural disasters and adapting to climate change, and to build capacity within our Pacific Island partners.

In the past year our staff developed new coastal forecasting services using NIWA's high resolution, numerical weather modelling.

A high-resolution wave forecast model is now providing operational information over the Tongan Exclusive Economic Zone to help the Tonga Meteorological Service provide improved marine forecast information for their inter-island shipping and ferry services, the fishing sector and other marine users.

Projects have also been completed on the spatial impacts of bottom trawl fisheries in the South Pacific, and there are ongoing projects modelling the spatial population of tuna, the management of deepwater snapper fisheries in Tonga and catch estimation methods for inshore fisheries in Fiji.

We have also continued to integrate *RiskScape*, a risk assessment tool developed by NIWA and GNS Science, into decision-making processes in Vanuatu, Samoa, Marshall Islands and Tuvalu.

Fostering collaborations and partnerships

One of the key ingredients for successful science is working with others, combining skills and resources to better understand a problem and develop an innovative solution. The vast majority of projects NIWA scientists work on involve collaboration with colleagues from other institutions in New Zealand and around the globe.

Some of these collaborations are informal – a sharing of expertise in the same field – and sometimes they involve formal agreements such as the Antarctic Platform modelling hub, the Unified Model Partnership and the New Zealand eScience Infrastructure (NeSI) which provides researchers with expertise and capability in computational and data intensive research.

And some of the most rewarding partnerships are built on mutual goodwill and understanding, such as NIWA's iwi links with Tūwharetoa and Ngāti Porou.

We continue to foster partnerships wherever possible and understand that a success shared is beneficial to everyone.

Safety first

NIWA staff face a multitude of challenges working in often demanding environments, and safety is of paramount importance. We continue to strengthen our efforts in this area and constantly review our safety practices through the application of *NIWAsafe*, our health and safety management system.

We have retained our tertiary level achievement for the Accident Compensation Corporation Accredited Employers Programme for the 12th consecutive period. NIWA's critical risks and their management were reviewed for relevance and effectiveness, and have been confirmed as appropriately identified and managed.

We also built on last year's initiative of providing seasonal safety communications to staff with an emphasis on behaviours and attitudes, both on-site and during field work.

A significant achievement this year was the successful trial of the new trip planner system, an online safety service replacing paper-based processes, for registering field worker intentions and triggering alerts if our people returning from field trips are overdue.

Tomorrow's scientists today

NIWA continues to invest substantially in future scientists and technicians by supporting students of all ages. At secondary school level we sponsor seven main city science and technology fairs and eight regional fairs which attract thousands of entries every year. Judges this year noticed a marked increase in the number of entries with an environmental theme which they believe reflects a growing interest in the quality of the students' future world.

Many of the science fair judges comprise NIWA staff who provide an insight into the range of science careers open to students and what it is like to work for an organisation committed to science as a solution provider.

We are the principal science partner with BLAKE, the former Sir Peter Blake Trust, and sponsor the Environment category of the prestigious BLAKE Awards. Our Blake Ambassador Programme continues to sponsor up to six outstanding young New Zealanders who work alongside our researchers as part of the programme.

The annual Sir Paul Callaghan Eureka Awards, open to secondary and tertiary students, also include a NIWA scholarship, awarded to the student who delivers the best presentation related to climate, freshwater or ocean science.

Top
Safety is a core component in the operation of our vessels; our professional crew meet the most stringent health and safety standards. *[Monique Ladds]*

Middle
BLAKE ambassadors provided a youthful perspective on our climate challenges at NIWA's *Climate Matters* conference, June 2019 *[Hamish McCormick]*

Bottom
The newly built Rotorua facility is furthering NIWA's capability to efficiently and effectively service customers in the central North Island. *[Julie Proud]*

This year NIWA staff supervised about 80 PhD and MSc or Hons students from universities around the country. In addition, we offered valuable work experience to more than 50 students from New Zealand and overseas universities, and we offer paid summer internships each year.

The NIWA/University of Auckland Joint Graduate School in Coastal and Marine Science and the NIWA/University of Waikato Joint Institute for Freshwater Management both aim to nurture high-achieving young scientists by giving them access to our world-class scientists and facilities and by equipping them with the highest levels of scientific discipline to carry forward into their careers.

Building the future

In a year in which the public focus on environmental science has grown markedly, it was extremely heartening for NIWA to be named as one of the top 10 most trusted public organisations in a Colmar Brunton survey. It is the first time we have been selected for this benchmarking which also included being rated in the top 5 in two categories: social responsibility and leadership.

The survey ranking is a credit to all NIWA staff. Colmar Brunton classified NIWA's reputation as "superior" – the highest category. We are proud of this result, which shows New Zealanders value the science NIWA undertakes and the role it plays in their world.

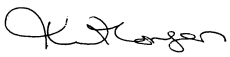
We look forward to future challenges, both in the science we undertake and within our organisation. We opened a new office in Rotorua this year, are substantially developing our Northland Marine Research Centre, and our planning for a multi-site building redevelopment programme to better equip NIWA for the future is now well advanced. The 5-year programme will result in our Wellington, Christchurch and Hamilton sites being redeveloped with contemporary facilities that have the flexibility required to meet the needs of a new generation of researchers and the science they will provide.

The preliminary designs have been completed, with the new working environments consistent across each site, and work has commenced on more detailed designs. The capital cost of the programme is projected at $170 million and building work is expected to begin early in 2021.

The need for this investment has been firmly underlined this year, and we are progressing with the confidence of an organisation with sound fiscal management and people who have the knowledge, experience and vision to build on our long track record of delivering scientific solutions to many of the most urgent challenges facing the planet.

Finally, we would like to thank the NIWA Board and the Executive Team for their support through this year and acknowledge the work of several retiring senior scientists whose contributions to NIWA's success have been extraordinary.

Barry Harris
Chairman



John Morgan
Chief Executive

OVERVIEW OF GROUP FINANCIAL PERFORMANCE

For the year ended 30 June 2019

NIWA Group Financial Summary

in thousands of New Zealand dollars	2019	2018	2017	2016	2015
Revenue and other gains	161,292	151,416	142,618	130,309	126,190
– Research	94,901	91,516	81,417	68,896	64,075
– Commercial science	66,390	59,899	61,200	61,412	62,115
– Other income	1	1	1	1	–
Profit before income tax	8,708	9,074	5,950	5,492	8,005
Profit for the year	6,247	6,472	4,250	4,011	5,755
Capital expenditure	21,460	33,573	13,053	12,592	15,652
Adjusted return on average equity (%)	6.2	6.9	4.8	4.7	7.0
Return on average equity (%)	5.1	5.5	3.8	3.7	5.5

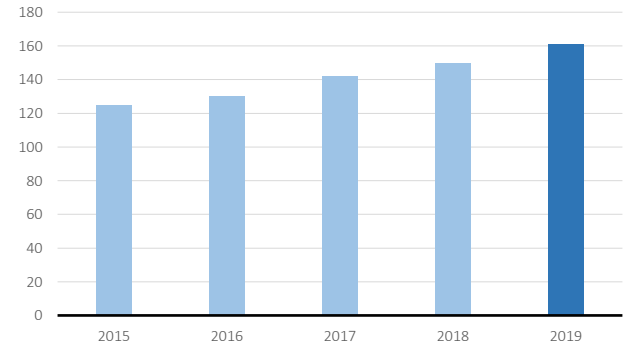
The 'adjusted return on average equity' uses a valuation basis comparable to that used by other Crown Research Institutes. This valuation basis arose from the transition to New Zealand Equivalents to International Financial Reporting Standards in 2006/07 and reverses the effect of the revaluation of certain land and buildings.

Group actual performance versus Statement of Corporate Intent (SCI)

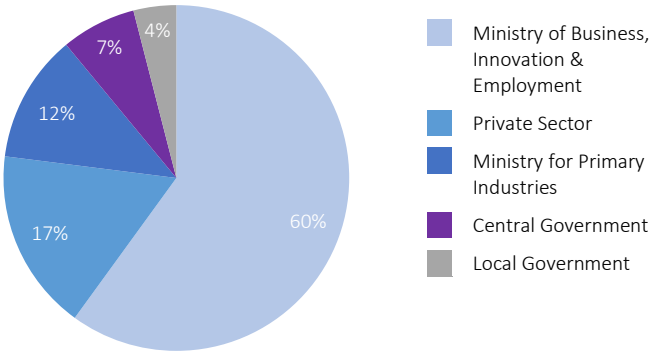
in thousands of New Zealand dollars	2019 Actual	2019 SCI	2018 Actual
Revenue and other gains	161,292	161,293	151,416
Operating expenses, depreciation, and amortisation	153,208	153,548	143,232
Profit before income tax	8,708	8,552	9,074
Profit for the year	6,247	6,157	6,472
Average total assets	167,855	163,820	160,388
Average shareholders' funds	123,169	122,760	116,826
Profitability			
Operating profit margin (%) (EBITDAF/revenue)	17.0	16.7	15.6
Adjusted return on average equity after tax (%) (net surplus/adjusted average equity)	6.2	6.2	6.9
Return on average equity after tax (%) (net surplus/average equity)	5.1	5.0	5.5
Return on assets (%) (EBIT/average total assets)	4.8	4.7	5.1
Profit volatility (%) (non-adjusted ROE)	12.7	6.2	7.2
Forecasting risk (%)	1.0	1.5	1.2
Liquidity and efficiency			
Current ratio	1.4	1.7	1.3
Quick ratio	2.2	2.1	1.9
Financial leverage			
Debt to average equity (%)	–	–	–
Gearing (%)	–	–	–
Proprietorship (%) (average shareholders' funds/total assets)	72	75	71

This year we continued to focus on building revenue and capability and establishing a strong platform for future growth.

Total revenue
($ in millions)



Revenue by source



Overview of group financial performance

Revenue

NIWA achieved revenue of $161.3 million in 2018/19, equal to budget and representing an increase of $9.9 million over the previous year.

The level of MBIE contestable research funding earned by NIWA increased by $4.4 million over the prior year. In addition, NIWA succeeded in securing an additional $2.5 million in applied science work carried out on behalf of the Ministry of Primary Industries (including voyages undertaken by RV *Tangaroa*).

NIWA's performance in securing commercial research vessel charters also continued the prior year trend with a $3.4 million year-on-year increase in revenue.

2018/19 saw a year-on-year decline of $1.5 million in the amount of commercial revenue contracts with central and local government secured by NIWA. However, this was more than offset by a $2.3 million increase in other revenue won on a commercial basis. This gives the organisation a level of confidence that sustainable increases in commercial revenue can be achieved.

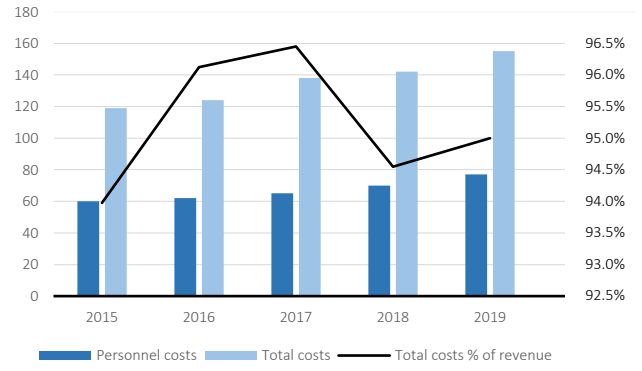
The share of NIWA's revenue arising from transactions with its key central government clients of the Ministry of Business, Innovation and Employment, and the Ministry of Primary Industries, was 72%, equal to the position in 2017/18.

Expenditure

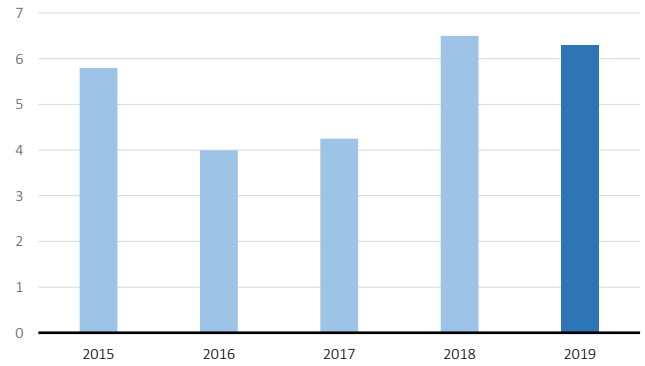
Operating expenses (including depreciation and amortisation) were approximately equal to budget while increasing by $10.0 million compared with the previous year.

Depreciation accounted for $3.8 million of the increase, due to the full-year operation of the new High Performance Computing Facility as well as adjustments to the estimated remaining useful lives of NIWA's buildings in Wellington, Hamilton and Christchurch. A further $3.5 million of the increase in operating expenses was accounted for by personnel costs, driven by salary increases and further growth in capacity. The balance of the increase was accounted for by higher direct costs associated with the increased revenue.

Expenditure
($ in millions)



Net profit after tax
($ in millions)

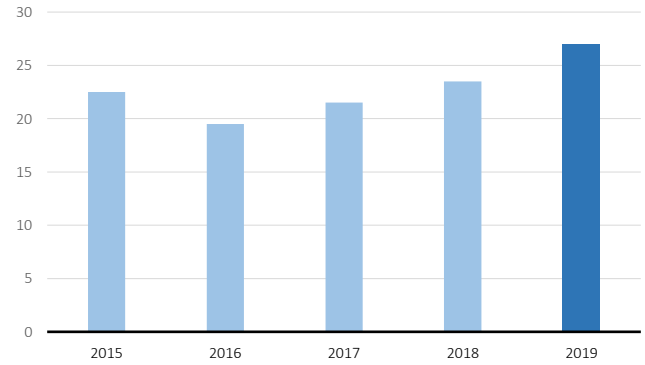


Profitability

NIWA delivered a profit before tax of $8.71 million and after tax of $6.25 million during 2018/19. With similar levels of growth in revenue and expenses over the previous year, these profit results reflected only a modest change compared with the previous year, with a decline of $0.37 million and $0.23 million respectively. Compared with budget the result was little changed, with improvements of $0.16 million before tax and $0.09 million after tax.

NIWA also closely monitors its Earnings before Interest, Tax, Depreciation and Amortisation (EBITDA), as this measure assists in understanding the Company's capacity to fund future investments and carry debt. Performance against this measure increased by $3.7 million compared with the previous year, to $27.4 million. This bodes well for NIWA's ability to finance its planned investments in upgrading its major facilities over the coming several years.

EBITDA
($ in millions)



NIWA's fundamental financial performance metric is adjusted return on equity, which enables comparison between CRIs on an equivalent basis. The Company delivered an adjusted ROE of 6.2% this year, which met the budget objective while being slightly lower than the 6.9% achieved in the previous year.

Capital management and cash

Cash flows

The following table summarises NIWA's cash flows this year and last year:

($ in millions)	2019	2018	Change
Net cash flows from operating activities	22.309	22.694	(0.385)
Net cash flows from investing activities	(25.837)	(13.296)	(12.541)
Net cash flows from financing activities	0.0	0.0	0.0
Net increase/(decrease) in cash	**(3.528)**	**9.398**	**(12.926)**

The above presentation is consistent with New Zealand Equivalents to International Financial Reporting Standards and therefore treats cash flows relating to short term deposits with maturities greater than three months as investing activities. In order to illustrate how the Company considers cash flows, the table below restates the summary of cash flows, treating all short-term investments as equivalent to cash:

($ in millions)	2019	2018	Change
Net cash flows from operating activities	22.309	22.694	(0.385)
Net cash flows from investing activities	(20.837)	(33.296)	12.459
Net cash flows from financing activities	0.0	0.0	0.0
Net increase/(decrease) in cash including other term deposits	**1.472**	**(10.602)**	**12.074**

Net cash flows from operating activities

Net cash inflows from operating activities decreased by $0.4 million to $22.3 million in 2019. This minor year-on-year change reflected the increased revenue and cash receipts being offset by additional costs and tax expense.

Net cash flows from investing activities (excluding term deposits)

Net cash outflows from investing activities (excluding the impact of cash flows associated with term deposits with maturities in excess of three months) decreased by $12.5 million to $20.8 million. This year-on-year variance was due to the purchase of a replacement High Performance Computing Facility in 2018.

Net cash flows from financing activities

Net cash outflows from financing activities remained at zero due to the Company paying no dividend during the year. This was signalled in the previous year's Statement of Corporate Intent, and reflects upcoming essential and material investments designed to ensure that its science facilities remain fit for purpose for the coming decades.

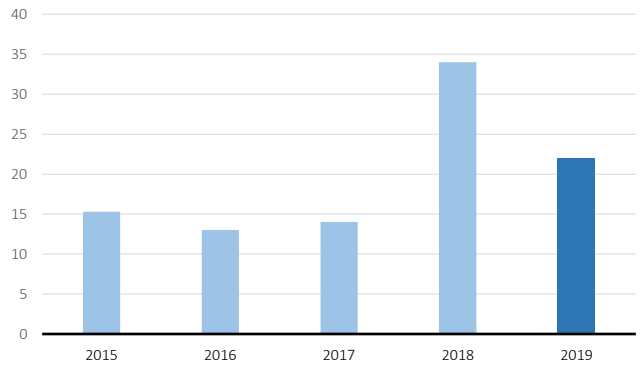
Capital spending

The following table summarises NIWA's capital expenditure this year and last year:

($ in millions)	2019	2018	Change
Land, buildings & improvements	7.769	4.523	3.246
Equipment	7.829	8.342	(0.513)
ICT equipment	2.436	18.593	(16.157)
Vessel equipment	1.853	0.801	1.052
Other	1.573	1.314	0.259
Total capital spending	**21.460**	**33.573**	**(12.113)**

Total capital expenditure was $21.5 million during the year, down from $33.6 million the prior year.

Capital expenditure
($ in millions)



Capital structure and liquidity

Shareholders' equity at 30 June 2019 was $126.3 million (2018: $120.1 million) which was broadly equal to the level forecast in the SCI budget. Total assets at year-end were $170.9 million (2018: $164.8 million). As at 30 June 2019, the Company's net debt balance was zero, equal to that at the prior year-end.

NIWA's liquidity is mainly provided by operating cash flows. In addition, the Company has access to financing facilities of $10.5 million provided by its bank, although this facility was not required to be called upon during the year.

Dividends

As foreshadowed in the Company's Statement of Corporate Intent, the Directors of NIWA have once again decided not to declare a dividend in respect of the 2019 year. This is in the light of a series of significant capital investments which will be required to maintain and build the Company's capability and financial sustainability for the future. These investments include renovating or replacing the physical infrastructure and facilities at three of the Company's main sites, and continued development at the Northland Marine Research Centre at Bream Bay.

PERFORMANCE TARGETS 2018/19

NIWA will measure its performance against the outcomes and operating principles in its Statement of Core Purpose using the following set of indicators.

Financial Indicators

Measure	Calculation	Reporting frequency	Target 2018/19	Actual 2018/19
Operating margin	Earnings Before Interest, Tax, Depreciation, Amortisation and Fair-value (EBITDAF)/Revenue	Annual	16.7%	17.0%
Profit per FTE	EBITDAF/FTEs	Annual	$40,000	$41,000
Quick ratio	Current assets less inventory less prepayments/ Current liabilities less revenue received in advance	Quarterly	2.06	2.2
Interest coverage	EBITDAF/ Interest paid	Quarterly	Not applicable	Not applicable
Profit volatility	Standard deviation of EBITDAF for past five years/ Average EBITDAF for the past five years	Annual	6.2%	12.7%
Forecasting risk	Five-year average of return on equity less forecast return on equity	Annual	1.5%	1.0%
Adjusted return on equity	NPAT excluding fair value movements (net of tax)/Average of share capital plus retained earnings	Quarterly	6.2%	6.2%
Revenue growth	% change in revenue	Annual	7.8%	6.5%
Capital renewal	Capital expenditure/Depreciation expense plus amortisation expense	Quarterly	117.6%	111.3%

Organisational Performance Indicators – 2018/19 at a glance

Measure	Calculation	Reporting frequency	Target 2018/19	Actual 2018/19
End-user collaboration*	Revenue per FTE from commercial sources	Quarterly	$94,000	$96,700
Research collaboration*	Publications with collaborators	Quarterly	75%	93%
Technology & knowledge transfer*	Commercial reports per scientist FTE	Quarterly	1.0	1.73
Science quality*	Impact of scientific publications	Annually	2.5	3.4
Operational efficiency*	Revenue per FTE	Quarterly	$241,000	$244,400
Operational delivery	% projects delivered on time	Annually	>90%	97.8%
Strategic progress - operations	% Enabling Plan KPIs in Section 3 achieved	Annually	>90%	80%
Strategic progress - science	% Science Plan KPIs in Section 2 achieved	Annually	>90%	98%
Stakeholder engagement*	% stakeholders confident in NIWA's priority setting process	Biennial	>70%	53%
Stakeholder engagement*	% collaborators confident in NIWA's ability to take a best team approach	Biennial	>90%	78%
Stakeholder engagement*	% end users who have adopted knowledge or technology developed by NIWA	Biennial	>90%	88%

*Ministry of Business, Innovation & Employment generic indicators

NIWA IN A NUTSHELL

Core purpose

- Improving management of aquatic resources
- Adapting to our climate
- Increasing resilience to weather hazards
- Improving aquatic biosecurity
- Increasing understanding of Antarctica and the Southern Ocean

Science strategies

Climate

- Increasing understanding of the changing climate to improve adaptation to its impacts
- Increasing global understanding of the atmosphere
- Validating greenhouse gas emissions to better inform mitigation
- Improving forecasts to reduce the impact of weather and climate-related hazards
- Tailoring forecasts to weather-dependent sectors

Freshwater

- Improving understanding of freshwater quality and quantity
- Maximising the sustainable use of freshwater
- Developing ways to improve freshwater ecosystems
- Identifying threats from exotic species and developing tools to reduce them
- Improving national flood forecasting

Oceans

- Increasing understanding of the marine environment to improve management
- Maximising the sustainable use of marine resources
- Identifying threats from exotic species and developing tools to reduce them
- Maintaining the national deepwater research vessel capability
- Developing high-value finfish aquaculture species to grow the industry

Technology, Innovation & Data Services

- Developing innovative ways to collect, assure and curate data
- Developing and providing enhanced data analytic tools
- Developing value-added, data-based products and services
- Effectively delivering environmental data and information
- Maintaining the national high performance computing facility

Enabling strategies

- **Safety**
  Safety first in everything we do
- **Science excellence**
  Globally respected, objective and trusted
- **Facilities and assets**
  State-of-the-art facilities, infrastructure and systems
- **Māori engagement**
  Respected, value-adding collaborator and commercial partner of Māori enterprises
- **Agility**
  Adaptable, responsive, opportunistic and embracing change
- **IT**
  State-of-the-art infrastructure and tools to deliver efficient and value-added services
- **People and leadership**
  Best scientists, technicians and support staff – the 'employer of choice'
- **Customer focus**
  Keep promises, communicate well, deliver on time, within budget and to specification
- **Productivity**
  Most cost-effective and efficient with resources, time and service delivery
- **Communication**
  Most respected and trusted brand, with innovative messaging tailored to audiences

NIWA'S SCIENCE

NIWA's three science platforms – Climate, Freshwater & Ocean Science – align with the Strategic Science Investment Fund Platforms we are contracted by MBIE to deliver and the Statement of Core Purpose Outcomes.

CLIMATE SCIENCE

Atmosphere
Weather
Natural Hazards

② ③ ④ ⑥

FRESHWATER SCIENCE

Water Quality
Hydrology
Estuaries
Biodiversity & Biosecurity

① ② ④ ⑤

OCEAN SCIENCE

Oceanography
Fisheries
Aquaculture
Vessels
Biodiversity & Biosecurity

① ⑤ ⑥

①

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

②

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

③

Increase resilience of New Zealand and South-West Pacific islands to tsunami and weather and climate hazards, including drought, floods and sea-level change.

④

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

⑤

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

⑥

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

CLIMATE SCIENCE

New Zealand's pre-eminent provider of atmospheric and climate science

- Climate change and variability
- High-precision weather forecasting
- Weather-related hazard forecasting
- Adaptation and mitigation

230
Science staff
New Zealand's largest team of climate scientists

$42M
Annual investment
in weather and climate research

7,500
Climate stations
The National Climate Database with information from 7,500 climate stations covering New Zealand, South-West Pacific and Antarctica

$18M
Supercomputer
enabling precise, highly localised forecasts

Left
NIWA's annual aerial survey of more than 40 glaciers in the Southern Alps confirmed the overall trend of ice loss. [*Hamish McCormick*]

FRESHWATER SCIENCE

Supporting the sustainable management of our freshwater resources

Freshwater quality and quantity

Sustainable use

Biodiversity and biosecurity

Flood forecasting

240

Science staff

New Zealand's largest team of freshwater scientists

$40M

Annual investment

Increasing knowledge of water quantity and quality

66,000

A National Flood Forecasting Service

Providing river flow forecasts for 66,00 catchments nationwide

Hydrological Network

A nationwide network of water and soil moisture monitoring stations

OCEAN SCIENCE

Understanding, managing and maximising the benefits of our marine estate

- Sustainable use of marine resources
- Biodiversity and biosecurity
- High-value finfish aquaculture

260

Science staff

New Zealand's largest team of ocean scientists

$67M

Annual investment

in coast and ocean, fisheries and aquaculture science

Northland Marine Research Centre

New Zealand's leading facility for finfish aquaculture

State-of-the-art Research Vessels

Left
The Arawhata river winds its way from Mount Aspiring National Park towards Jackson Bay on the west coast of the South Island. Glacial silt suspended in the water gives the Arawhata, and many other rivers in the area, its distinctive turquoise blue colour.
[Dave Allen]

Right
NIWA's world-class deepwater research vessel, RV *Tangaroa* sailing through the Wellington heads.
[Dave Allen]

OUR PEOPLE

A commitment to scientific excellence, high calibre collaborations and a continuous focus on the needs of our customers are at the centre of how we maximise the value and impact of our science.

Innovation is an enduring focus for our people. NIWA staff regularly leverage cutting edge technology and lead in the development and application of novel scientific methods, creating new scientific knowledge of national and global importance, which helps to enhance the understanding and management of key environmental, economic and social aspects of our world.

Left

The theme of NIWA's 2018 Leaders' Forum was 'Innovation advancing science'.
[Hamish McCormick]

Top

Our annual NIWA Excellence Awards – announced during the NIWA Leaders' Forum each year – celebrate the achievements of staff who have made an extraordinary contribution.
[Hamish McCormick]

Leading in a culture of innovation

The theme of the Leaders' Forum this year was 'Innovation advancing science'. NIWA leaders gathered to review the past year's achievements, network with colleagues and stakeholders and discuss key areas of focus for the coming year. There was an emphasis on the increasing importance of digital capabilities, how the adoption of new technologies will contribute significantly to NIWA's ongoing success, and the identification of ways to further enhance and promote continuous innovation throughout the company.

Employment relations collaboration

NIWA regularly engages with employees and employee representatives regarding workplace policies and practices. Members of the Executive Team met with union delegates to share information about NIWA's remuneration system, with the aim of enhancing their understanding of remuneration processes. Remuneration information seminars for staff were run at each of NIWA's main sites, with remote participation available for other employees. These seminars were positively received by staff, and the information has been made available as an ongoing resource.

After meetings between union delegates and the Executive Team during 2017/18 to help facilitate the sharing of perspectives and enhance mutual understanding, a similar meeting was held this year with a group of non-union staff.

NIWA recognises the importance of meeting the good employer requirements under Section 118 of the Crown Entities Act 2004 and ensures that People & Capability policies and practices are consistent with the fair and proper treatment of staff in all aspects of their employment.

High quality talent acquisition and retention

During the year 27 new permanent positions were approved to meet science demand and provide important operational support for our science delivery. Several of these positions were strategic new senior appointments to provide additional business development and science programme leadership as we strengthen and expand our delivery across all our science platforms. The creation of a General Manager – Māori Strategy and Partnerships position was another key new role, to enhance NIWA's ongoing collaborations with iwi, hapū and other Māori stakeholders.

Best practice talent acquisition processes are the central focus whenever a vacancy arises. All our managers receive comprehensive recruitment and selection training, and we also deliver a shorter recruitment workshop tailored for selection panel members to ensure that they are cognisant of important recruitment practices. NIWA undertakes a thorough selection process for appointments to ensure that the position requirements are all explicitly met or exceeded. Our focus on attracting the right people for NIWA's needs means that we will re-advertise a position if necessary to ensure an appointment that meets all of the job requirements.

A focus on our employee experience

NIWA's induction process is tailored with job-specific content as well as information about pan-NIWA policies and processes. Induction experiences are evaluated via a post-entry interview to ascertain relevance, accessibility and timeliness of the information provided, with a view to identifying aspects for improvement. NIWA has identified that digital onboarding technology platforms have the potential to offer a more consistent, contemporary induction experience, while also delivering administrative efficiencies. NIWA has initiated a vendor selection process, and new onboarding technology will be implemented in the coming year.

NIWA's flexible working practices help staff create a sustainable balance between their work and non-work responsibilities and maintain their personal wellness. Some staff arrange non-standard start and finish times to accommodate their commitments, others work part time for a fixed period or on an ongoing basis. Currently 14.2% of our staff work part time.

Departing staff are asked to complete an exit interview to help NIWA to gain an understanding of their reasons for leaving and their perspective of NIWA as an employer. Exit interview information is collated into an anonymous summary which helps People & Capability identify key themes in terms of positive aspects and opportunities for improvement.

NIWA's employee retention rate remains high at just over 92% for the past year.

Promoting and supporting the development of our people

NIWA supports staff development through the annual Performance and Development Review process (which includes Individual Development Plans) and invests in regular staff training. NIWA recognises continuous learning as a key contributor to the organisation's ongoing success. Each year NIWA makes a significant investment in conference participation and other relevant professional development for staff. Last year NIWA spent almost $480,000 on professional development-related activities.

Our People & Capability team regularly reviews and enhances the in-house leadership and management development course offerings. The current in-house training suite includes workshops covering the following topics: Crucial Conversations, Recruitment & Selection, Developing Others, Challenge of Change – Resilience, Inclusiveness in Action, Preventing and Responding to Unacceptable Behaviour as well as Family Violence and Rainbow Community Awareness training. A variety of other regional seminars and workshops are also offered.

The annual workforce planning process is completed with detailed input from NIWA's Joint Management Team, and the associated workforce analysis and projections enable NIWA to align capability and capacity requirements with market demand. As part of the annual workforce planning process, future leaders are identified for retention and targeted development opportunities. Each year, succession plans are reviewed and talent acquisition and work transition plans are established for staff signaling departure.

Most staff receive three personal development leave days per year, and NIWA encourages the use of this leave to undertake broader personal development.

A continued focus on diversity and inclusion

NIWA is committed to continuing to increase staff understanding and awareness of the value and importance of diversity and inclusion at work, and to further promoting inclusive work practices. All NIWA policies, guidelines and practices continue to be based on the principles of fairness, equity and non-discrimination, and NIWA is an equal opportunities employer.

NIWA has continued to work towards achieving the Domestic Violence Free certification (DVFree) from SHINE – a specialist family violence support organisation. The DVFree certification recognises the important role that employers have in raising awareness of family violence, creating a safe working environment for staff experiencing family violence, and providing support for these staff to become safe outside of work. This year, an additional Family Violence Contact Person training workshop was held, and NIWA's new Family Violence Policy was implemented. Family Violence Awareness training for managers has been scheduled across NIWA.

Another component of NIWA's diversity and inclusion focus is participation in the Rainbow Tick accreditation programme. The Rainbow Tick is a confidence mark designed to show an organisation is a safe, welcoming and inclusive place for people of diverse sexualities and gender identities. During the past year NIWA completed an initial accreditation assessment, and an associated programme of work is underway. Rainbow Community Awareness workshops were made available to all staff and delivered across NIWA's main sites, with more planned for the coming year.

One diversity dimension is age, and NIWA recognised that many of the more senior decision makers in the organisation are in an older age demographic. To help facilitate the sharing of early career staff perspectives with senior management, People & Capability ran a series of focus groups for early career science and support staff across NIWA. These were very positively received by the attendees and provided valuable insight into the perceptions, expectations and preferences of this cohort.

As part of providing a safe workplace for all staff, NIWA has Unacceptable Behaviour Contact People across the organisation, whom staff can contact confidentially should they wish to discuss a concern. An Unacceptable Behaviour Contact Person Training refresher workshop was held during the year.

NIWA undertakes an annual review of staff demographics and People & Capability processes. One demographic aspect is gender, and an additional category of 'other gender identity' has been added to recognise that, for some people, gender is non-binary. Of NIWA's new starters last year, just over half identified as women and 2.1% identified as 'other gender identity'. The results for the 2018/19 analysis of People & Capability processes again indicated that our appointment, promotion, remuneration and recognition processes are merit-based and non-discriminatory.

An ongoing emphasis on employee wellness

Wellness seminars were again organised across NIWA's main sites, with presentations on healthy nutrition, sleep and first home purchasing using KiwiSaver. Feedback from staff continues to be very positive, and further seminars are planned for next year. The People & Capability team continue to maintain the intranet Wellness Hub with a range of physical, mental, financial and social wellness resources.

NIWA identified mental health awareness as being important for both staff and managers, and a comprehensive mental health workshop was delivered at NIWA's main sites. This workshop focused on understanding, identifying and responding to mental health issues both in and outside the workplace.

Like many organisations, we have an aging workforce, and NIWA identified an opportunity to support staff with retirement planning and transition. A holistic retirement planning workshop was selected which covered both lifestyle and financial planning aspects. This workshop was aimed at staff within 15 years of retirement and was offered across NIWA.

Recognising our talented staff

As a knowledge-based company, NIWA recognises that it is the extraordinary talent and commitment of its staff which drives the organisation forward. NIWA has a well-established commitment to recognising and rewarding staff, and NIWA's remuneration framework includes regular market benchmarking to ensure that staff are fairly remunerated. NIWA continues to apply the Living Wage as the minimum wage for any NIWA staff member, effective from April each year.

NIWA has an annual Performance and Development Review process as well as a manager-initiated relativity review process. Relativity reviews are requested by managers where an individual's overall capabilities indicate a salary review would be appropriate. In the past year there were 58 successful relativity reviews. Following a review of NIWA's remuneration framework, the relativity review process has been moved forward by five months and will now occur in conjunction with the Performance and Development Review process, for which the related salary increases are effective from 1 October each year. This will help deliver a more cohesive experience for staff, where they will be advised of both their performance rating and the outcome of a manager-initiated relativity review (if applicable) at the same time. From next year, NIWA will also publish an annual comparison of the NIWA median data against relevant external market benchmarks to give staff a more detailed perspective of their remuneration relative to the market.

Each year NIWA facilitates a comprehensive, peer-review level promotion process, and this year 25 science staff were recognised with a level promotion. These promotions reflect years of consistently high quality science contribution in their chosen field. Our senior promotions to Principal Technician or Principal Scientist reflect many years of scientific endeavour at both a national and international level. Last year six scientists were promoted to Principal Scientist and five technicians were promoted to Principal Technician.

Recognising outstanding contributions to NIWA's success

A high number of nominations were again received for consideration by NIWA's Excellence Awards panel. The selection for these highly regarded awards involves a thorough peer review, followed by an Executive Team endorsement process. The exceptional talent and commitment of our staff was again celebrated at NIWA's annual Excellence Awards ceremony with recognition of the significant achievements of winners and runners up in the 11 awards categories.

Staff photography provides exceptional insight into NIWA's day-to-day operations and the vital work we do. We regularly use photographs taken by staff to help communicate the relevance and importance of our science to the wider public and our stakeholders. We again recognised our outstanding photographers across six photo award categories as part of the Excellence Awards programme.

Fostering future science talent

NIWA recognises the importance of promoting science careers and seeking opportunities to support the next generation of science staff. NIWA's well-established sponsorship association with regional and national science fairs contributes to this and our staff are regularly involved in these events as judges.

NIWA also supports senior staff to supervise tertiary students, and about 80 PhD and MSc or Hons students from New Zealand universities received support from NIWA staff. NIWA's national and global collaborations led to NIWA hosting more than 50 students from both local and international universities to enable them to conduct research in conjunction with our experienced staff.

NIWA aims to offer Summer Internships each year to provide a paid work experience opportunity for science students, and PhD Scholarships and Postdoctoral Fellowship positions are also regularly offered. As the Principal Science Partner of BLAKE, NIWA is proud to collaborate on the provision of annual BLAKE/NIWA Ambassador opportunities as well as providing substantial additional collaboration in NIWA and BLAKE initiatives.

A continuous safety-first focus

Working safety is of paramount importance at NIWA, and we continually strengthen our safety focus. Our health and safety practices are continually reviewed through the application of NIWAsafe, our health and safety management system.

Safety fundamentals remained unchanged over the last year, including the retention of Tertiary Level achievement for the Accident Compensation Corporation Accredited Employers Programme for the twelfth consecutive period. NIWA's Critical Risks and their management were reviewed for relevance and effectiveness, and have been confirmed as appropriately identified and managed.

We built on last year's approach of providing Seasonal Safety communications with an emphasis on behaviours and attitudes, both on-site and during field work.

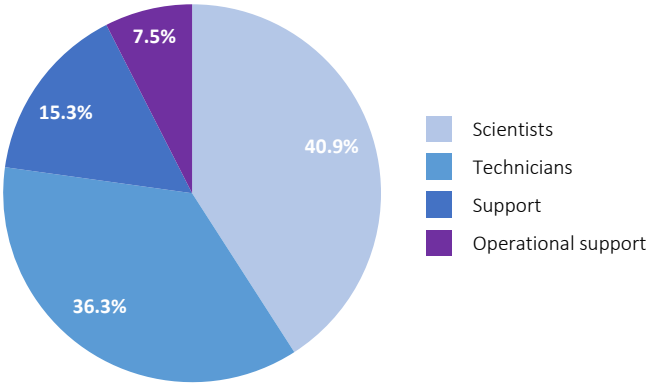
We have improved accessibility to health and safety information by refreshing the NIWAsafe intranet, with more intuitive access to NIWAsafe policy, procedures and other guidance.

We have improved automation of tools such as the NIWAsafe Incident Management System, corrective actions and more timely document reviews.

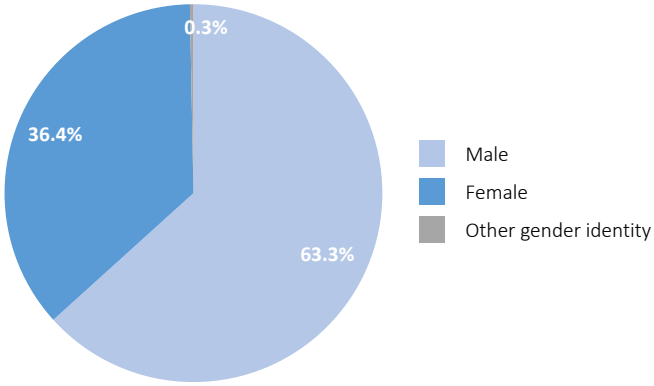
A significant achievement this year was the successful trial of a new 'Trip Planner', an online safety service replacing paper-based processes, for registering field worker intentions and triggering alerts if trips are overdue.

NIWA BY THE NUMBERS

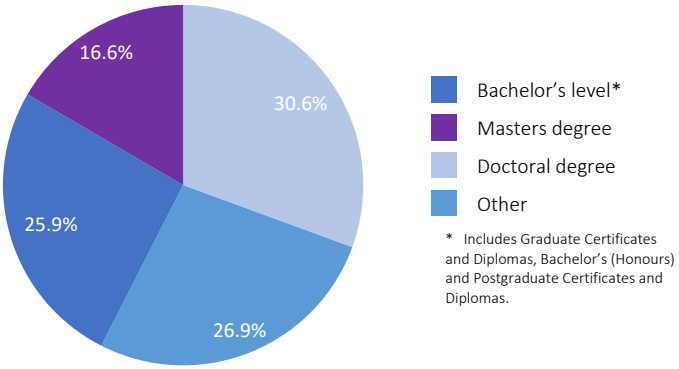
Roles



Gender

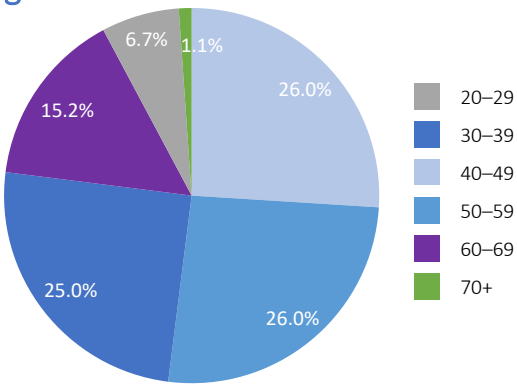


Highest qualification

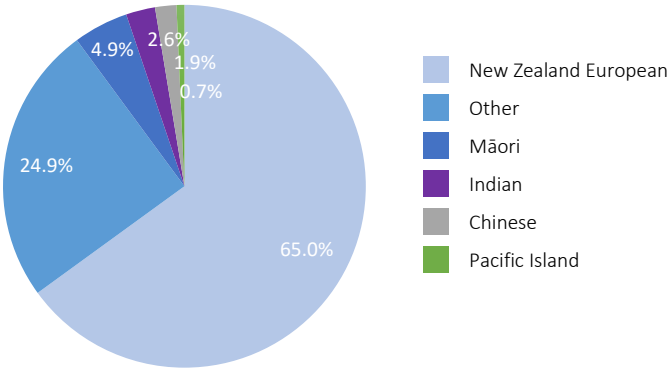


* Includes Graduate Certificates and Diplomas, Bachelor's (Honours) and Postgraduate Certificates and Diplomas.

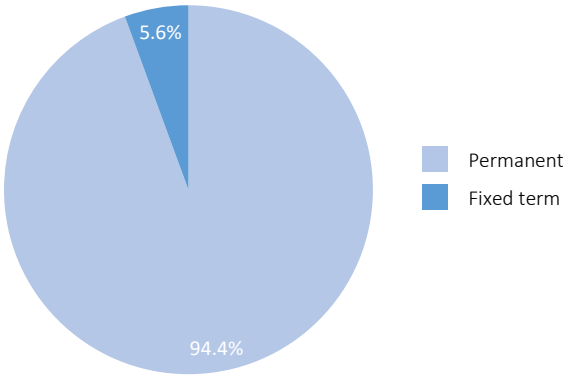
Age



Ethnicity



Employment status



NIWA Group by location

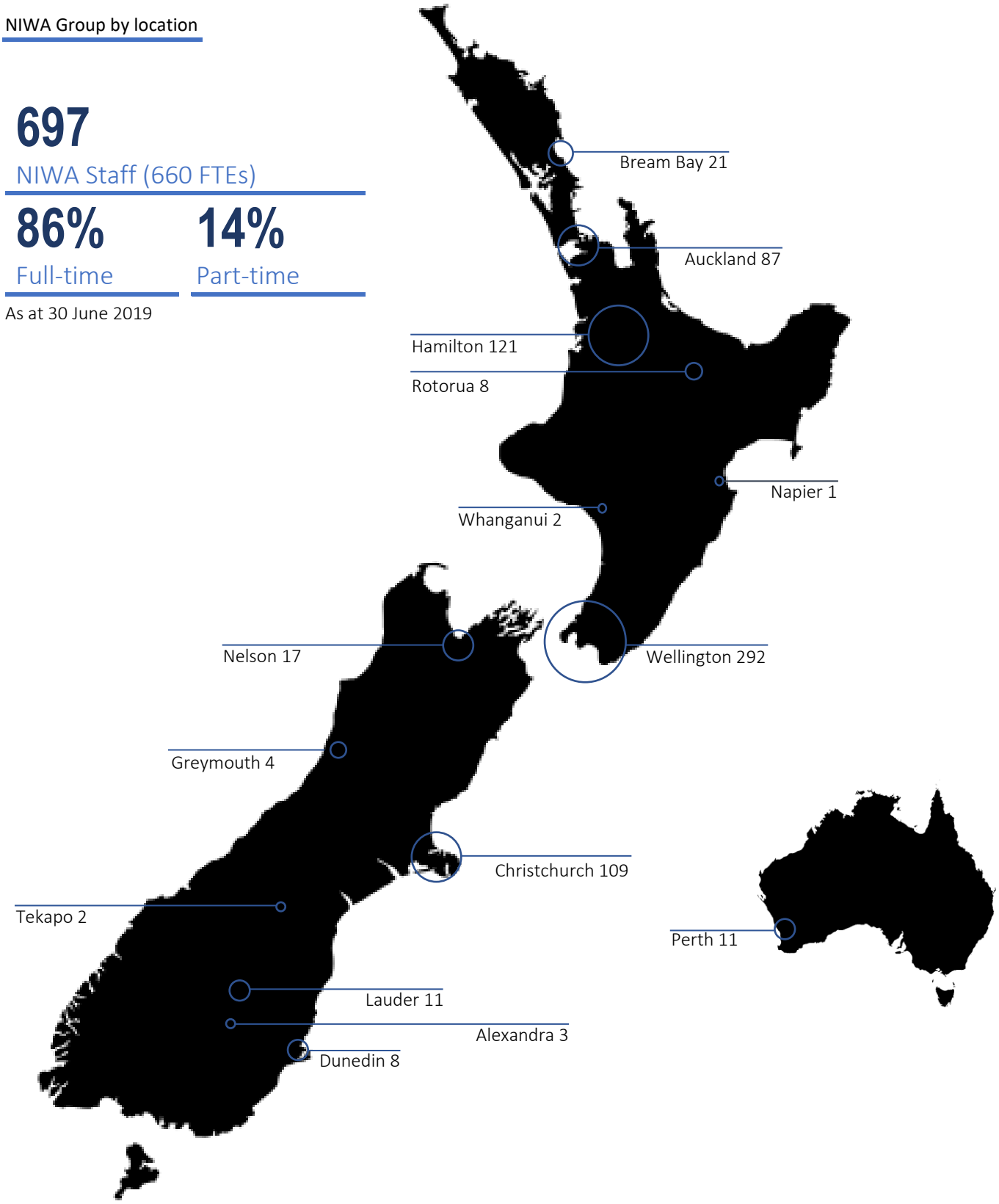
697

NIWA Staff (660 FTEs)

86% Full-time

14% Part-time

As at 30 June 2019



Recruitment
27 approved new permanent positions
52 approved permanent replacement positions
13 approved fixed term positions
95 new employees

Turnover
Turnover to the end of June for the NIWA Group was 7.89%.

Personal Development Leave (NIWA Science)
3 days of Personal Development Leave is provided for staff members, excluding those on management employment agreements.

PSA membership
317

Disabilities
1.6% of NIWA staff have a form of disability.

Remuneration reviews (in addition to standard NIWA annual process)

Extraordinary Market Relativity Reviews (Science Levels 1–3)	199
Operations Relativity Reviews	35
Support Relativity Reviews	23
Successful Level Promotions	25
Successful Performance Rating Appeals	6
Successful Salary Appeals	41
Total	**329**

OUR VALUES

NIWA's core values are part of our ongoing efforts to maintain a positive and strong culture, and be clear about what we need to promote, and stand for, in order to continue to be a successful organisation.

SAFETY

Working safely is paramount at all times.

- We take personal responsibility for the safety of ourselves and others
- We are always safety conscious, thinking "What am I about to do? What could go wrong? How can I do it safely?"
- We maintain high standards of safety in all working environments
- We report all hazards, incidents and near misses, acting on and learning from them
- We continually improve our safety systems and processes.

EXCELLENCE

We strive for excellence in everything we do.

- We apply the highest standards of rigour to our work
- We are creative and innovative in our thinking and apply leading-edge practice
- We are highly professional in the way we operate
- We are proud of our reputation for high-quality science
- We are efficient, effective and resourceful, seeking to eliminate waste and maximise opportunities.

CUSTOMER FOCUS

We provide our customers with an outstanding service and experience.

- We recognise that NIWA wouldn't exist without its customers
- We all work together to ensure a positive customer experience
- We value and respect our customers, and act to ensure excellent and enduring relationships with them
- We communicate with our customers openly and proactively
- We deliver on our commitments to customers – in full, on time and within specifications
- We seek customer feedback to help us improve.

AGILITY

We are agile, resourceful and responsive to opportunities and challenges.

- We actively create, identify and develop new opportunities
- We react quickly and flexibly to changing priorities
- We are positive, solution-focused and future-oriented in our outlook
- We recognise change as continuous, and treat it as an opportunity
- We are committed to continuous learning and improvement.

PEOPLE AND TEAMWORK

We are 'OneNIWA' and work collaboratively for the greater benefit of NIWA and our customers.

- We help and support our colleagues, treating each other with courtesy and respect
- We value diversity and respect other cultures
- We value the opinions, knowledge and contributions of others, and celebrate success
- We willingly share our expertise
- We all take responsibility for getting things done
- We listen openly and communicate honestly and constructively
- NIWA's interests and reputation take precedence over advancing our own individual interests and reputation.
- We are proud to be a part of NIWA.

INTEGRITY

We are honest, trustworthy and reliable in our work and our relationships with others.

- We uphold the highest ethical standards
- We deliver
- We take ownership and are accountable for our actions
- We provide accurate, evidence-based information and advice
- We maintain objectivity at all times, avoiding advocacy and bias
- We are viewed as trusted professionals in our areas of expertise
- We avoid or declare all conflicts of interest.

NIWA'S ORGANISATIONAL RESPONSIBILITY CHARTER

NIWA is committed to contributing positively to the social, economic and environmental wellbeing of New Zealand, as outlined in our Organisational Responsibility Charter below.

SOCIAL

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

We are committed to:

- Ensuring that people are safe in our workplaces
- Engaging positively with the communities in which we operate and live
- Respecting cultural values and diversity in New Zealand and in the countries where we work
- Fostering positive interactions with, and outcomes for, Māori.

ECONOMIC

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

We are committed to:

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

ENVIRONMENTAL

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

We are committed to:

- Minimising the environmental effects of performing our business
- Integrating environmental perspectives into our wider business planning
- Complying with all regulatory requirements, standards and best practice guidelines.

Operating to our Charter Principles

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

SOCIAL

We will support the Organisational Responsibility Charter by:

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

ECONOMIC

We will support the Organisational Responsibility Charter by:

- Being fair and honest in all our business dealings
- Maintaining objectivity in our service provision and avoiding actions that could damage NIWA's reputation for impartiality
- Taking a 'NZ Inc.' approach to business decisions and using any market advantage responsibly
- Delivering on our project commitments – on time, to budget and with the expected quality
- Employing our assets responsibly to benefit both the company and the wider community
- Abiding by the laws of the lands in which we operate
- Resolving differences without the need for litigation.

ENVIRONMENTAL

We will support the Organisational Responsibility Charter by:

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

2019 EXCELLENCE AWARD WINNERS

Research

Winner: Graeme Inglis

Runner up: Joshu Mountjoy

Applied Science

Winner: John Zeldis

Runner up: Mike Beentjes

Early Career Science

Winner: Elizabeth Graham

Runner up: Kelly Ratana

Science Communication

Winners: Rob Bell

Petra Pearce

Runner up: Alex Fear

Leadership

Winner: Mary de Winton

Runner up: Gordon Brailsford

Project Delivery

Winner: Stuart Escott

Runner up: Jenny Beaumont

Customer Focus

Winner: Kathy Walter

Runner up: Mike Bargh

Operational Innovation

Winner: Chris Ray

Runner up: Rod McKay

Support Services

Winner: Stuart Mackay

Runner up: Karen Keddy

Health & Safety

Winner: Jenny McLean

Runner-up: Grace Frontin-Rollet

Team

Winner: Singapore Drainage Grid System Team

(Jochen Schmidt, Mike Bargh, Shailesh Singh, Murray Kinsman, Kevin Chung, Tony Hill)

Runner up: TAN1902 Team

(Alan Orpin, Will Quinn, Jenny Beaumont, Rachael Peart, Kate Neill, Paul Bird)

Lifetime Achievement

Rob Bell

Rosie Hurst

2019 NIWA Photography Award Winners

Our People – Jochen Bind

Our Work – Crispin Middleton

Our Places – Shannan Crow

Freshwater – Crispin Middleton

Emerging Photographer – Shantanu Patke

Special Award – Sarah Searson

People's Choice – Shannan Crow

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

NIWA's research and applied-science services are delivered through our science and sector-focused management units.

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

Sector benefits from research and applied science funded by MBIE Strategic Science Investment Funds are described in a separate report to MBIE and available on NIWA's website "Benefits of MBIE Strategic Science Investment Funds".

Statement of

CORE PURPOSE OUTCOMES

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

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

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

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

NIWA'S NATIONAL SCIENCE CENTRES

National Centre for Climate and Atmosphere

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

Our work includes:

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

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

National Natural Hazards Centre

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

Our work includes:

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

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

National Centre for Coasts and Oceans

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

Our work includes:

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

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

National Centre for Environmental Information

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

Our work includes:

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

niwa.co.nz/our-science/ei

National Aquaculture Centre

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

Our work includes:

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

niwa.co.nz/our-science/aquaculture

Te Kūwaha – National Centre for Māori Environmental Research

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

Our work includes:

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

niwa.co.nz/our-science/te-kūwaha

National Centre for Freshwater and Estuaries

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

Our work includes:

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

niwa.co.nz/our-science/freshwater

National Fisheries Centre

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

Our work includes:

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

niwa.co.nz/our-science/fisheries

Vessels

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

Tangaroa, our flagship deepwater research vessel, is ice-strengthened and New Zealand's only DP2-equipped vessel. DP2, an advanced dynamic positioning system, enables the vessel to remain stationary or follow a precise path even in strong winds and rough seas.

Tangaroa is also equipped with a range of sophisticated equipment enabling us to explore from sea surface to seabed and expand our understanding of our unique marine environment and its resources.

A wide range of inshore and coastal research is made possible by *Kaharoa* and *Ikatere* – as well as a fleet of smaller inshore boats – to assist in coastal resource management.

niwa.co.nz/our-science/vessels

Pacific Rim

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

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

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

National Centre for Technology & Innovation

Environmental science is increasingly advancing on the back of new technologies that are enabling collection of data at finer temporal and spatial scales, and providing information on systems and processes that was previously not possible. New data analytics, visualisation and virtual reality technologies are delivering new insights and presenting it more clearly and usefully.

NIWA is at the forefront of developing and using such technologies and was an early adopter of high-performance computing, remote sensing, real-time data collection and communications, intelligent control systems, remotely operated vehicles and environmental isotope technologies, for example. This technological capability continues to advance at an accelerating rate.

Developments this year included:

- appointing a GM – Technology & Innovation to the Executive Team
- a new Technology and Innovation portfolio, including:

  Environmental Information strategic science team,

  Environmental Information operations (including networks and instrument systems),

  Information Technology (IT), and

  High Performance Computing
- a strategy to accelerate technology uptake and innovation internally and with our collaborators
- consideration of a 'National Environmental Data Service', in association with key collaborators and stakeholders.

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

Hoki surveys

The quota for New Zealand's largest finfish fishery is a constant balancing act.

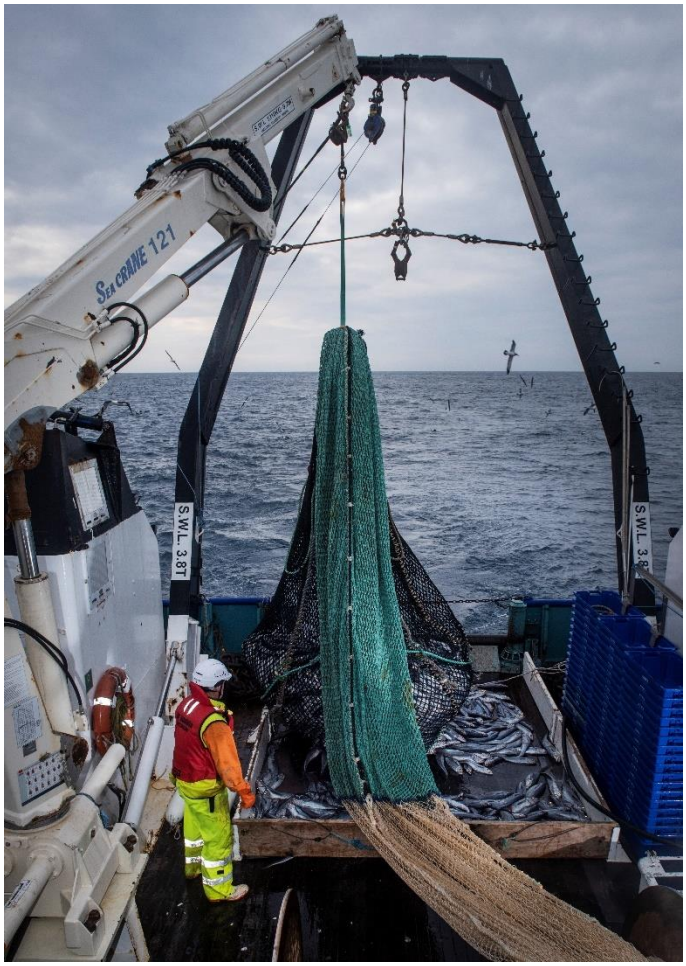
Hoki is a fish in demand, earning exports of $229 million in 2017, and the process to determine how many tonnes can be caught each year is lengthy and comprehensive. It begins with scientific surveys conducted by NIWA, which monitor the abundance of fish from both New Zealand hoki stocks. This information allows for a catch limit that is responsive to both the current adult abundance and to the number of small fish coming into the fishery.

Although managed within a single quota management area, hoki are assessed as two stocks, western and eastern – juveniles from both stocks mix on the Chatham Rise. Last year the 25th in a time series of random trawl surveys on the Chatham Rise was completed from NIWA's research vessel *Tangaroa*. This time series is the most comprehensive of the fisheries surveys conducted by NIWA for Fisheries New Zealand, and provides estimates of relative abundance for the species, which is found at water depths of 200 to 800m in New Zealand's Exclusive Economic Zone. It is particularly important for monitoring the abundance of young hoki on the major Chatham Rise nursery ground.

NIWA also conducts trawl surveys of hoki in the Sub-Antarctic region and acoustic surveys of spawning hoki in Cook Strait and on the west coast of the South Island.

Abundance, size and age data from the surveys are essential inputs into the NIWA stock assessment model for the sustainable management of hoki. Recently, the abundance of adult hoki has declined in all four survey areas, and 20,000t of the 150,000t quota was "shelved" by industry agreement in the 2018/19 fishing year.

The surveys also fulfil an important ecosystem monitoring role by providing additional information on the distribution, abundance, and biodiversity of associated species.



Top
NIWA fisheries scientists have been surveying hoki fish populations to help New Zealand set sustainable fisheries quotas.
[*Rebekah Parsons-King*]

Top
The heart of an oyster contains the richest source of red blood cells necessary for Bonamia testing.
[Dave Allen]

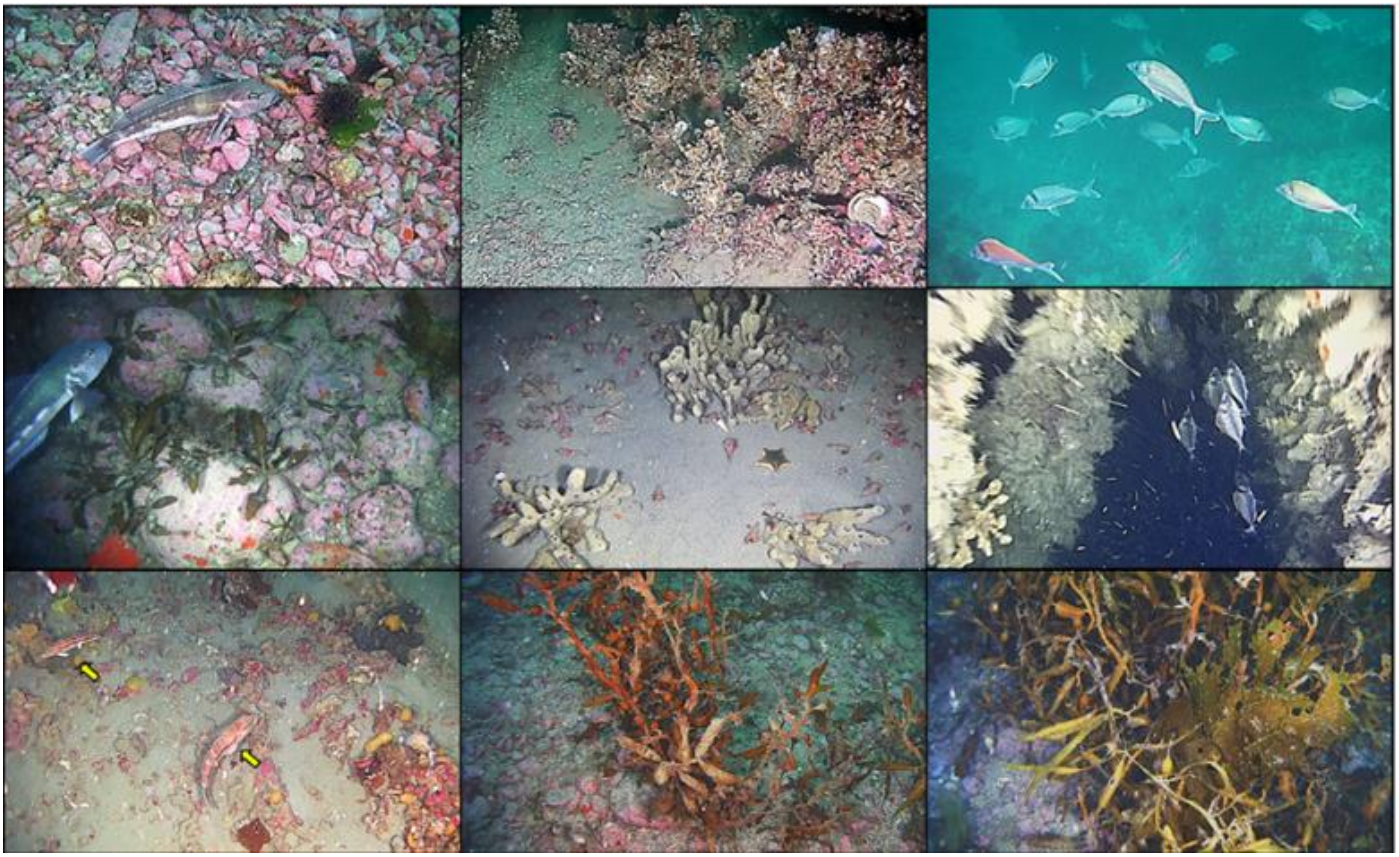
Advances in *Bonamia ostreae* testing

The recent spread of the parasite *Bonamia ostreae* into New Zealand poses a significant threat to oyster populations, including the nationally important Bluff oyster fishery. *Bonamia ostreae* causes catastrophic mortality of over 90% in infected oyster populations. It is closely related to *Bonamia exitiosa*, which has been present in the Bluff oyster fishery since 1964, but is much less lethal.

First discovered in the Marlborough Sounds in 2015, *B. ostreae* had spread to Stewart Island's Big Glory Bay by 2017. The Ministry for Primary Industries (MPI) ordered the removal of farmed flat oysters from these areas to protect the valuable wild oyster populations in Foveaux Strait, Tasman Bay and Cloudy Bay from infection. NIWA has undertaken regular sampling and testing for MPI to monitor the spread of *B. ostreae*.

NIWA and MPI scientists have leveraged the superior capabilities of droplet digital PCR (ddPCR) to detect and quantify multiple pathogens in a single test. A new assay, developed by NIWA, detects infection with high levels of precision and distinguishes between *B. ostreae* and *B. exitiosa*. It is highly sensitive, allowing detection of low-level infections, and provides a repeatable, cost-effective means of high-throughput testing (up to 400 oysters per day).

The complete life cycle of *B. ostreae* is not known. The disease can only intensify in oyster hosts, and removing high densities of oyster hosts is the only means of minimising the spread of infection. Since the removal of flat oyster farms in Big Glory Bay and the Marlborough Sounds, there have been no further detections of *B. ostreae*. It is not possible to confirm eradication because the parasite can persist in the environment in the absence of oyster hosts for several years. Ongoing monitoring of *B. ostreae* is essential to protect wild oyster populations, and NIWA will continue working with MPI to undertake surveillance of 25 sites around New Zealand.



Mapping unknown habitats

Contrary to popular belief, only a fraction of seafloor habitats around the New Zealand coast and Exclusive Economic Zone have been mapped. NIWA science is gradually changing all that.

By combining multibeam echosounder technology with high resolution video and camera footage NIWA scientists are learning more about marine features beneath our waters and what organisms live there.

Up-to-date marine charts are essential for safe navigation, identification of natural hazards, habitat protection for marine conservation, better understanding of land-use effects, and dynamic spatial management.

Modern marine mapping uses multibeam echosounders to unravel the intricate shape and nature of the seafloor by emitting sound waves from a vessel and measuring the time it takes for them to bounce off the seabed and return to a receiver.

When integrated with video observation of the seafloor, these maps become powerful tools documenting the distribution of benthic habitats and biological communities – knowledge that is critical to regulatory agencies working to manage and conserve New Zealand's diverse marine life.

One of NIWA's exemplars for undersea habitat mapping combining multibeam echosounders with high definition video, is the Marlborough Sounds survey. Mapping of Queen Charlotte Sound, Tory Channel and parts of Cook Strait has revealed new areas that support ecologically significant habitats and biological communities, such as the amazing sponge gardens on deep reefs in Cook Strait and fragile bryozoan reefs and tubeworm towers.

The benefit for local governments (such as Marlborough District Council) is that for the first time they have a full picture of highly-valued, heavily-contested, and multiple-use environments critical for maintaining biodiversity, and a comprehensive understanding of the spatial structure of fragile undersea habitats they manage or need to protect.

Seafloor habitat mapping amounts to a stock-take of what is there, what is being lost and what could (or should) be protected. That ultimately helps decision-makers make sensible choices and craft evidence-based strategies for managing our marine environment.

Top
A selection of images from the Cbedcam showing the benthic communities beneath the ocean.
[Tara Anderson]

At 700,000 square kilometres, Tonga's EEZ represents a substantial challenge to the sustainable management of its resources.

Sustainably fishing in Tonga

NIWA scientists have continued to work closely with the Tongan Ministry of Fisheries, the Secretariat of the South Pacific Communities, and the local fishing industry to improve the sustainable management of deepwater fisheries in Tonga's Exclusive Economic Zone (EEZ) through the development of science-based stock assessment and monitoring programmes.

At 700,000 square kilometres, Tonga's EEZ represents a substantial challenge to the sustainable management of its resources. NIWA scientists are working with the fishing fleet to develop its capacity to diversify its catch to reduce pressure on deepwater snapper and grouper and develop new local economic opportunities.

Five local vessels have trialled new mini-longline equipment to target tuna, wahoo and mahimahi. A collaborative project to trial fishing for diamondback squid resulted in fishers successfully catching dozens of the 10kg deepwater squid during the first trials in June. Local markets for the squid are now being developed, and additional trials are planned for other species.

New management measures have also been implemented this year to minimise the catch of undersize flametail snapper, and a squid management plan that will be part of the Deepwater Fisheries Management Plan is being developed.

The project, funded by the Ministry of Foreign Affairs and Trade, has also provided emergency safety grab bags for Tongan fishers on 20 commercial deepwater snapper fishing vessels in Tonga's EEZ. The bags contain safety and first aid equipment, including personal locator beacons, GPS and sea anchors, and were provided with training on their proper use and maintenance.

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

Wind and solar energy forecasting

A NIWA team working to improve New Zealand's high-resolution weather modelling is enabling more accurate forecasting for wind and solar energy production. This knowledge will be vital as New Zealand looks to increase renewable energy production to meet the Government's zero carbon goals.

About 80% of New Zealand's electricity generation already comes from renewable sources, but energy production from renewable sources across all sectors is closer to only 40%. Working out how to significantly increase the contribution of renewables to energy generation is one of the big climate change-related challenges New Zealand and other countries face.

A more accurate spatial and temporal understanding of wind properties, such as direction, speed, gustiness and variability, will help energy companies choose the best sites for turbines. Knowing more about cloud processes and improved cloud cover forecasting will help in locating and positioning solar networks, especially for areas away from more traditional observation networks.

This research forms part of NIWA's collaborative work under the Unified Model Partnership – an international collaboration to develop world-leading weather and climate forecasting systems. It depends on our High Performance Computing Facility investment because it involves the manipulation of vast datasets to produce the most accurate forecasting of any operational model in the country.

As part of this work the researchers will also be creating a 'high resolution weather reanalysis' – where the best models and all available observations are used to reproduce the recent climate. This will provide crucial insights into recent climate variations and can be used to simulate likely energy yields at different times of the year in different locations.

More rain will boost hydroelectric power

Freshwater turns the hydroelectric turbines that provide almost two-thirds of New Zealand's electricity. NIWA researchers have revealed that our changing climate and, in particular, a predicted rise in South Island rainfall, might increase the water available for hydropower generation by 10% a year across New Zealand. This could help offset increased electricity demand as we move away from fossil fuels.

To understand how electricity production may change in the future, NIWA modelled how much water is expected to flow into six hydropower schemes up until the end of the century: Waikato, Matahina and Waikaremoana in the North Island, and Waitaki, Clutha and Manapouri in the South Island.

The researchers found that over the course of the century, water available for national hydropower generation is projected to increase, particularly under the more extreme climate change scenarios. This is largely due to substantial increases in rainfall projected for the headwater catchments of the South Island hydropower schemes. These increases more than compensate for expected slight decreases in generation capability among the smaller North Island schemes.

Hydropower droughts due to diminished water supply are likely to become less severe, and water available for electricity generation during winter – when demand is currently highest – may increase by over 30%. These results will be a key component, alongside research into other renewable energy sources, of moving New Zealand towards a carbon neutral future.

The research was carried out for the Deep South National Science Challenge. NIWA researchers are looking in more detail at the South Island's Waitaki hydropower scheme with Meridian Energy, which owns six of the scheme's eight power stations.

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

Forecasting the future of flows in our rivers

NIWA is committed to providing better forecasting information for New Zealand to support and strengthen extreme weather predictions and response planning.

NIWA's national river flow forecasting system provides hourly forecasts, two days in advance, for more than 60,000 rivers across New Zealand.

The system uses our High Performance Computing Facility to link NIWA's national hydrological model with high resolution weather model output, satellite and climate station data.

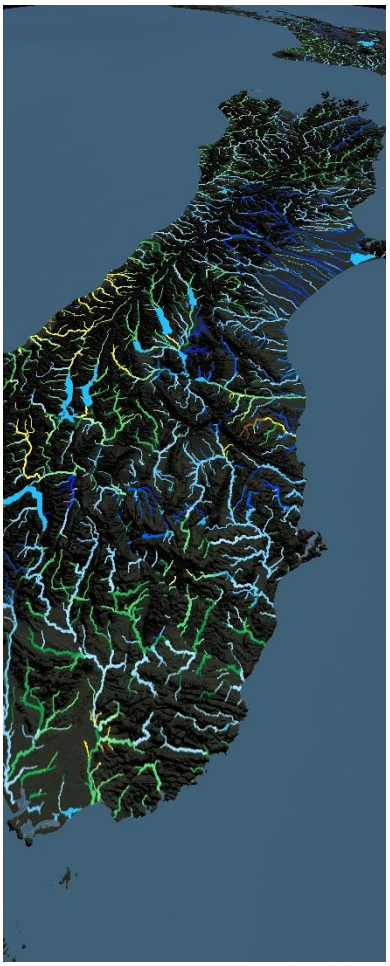
The forecasts are displayed as relative flow values based on long-term flow simulations. Simulations are generated from more than 40 years of climate records from hundreds of monitoring sites around the country interpolated to NIWA's Virtual Climate Station Network.

NIWA is using a collaborative stakeholder-focused approach to develop New Zealand river flow forecasts, working in partnership with key government decision makers.

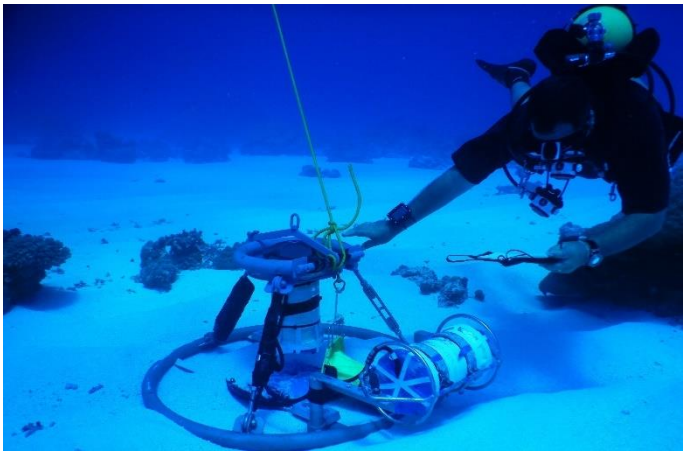
The system complements and supports existing local models already used to measure flows by local authorities. This research has NIWA scientists and local authorities working together to shape a tool that is better designed for decision-makers' needs and priorities.

The river flow forecasting system creates automated, state-of-the-art flow forecasting videos at national scales. This user-friendly visual format can be sent out via a link daily to end users.

The NIWA forecasting system has significant potential to support decision making for public safety. The system will be a critical tool to enable decision makers to better plan their response to flooding hazards, and for the public to increase their awareness and preparedness for future river flow conditions.



Top
Visualisation of the South Island river system from NIWA's river flow forecasting tool.
[*NIWA*]



Increasing resilience through improved information

Tonga's 169 islands stretch out over 800 kilometres across the Pacific Ocean, making effective weather and coastal forecasting a significant challenge for the Tonga Meteorological Service (TMS). TMS recognises better weather forecasting as key in increasing the nation's resilience to extreme weather events and climate variability and change. Improving the meteorological data availability throughout the country has multiple benefits. It will support climate resilient development in all sectors, including agriculture, water resources, health and fisheries. Other outcomes of TMS's Climate Sector Resilience Project are improved aviation safety, and more accurate marine forecasting for Tonga's interisland ferry and cargo services, the fishing industry and other marine operators.

NIWA has worked with TMS to provide and install new automatic meteorological and coastal monitoring stations covering the entire Tongan archipelago, and develop forecast products to help build resilience and effective warning of extreme weather and coastal events.

Between October 2018 and May 2019, NIWA staff working with TMS colleagues successfully installed 22 weather stations, two permanent sea-level monitoring stations and temporary wave and tide monitoring gauges at eight further locations.

The temporary gauges were used to calibrate and validate a wave forecasting system for operational interisland and other shipping. The installation challenges were not insignificant, given the remoteness of some of the locations and the lack of infrastructure, necessitating chartering ships and bringing in three containers of equipment.

Data is transferred from the stations via satellite every hour, or more frequently if required. NIWA staff also installed servers and software to integrate the data into TMS's data management system. The servers receive the data from NIWA's Neon telemetry system, and support importing the climate data into the Australian Bureau of Meteorology-installed CliDE (Climate Data for Environmental Services) database. NIWA also installed the latest version of the CliDEsc product generator suite and trained more than 12 TMS staff to use it. The Neon and CliDESsc dashboards were immediately adopted into use for routine pilot briefings for domestic flights in Tonga, and products produced via CliDESsc were also used in Tonga's National Climate Outlook Forum.

Fighting fires one forecast at a time

NIWA has this year introduced a range of new weather forecasting products aimed at providing a tailored service for significant events. These products, including an Incident Response Service, were first used during the February forest fires at Pigeon Valley, near Nelson.

While NIWA has provided an on-call weather forecasting service to Fire and Emergency New Zealand (FENZ) since 2017, the Nelson fires were the first time the forecasting team worked alongside key decision makers during an emergency as an integral part of the firefighting strategy.

The team created detailed forecasts and then presented them to FENZ managers at daily meetings. Using maps and computerised graphics of wind speeds and directions, the forecasters talked though the forecast for the day and week ahead to provide a comprehensive overview of the weather.

NIWA's high resolution forecasting service is able to predict weather changes in very small areas, taking account of terrain and landscape and how the air interacts with mountains and the sea, resulting in highly detailed forecasts. It is this micro-scale understanding that is one of the first priorities for firefighters, and helps them shape frontline decisions for crews. FENZ managers say the models performed well at a time when accurate and high quality forecasting is critical.

Over the duration of the Nelson fires the NIWA team delivered three of these briefings, which were supplemented by four targeted forecasts a day – some short-term, some extremely localised and some a weekly outlook – so FENZ could plan its firefighting strategy.

NIWA provided 95 forecasts to FENZ during February, underpinned by high quality modelling that added clarity and removed doubt.

Top Left
An Acoustic Doppler Current Profiler (ADCP) is deployed on the seafloor in Tonga. The ADCP will measure the current in the water column above and provide a velocity profile of the entire water column.
[Aleki Taumoepeau]

Top Right
NIWA's high resolution weather updates helped shape frontline decisions for crews battling the Pigeon Valley blaze.
[FENZ]

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

Helping wine growers get ahead

The New Zealand wine industry provides more than 20,000 jobs nationally, and its exports are worth $1.7 billion annually.

Year-round, it's important for winegrowers to know how changing weather and environmental conditions could impact their operations. NIWA's cutting-edge weather forecasting capabilities are helping growers get ahead.

Like many climate-sensitive sectors, winemaking is a balancing act of timing and decision making.

Robust environmental data and forecasts greatly improve viticulture management, including decisions on planting, pruning, harvesting, workforce planning, frost and disease protection, crop quality, timing and yield.

NIWA has been working alongside industry partners since 2016 to develop a prototype information and decision-making system for winegrowers. The tool combines detailed and ongoing operational data supplied by wineries with tailored, real-time forecast data from NIWA.

Still under development, the tool is already proving its worth. When a significant rain event aligned with harvest time, forecasts were relied on to contract more pickers, extend picking from 8 hours to 12.5 hours and increase winery hours to process the additional fruit.

For the company, these operational decisions mitigated the pernicious fungus botrytis, ensured grape quality, and eliminated the need for chemicals such as tartaric acid and copper. They advised that the estimated value of such harvest timing decisions is worth tens, if not hundreds, of thousands of dollars.

NIWA is looking to deploy a dedicated weather-monitoring instrument network for growers and increase industry involvement. These measures will further develop and improve the efficacy of the tool, as well as promoting its viability as a robust support tool for climate-sensitive primary industries.

Developing an Earth System Model for Aotearoa New Zealand

NIWA and the Deep South National Science Challenge are developing the New Zealand Earth System Model to produce improved climate change projections for New Zealand and the Southern Hemisphere. This state-of-the-art modelling system is now operational and producing global climate simulations.

An earth system model combines the physical processes of atmospheric and oceanic circulation with the chemical and biological processes that make up the earth system. NIWA researchers and colleagues from universities across the country are working together to develop the New Zealand Earth System Model, which is derived from, and feeds back into, the UK Earth System Model. New Zealand is one of the smallest countries in the world with its own earth system model, making it an ambitious project.

This work is part of the Unified Model Partnership – an international consortium led by the UK Met Office that celebrated its 20th anniversary this year. NIWA (on behalf of New Zealand) was the first partner outside the UK to join the Unified Model Partnership.

Developing a New Zealand-specific Earth System Model means we can tailor it to our own situation and scientific requirements and target our efforts to areas where other models face challenges, such as certain issues with modelling the Southern Hemisphere climate. For example, recent work on the New Zealand Earth System Model has reduced biases in cloud radiative forcing – the impact of clouds on heat and sunlight in the atmosphere – above New Zealand.

While the model is now being used to generate updated global climate-change simulations, the next step will be using these global datasets to produce regional high resolution climate simulations for New Zealand – a process known as downscaling – using NIWA's Regional Climate Model. These simulations will inform New Zealand's climate change adaptation actions and policy decisions.

Innovative sensor networks enhancing winter air quality

Poor air quality is a problem during winter in many New Zealand regions – and air pollution can have a significant detrimental effect on human health. NIWA researchers have been working with several communities in New Zealand and abroad to help tackle air pollution issues.

Domestic wood burners are a major source of air pollutants in urban areas. But, until recently, little scientific evidence had been gathered to show how smoke levels are influenced by the weather, topography, buildings and home-heating behaviour. This NIWA research is helping inform the design of effective intervention and mitigation strategies by councils and others.

The researchers have developed world-leading low-cost sensors to measure air quality inside and outside individual homes. Their outdoor sensors – called outdoor dust information nodes (ODINs) – are installed on lamp posts and, combined with weather information, provide insights into air quality right across a town.

The team has already published ODIN datasets for studies in Alexandra in winter 2018 and in Kellogg, Idaho during their winter. As well as fostering important collaborative links, using the sensors to study Northern Hemisphere towns during our summer enables the researchers to collect two sets of data in a single year. In the past couple of years, ODINs have also been deployed in Gisborne and Motueka as part of commercial contracts, and in Tasmania and Christchurch through research collaborations.

This winter the research is continuing in Arrowtown, with 35 ODINs deployed across the town and 84 homes signed up for indoor monitoring. In collaboration with the Otago Regional Council, Southern District Health Board and Cosy Homes Trust, home owners are being encouraged to upgrade their woodburners to more efficient heating sources and to install indoor air quality sensors to study the impact. Next winter plans are in place for a further concerted effort to improve air quality across the town – and the NIWA researchers will be back to measure its effectiveness.

Top
NIWA is helping communities to understand the impacts of air pollution from wood burners on their health, by distributing indoor (pictured) and outdoor sensors which measure air quality.
[Stuart Mackay]

Doing the rounds with orbiting satellites

NIWA's Lauder research station contributes to a worldwide monitoring effort by validating readings of greenhouse gases taken high above by orbiting satellites.

NIWA does this as part of its membership of the Total Carbon Column Observing Network (TCCON) - a global network of ground-based instruments set up specially to measure the quantity of atmospheric greenhouse gases in the atmospheric column directly above each site.

NASA's Orbiting Carbon Observatory (OCO-2) passes over NIWA's Lauder facility and takes measurements every few days. In addition, it 'targets' Lauder twice a month in summer. Target mode measurements are compared with those acquired by Lauder's ground-based instruments to calibrate the OCO-2 instrument and validate mission data. Scientific equipment at Lauder forms a vital part of the TCCON satellite validation network.

Elsewhere, NIWA has a contract to supply validation data for GOSAT – the Greenhouse Gases Observing Satellite. GOSAT is operated by the Japan Aerospace Exploration Agency (JAXA). It passes over Lauder once every three days.

As well as validating satellite-derived data for greenhouse gas satellites, NIWA targets launches of its weekly ozone sondes from Lauder to validate data taken by Sage3/ISS (Stratospheric Aerosol and Gas Experiment) – a NASA-operated instrument mounted to the International Space Station, which measures ozone, aerosols, water vapour and other gases in the atmosphere.

In a warming world, these orbiting observatories are an invaluable monitoring tool for the scientific community. NIWA has a vital role of a good global neighbour by supplying validation data as the satellites pass over.

Validation data taken by NIWA has been supplied to key international databases and used as a primary source of data for international assessments of the state of the atmosphere and climate system, including by the UN Framework Convention on Climate Change.

NIWA's efforts in this space build on its long track record in measuring and monitoring atmospheric constituents such as ozone and greenhouse gases from Lauder and other related sites, such as Baring Head on Wellington's South Coast and Arrival Heights in Antarctica.

A bird's eye view of New Zealand's carbon balance

CarbonWatch NZ is an ambitious NIWA-led research programme that aims to build the world's first complete national-scale picture of a country's carbon balance. This is precisely the sort of detailed information policy makers urgently require if New Zealand is to meet its goal of being carbon neutral by 2050.

By combining measurements of greenhouse gases in the air above New Zealand with high resolution weather models that show where those gases have come from, CarbonWatch NZ is developing a complete top-down picture of our country's carbon balance. This is known as an inverse modelling approach. Simulations from a land model and ocean carbon data will provide additional information. NIWA's High Performance Computing Facility is playing an important part in the work by crunching the huge quantities of data involved.

The project is addressing crucial carbon cycle questions in the landscapes that are most important to New Zealand's carbon balance: indigenous and exotic forests, farmland and urban environments. The programme measures our two main greenhouse gases – carbon dioxide (CO_2) and methane (CH_4) – as well as other gases that will help us understand processes.

CarbonWatch NZ wouldn't be possible without NIWA's long-term greenhouse gas measurements from our monitoring stations at Baring Head near Wellington and Lauder in Central Otago. Our newest atmospheric monitoring station, Maunga Kākaramea/Rainbow Mountain, near Rotorua, is capturing data in the central North Island, and additional measurements will be made around Auckland, Canterbury Plains, Fiordland and in forested land near Lake Taupo.

The research received $11.4 million from MBIE's prestigious Endeavour fund in 2018 and is a collaboration with GNS Science, Manaaki Whenua Landcare Research, Auckland Council and the University of Waikato. CarbonWatch NZ has already prompted the United Nations World Meteorological Organization to highlight New Zealand as an "exemplar" country, providing a template for other nations to follow for their own carbon reporting.

Top Left
Clear skies and geographical isolation make NIWA's atmospheric research station situated at Lauder perfect for observing atmospheric chemistry and radiation.
[Dave Allen]

Top Right
NIWA's newest atmospheric monitoring station at Maunga Kākaramea, near Rotorua, is providing data about greenhouse gas emissions to the CarbonWatch NZ programme.
[Dave Allen]

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Outcome 5

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

Reclassifying the leopard seal

Understanding the behaviour of marine mammals is a key focus of NIWA's coasts and oceans research.

Many New Zealand marine mammals are classified as either 'threatened' or 'at risk'. Understanding the behaviour and movements of these animals is crucial to the way they are managed, and ultimately, their survival.

A NIWA-led study investigating leopard seal occurrence around New Zealand resulted in a change in the conservation status of the animal to a 'resident species' under the Department of Conservation's 2019 Marine Mammal Threat Classification System Report.

Leopard seals are solitary predators that primarily inhabit the Antarctic icepack. While they have been known to frequent New Zealand waters, evidence of their occurrence in New Zealand had been predominantly anecdotal, with no dedicated database to record sightings.

Prior to their reclassification, leopard seals were classified as a 'vagrant species' or 'occasional visitors' to New Zealand.

Many questions on the management of this Antarctic species arose after Owha, an adult female, took up residence in Auckland's Waitemata Harbour in 2012, disrupting NIWA's marine biosecurity surveillance there, and later in Whangarei Harbour. Owha's frequent travels between the two harbours prompted NIWA to carry out a photo-identification study to record sightings to better understand leopard seal occurrence in New Zealand.

The research reported widely distributed leopard seal occurrence in all seasons, including three births on mainland New Zealand, and a large increase in sightings in the last two decades. A dedicated website has been established for people to submit leopard seal sightings. The study also noted that Owha maintains the longest-standing residency for an individual outside of Antarctica.

The online database increased the scope and efficacy of the study, highlighting the importance of citizen science.

Top
A leopard seal at Owhiro Bay, Wellington. Recurring sightings of leopard seals in New Zealand waters have resulted in the threat status of the species being updated from vagrant to resident. *[Hamish McCormick]*

Uncovering the mysterious lives of longfin and shortfin eels

Tuna or freshwater eels are a very significant, widely-valued, culturally iconic mahinga kai species.

Tuna have an unusual life cycle that sees them travelling between ocean and freshwater habitats. Much remains unknown about the marine phase of the tuna life cycle, especially their spawning ground locations and how the larvae make the precarious journey back to New Zealand.

NIWA freshwater fish ecologists are leading projects to refine the location of tuna spawning grounds in the western Pacific, understand how the larvae use ocean currents to bring them to the New Zealand coast and determine whether the migrations and larval movements of shortfin and longfin tuna differ.

After their long journey from unknown parts of the Pacific, the larvae arrive at New Zealand's coastline and transform into glass eels, named for their translucent appearance.

NIWA researchers are studying glass eel diet, hatch dates, age, growth rates and environmental history by analysing otoliths and tissue samples. Tuna otoliths add a layer of calcium carbonate each day that can reveal information about the marine environment the fish experiences. The layers act as a daily diary of an eel's life and could reveal the routes the larvae took to get to New Zealand's coastline.

NIWA researchers recently tagged several female longfin tuna before they left New Zealand in a related project to pinpoint their spawning ground, which is likely to be in an area between Tonga and New Caledonia.

Top Left
NIWA scientists are hoping to discover where freshwater eels travel to spawn by fitting them with electronic tags that record temperature, depth and light as the tuna migrate.
[Stuart Mackay]

Top Right
NIWA scientists carry out surveys to monitor and report on the ecological condition of our lakes. Invasive plant species, such as the lagarosiphon (pictured), are one of the greatest threats to these ecosystems.
[Rod Budd]

Protecting our lakes and rivers from invasive plants

Invasive pests are a concern to the New Zealand public and to those responsible for pest management. Pest aquatic plants pose a significant threat to the New Zealand environment and economy. NIWA is working to help protect our freshwater ecosystems from the effects of these plants.

Of the more than 70 non-native aquatic plant species with established populations in New Zealand, more than 75% have become problem weeds, or are classified as future problem weeds. Problem weeds are those that pose a threat to the native environment. Various management interventions can protect waterways from future weed issues by, for example, stopping weeds from spreading.

The NIWA freshwater biosecurity team has created a guidance framework for Best Management Practice for Aquatic Weeds. The framework aligns with biosecurity and freshwater priority issues set out in local and national government strategies. This best practice guidance informs biosecurity decision making, including the preventative and reactive management of aquatic weeds.

The framework sheds light on the mechanisms by which aquatic weeds are transported, become established and have adverse effects on the environment. The guidance focuses on the management and mitigation of aquatic weeds and the tools required for strategic analysis, incursion detection and control of established populations.

The strategic analysis tool informs the rationale for aquatic weed control using an evaluation of desired outcomes from management. This tool explores why aquatic weeds differ from their terrestrial counterparts and the legislation facilitating their management. The incursion detection tool helps managers target weed species based on their proximity to different areas and their dispersal pathways. The control toolbox includes detailed methods for removing or preventing the spread of different weed species and recommendations for their use.

This NIWA research contributes to the prevention, reduction and elimination of the adverse effects of harmful organisms on economic wellbeing, the environment and human health.

Indigenous peoples gather to discuss marine biosecurity at Tauranga Moana

An Aotearoa-led wānanga brought together an international group of indigenous practitioners, researchers and guardians to discuss how we prevent, respond to and manage marine pest species.

Māori and other indigenous people worldwide have not often been engaged in marine biosecurity deliberations. Their concerns and aspirations for the protection of culturally important resources, places, practices and taonga, or potential utilisation of marine pests have not yet been considered adequately in marine biosecurity decision making. The world is faced with the rising threat of invasive marine species due to increased pressure from the growing international shipping transport system, travel and tourism.

Building on established relationships that have been developed with researchers in Tauranga Moana – Manaaki Te Awanui and NIWA co-hosted a May 2019 wānanga for local and international indigenous guests to share ideas and experiences about invasive marine species, and more broadly the concept of kaitiakitanga in the marine environment.

Eight international indigenous kaitiaki from Australia, Canada and the US, with kaitiaki from Tauranga Moana, researchers, and biosecurity practitioners from central and local government, attended the four-day Te Waharoa wānanga at Hungahungatoroa Marae in Tauranga to share their experiences of impacts of marine pests in each country. The international guests included delegates from the Heiltsuk Nation (Canada), Yirrganydji Land and Sea Ranger Program (North Queensland, Australia), and Paepae o He'eia, Hawaii (US).

Presentations and field trips enabled delegates to share learnings and tools for marine pest management and potential models for engagement in biosecurity decision making. Although biosecurity was the unifying theme, the discussion was set within the broader context of the unique role and responsibilities indigenous people have as guardians of their marine environment for future generations. These conversations were shared with the broader local community at an open day attended by representatives from Biosecurity New Zealand and regional councils.

The wānanga was supported by funding from NIWA Strategic Science Investment Fund and an MBIE International Relationships Fund project that was designed to foster greater collaboration and understanding among those working on marine biosecurity in New Zealand, Australia, the US and Canada.

Developing the next generation of freshwater taonga species scientists

Taonga species such as tuna (freshwater eels), kōura (freshwater crayfish) and kākahi (freshwater mussels) are central to the identity and wellbeing of many Maori. Te Kūwaha, NIWA's national centre for Maori environmental research, has been working with whanau, hapū and iwi for more than a decade to co-develop methods for the protection, restoration and economic development of these species.

One of the goals of a current MBIE-funded Cultural Keystone Species programme led by Te Kūwaha is to develop new capability and capacity to research, manage and restore freshwater taonga species.

The programme has supported a cohort of seven graduate students and three summer research scholarship interns. They have benefitted from a well-resourced suite of practical experiences and research challenges under the guidance of a NIWA scientist and a University of Waikato Associate Professor in collaboration with the University of Waikato and the Biological Heritage National Science Challenge.

The programme has enabled the next generation of taonga species scientists to develop strong professional networks and understanding of the importance of partnerships with Māori, agencies and research providers for the effective implementation of freshwater restoration strategies and the benefit of Cultural Keystones populations and the wider socio-ecological systems these taonga species are part of.

It is not only the students who benefit from this support. Our understanding of kākahi and kōura ecology has significantly increased with important research developments led by these graduate students. Their work has contributed to more targeted restoration strategies that incorporate the holistic ecological requirements of these taonga species. They also brought fresh, new approaches to the communication of the research on social media platforms.

Top Left
Kaitiaki learning about the potential impact invasive crab species may have on the titiko (mudflat snail) and the native pāpaka (crabs), two of the taonga species of Te Tahuna o Rangataua
[Graeme Inglis]

Top Right
Kākahi (freshwater mussels) are monitored in a Hamilton urban stream. Students are given practical experiences under the guidance of scientists.
[Stuart Mackay]

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

Keeping tabs on the ozone hole

The Montreal Protocol is a treaty ratified by all UN member countries as well as Niue, the Cook Islands, the Holy See and the European Union to phase out ozone-depleting substances such as chlorofluorocarbons (CFCs). NIWA is a key player in the success of the protocol.

The protocol requires four-yearly global assessment of ozone depletion, led by the World Meteorological Organization (WMO), and of its environmental effects, led by the United Nations Environment Programme (UNEP). NIWA leads New Zealand's contribution to both of those reports.

Measurements from NIWA's atmospheric monitoring station at Lauder are the only Southern Hemisphere data available in several key parts of the report, underscoring Lauder's position as the leading observatory of its kind in southern mid-latitudes.

Sophisticated instruments operated by NIWA at Lauder and Arrival Heights in Antarctica measure ozone, other trace gases, and UV radiation to complement and validate measurements from satellites and contribute to global databases and research into global stratospheric chemistry.

Monitoring variations in ozone concentrations is additionally beneficial because of New Zealand's high skin cancer rates. NIWA plays a disproportionately large role on the world stage with global ozone and UV monitoring for this reason. Nationally, NIWA produces maps and graphs showing daily predictions and measurements for UV levels across New Zealand.

New Zealand does not have extreme levels of UV by global standards, but the combination of our outdoor lifestyle, many people's fair skin pigmentation and cooler climate mean New Zealanders are not always as cautious about sun exposure as we should be.

Top
Every week at Lauder, ozone sonde balloons are launched carrying chemical in situ sensors to altitudes of around 35 kilometres before descending back to the ground. *[Dave Allen]*

Monitoring the Ross Sea Marine Protected Area

NIWA's deepwater research vessel *Tangaroa* completed its 13th voyage to Antarctica this year, travelling almost 12,000km on a six-week voyage to gather new knowledge about the Ross Sea.

The science programme focused on baseline information to monitor the year-old Ross Sea Marine Protected Area (MPA), which covers more than one million square kilometres and is the largest of its kind in the world.

Establishing a long-term monitoring programme to determine the efficacy of the MPA was a condition of its establishment, and New Zealand is playing a lead role, with other nations within the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR).

New Zealand scientists were joined on the voyage by marine scientists from China, France and Italy.

The researchers collected about 4,700 samples, took almost 33 hours of video of plants and animals living on the seabed, deployed gear 227 times to measure physical properties of the water and sample organisms from plankton to fish, and collected nearly 700 litres of seawater for analysis. In addition, six moorings holding an array of environmental sensors were retrieved and six deployed to continue to collect data until they are picked up in 2021.

This meant substantial progress was made on improving baseline information on spatial patterns in the biodiversity and ecology of the Ross Sea region, while key information was also obtained on the prey and bycatch species of toothfish along the Ross Sea Slope.

Results have been presented to end-user groups and international conferences and also used by the Ministry for Primary Industries and the Ministry of Foreign Affairs and Trade to develop strategic plans for MPA assessments through CCAMLR.

This research has consolidated New Zealand's position as the leader on ecosystem change in the Ross Sea region and made progress towards managing the ecosystem effects of fishing in a pristine ecosystem.

Top
Tangaroa transits through pancake ice on its way to Terra Nova Bay, Antarctica.
[Dave Allen]

NATIONAL SCIENCE CHALLENGES

Collaborating for New Zealand's benefit

The National Science Challenges are cross-disciplinary, mission-led programmes designed to tackle New Zealand's biggest science-based challenges. They require collaboration between researchers from Crown Research Institutes, universities and other institutions, businesses and non-government organisations.

NIWA is involved in 6 of the 11 challenges, with our researchers leading many significant projects.

We host two challenges – *Deep South* and *Sustainable Seas*.

Deep South is focused on helping New Zealanders anticipate, adapt, manage risk and thrive in a changing climate.

As part of the Challenge project National flood risks & climate change, NIWA's Ryan Paulik and Rob Bell mapped the national infrastructure potentially exposed to extreme river and coastal flooding from storms and sea-level rise. Huge stakeholder interest in the findings support the team's recommendations that a national flood map is a crucial next step in readying New Zealand for a changing climate.

The Sustainable Seas vision is for healthy marine ecosystems providing value for every New Zealander.

New Zealand's coasts and oceans are one of Aotearoa's greatest cultural, economic and social assets. Sustainable Seas supports a holistic, inclusive, ecosystem-based approach for managing the marine environment in Aotearoa and all the competing uses, values and demands on it. In 2018/19, 40 projects, 14 led by NIWA, have been completed with many high-quality publications. A key focus of the last year has been engagement with researchers, Māori and stakeholders to co-develop the research for phase II (2019-2024) of the Challenge.

NIWA also leads two of the largest programmes in the ***Our Land and Water*** science challenge. The first programme focuses on quantifying the loss of aquatic contaminants such as nutrients and faecal bacteria from different land uses, and the transport of these contaminants through groundwater and rivers. The second programme focuses on land-use effects on economic, environmental, social and cultural values at whole-catchment scales.

Our major project for New Zealand's ***Biological Heritage*** challenge is an investigation into what's in our groundwater. This study has revealed substantial crustacean biodiversity in New Zealand's alluvial aquifers. Most of the 59 species distinguished using DNA analyses were endemic to individual aquifers, although a few occurred in multiple catchments in Canterbury.

NIWA is also looking at tangible solutions to support communities in vulnerable coastal areas as part of the ***Resilience to Nature's Challenges*** initiative. And we are contributing to research outcomes for the ***Building Better Homes, Towns and Cities*** challenge.

Top Left
Two reports released by NIWA and the Deep South National Science Challenge reveal new information about how many New Zealanders, how many buildings and how much infrastructure could be affected by extreme river and coastal flooding from storms and sea-level rise. *[Alan Blacklock]*

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NIWA GROUP
STATEMENT OF COMPREHENSIVE INCOME

For the year ended 30 June 2019

in thousands of New Zealand dollars	Notes	2019 Actual	2019 SCI Budget (unaudited)	2018 Actual
Revenue and other gains	1			
Revenue		161,291	161,292	151,415
Other gains		1	1	1
Total income		**161,292**	**161,293**	**151,416**
Operating expenses	2			
Employee benefits expense		(73,539)	(72,766)	(70,079)
Other expenses		(60,380)	(61,651)	(57,669)
Total operating expenses		**(133,919)**	**(134,417)**	**(127,748)**
Profit before interest, income tax, depreciation, and amortisation		**27,373**	**26,876**	**23,668**
Depreciation	4	(18,260)	(18,038)	(14,448)
Amortisation	6	(1,029)	(1,093)	(1,036)
Profit before interest and income tax		**8,084**	**7,745**	**8,184**
Interest income		624	807	890
Net interest and other financing income		**624**	**807**	**890**
Profit before income tax		**8,708**	**8,552**	**9,074**
Income tax expense	10	(2,461)	(2,395)	(2,602)
Profit for the year		**6,247**	**6,157**	**6,472**
Other comprehensive income (loss)				
Items that may be reclassified to profit or loss				
Foreign currency translation differences of foreign operations		(71)	–	39
Total comprehensive income for the year		**6,176**	**6,157**	**6,511**
Profit attributable to:				
Owners of the Parent		6,248	6,157	6,451
Non-controlling interest		(1)	–	21
Profit for the year		**6,247**	**6,157**	**6,472**
Total comprehensive income attributable to:				
Owners of the Parent		6,177	6,157	6,490
Non-controlling interest		(1)	–	21
Total comprehensive income for the year		**6,176**	**6,157**	**6,511**

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

NIWA GROUP
STATEMENT OF CHANGES IN EQUITY

For the year ended 30 June 2019

in thousands of New Zealand dollars	Share capital	Retained earnings	Non-controlling interest	Foreign currency translation reserve	Total equity
Balance at 1 July 2017	**24,799**	**88,813**	**235**	**(277)**	**113,570**
Profit for the year	–	6,451	21	–	6,472
Other comprehensive income	–	–	–	39	39
Total comprehensive income	–	6,451	21	39	6,511
Balance at 30 June 2018	**24,799**	**95,264**	**256**	**(238)**	**120,081**
Balance at 1 July 2018	**24,799**	**95,264**	**256**	**(238)**	**120,081**
Profit for the year	–	6,248	(1)	–	6,247
Other comprehensive income	–	–	–	(71)	(71)
Total comprehensive income	–	6,248	(1)	(71)	6,176
Balance at 30 June 2019	**24,799**	**101,512**	**255**	**(309)**	**126,257**

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

Share capital

The Group has authorised issued and fully paid capital of 24,798,700 ordinary shares (2018: 24,798,700 ordinary shares). All shares carry equal voting and distribution rights and have no par value.

NIWA GROUP
STATEMENT OF FINANCIAL POSITION

For the year ended 30 June 2019

in thousands of New Zealand dollars	Notes	2019 Actual	2019 SCI Budget (unaudited)	2018 Actual
Equity and liabilities				
Equity				
Share capital		24,799	24,799	24,799
Equity reserves		101,203	101,224	95,026
Shareholders' interest		**126,002**	**126,023**	**119,825**
Non-controlling interest		255	266	256
Total equity		**126,257**	**126,289**	**120,081**
Non-current liabilities				
Provision for employee entitlements	3	932	840	872
Deferred tax liability	11	5,770	7,956	5,908
Total non-current liabilities		**6,702**	**8,796**	**6,780**
Current liabilities				
Payables and accruals		12,041	12,838	12,222
Revenue in advance		15,991	7,539	14,668
Provision for employee entitlements	3	8,516	9,265	8,168
Taxation payable		1,383	664	2,887
Forward exchange derivatives		12	17	1
Total current liabilities		**37,943**	**30,323**	**37,946**
Total equity and liabilities		**170,902**	**165,408**	**164,807**
Assets				
Non-current assets				
Property, plant, and equipment	4	115,071	111,653	112,892
Identifiable intangibles	6	1,439	1,348	1,868
Deferred tax asset	11	159	–	178
Prepayments		142	43	51
Total non-current assets		**116,811**	**113,044**	**114,989**
Current assets				
Cash and cash equivalents	12	13,277	21,745	16,839
Other short-term investments	12	10,000	–	5,000
Receivables	8	19,745	17,522	17,843
Prepayments		2,317	3,459	2,431
Assets Held For Sale	7	245	–	188
Uninvoiced receivables		5,874	7,179	5,043
Inventory	9	2,633	2,459	2,474
Total current assets		**54,091**	**52,364**	**49,818**
Total assets		**170,902**	**165,408**	**164,807**

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

For and on behalf of the Board:

Barry Harris
Chairman

Nicholas Main
Deputy Chairman

The financial statements were authorised for issue by the directors on 16 August 2019.

NIWA GROUP
CASH FLOW STATEMENT

For the year ended 30 June 2019

in thousands of New Zealand dollars	Notes	2019 Actual	2019 SCI Budget (unaudited)	2018 Actual
Cash flows from operating activities				
Cash was provided from:				
Receipts from customers		159,762	152,906	150,511
Dividends received		1	–	1
Interest received		624	807	890
Cash was disbursed to:				
Payments to employees and suppliers		(133,994)	(133,837)	(127,290)
Taxation paid		(4,084)	(2,524)	(1,418)
Net cash inflow from operating activities	12	**22,309**	**17,352**	**22,694**
Cash flows from investing activities				
Cash was provided from:				
Sale of property, plant, and equipment		337	–	162
Term deposits maturing		12,000	–	24,000
Cash was applied to:				
Purchase of property, plant, and equipment		(20,575)	(21,407)	(32,479)
Purchase of intangible assets		(599)	(1,093)	(979)
Investments in other term deposits		(17,000)	–	(4,000)
Net cash outflow from investing activities		**(25,837)**	**(22,500)**	**(13,296)**
Net cash inflow from financing activities		–	–	–
(Decrease) increase in cash and cash equivalents		**(3,528)**	**(5,148)**	**9,398**
Effects of exchange rate changes on the balance of cash held in foreign currency		(34)	–	12
Opening balance of cash and cash equivalents		16,839	26,893	7,429
Closing cash and cash equivalents balance		**13,277**	**21,745**	**16,839**
Made up of:				
Cash at bank and on hand		1,495	21,745	3,029
Short-term deposits		11,782	–	13,810
Closing cash and cash equivalents balance		**13,277**	**21,745**	**16,839**

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

NIWA GROUP
NOTES TO THE FINANCIAL STATEMENTS
For the year ended June 2019

1. Revenue and other gains

Rendering of services
The Group uses the 'percentage-of-completion method' to determine the appropriate amount of revenue to recognise in a given period. The stage of completion is measured by reference to the labour and non-labour costs incurred up to the end of the year as a percentage of total estimated costs for each contract. Contract duration is typically 1-5 years and revenue is recognised over time as service is rendered. The customer pays a fixed amount over the contract term in accordance with the payment frequency specified in the contract.

Goods sold
The Group recognises revenue from the sale of goods when control of the goods has passed to the customer, the associated costs and possible return of goods can be estimated reliably, there is no continuing management involvement with the goods, and there is a high probability that a significant reversal in the revenue recognised will not occur. Revenue from the sale of goods is measured at the fair value of the consideration received or receivable, net of returns and allowances. The timing of the transfer of control varies depending on the individual terms of the sales agreement.

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

For financial reporting purposes this Strategic Funding is treated as a Government Grant in terms of NZ IAS 20. Strategic Funding received and recognised during the year was $49.489 million exclusive of GST (2018: $49.489 million). All Strategic Funded projects were completed during the year.

Financing Components
The Group does not expect to have any significant contracts where the period between the transfer of the promised goods or services to the customer and payment by the customer exceeds one year. As a consequence, the Group does not adjust any of the transaction prices for the time value of money as this is considered to not have a material impact.

Contract Balances
Contract Assets
A contract asset is the right to consideration in exchange for goods or services transferred to the customer, conditional on something other than the passage of time. If the Group performs under a contract by transferring goods or services to a customer before the customer pays consideration or before payment is due, a contract asset is recognised for the earned consideration that is conditional.
Contract assets are classified as 'Uninvoiced receivables' in the Statement of Financial Position.

Contract Liabilities
A contract liability is the obligation to transfer goods or services to a customer for which the Group has received consideration (or an amount of consideration is due) from the customer. If a customer pays consideration before the Group transfers goods or services, a contract liability is recognised. Contract liabilities are recognised as revenue when the Group performs under the contract.
Contract liabilities are classified as 'Revenue in advance' in the Statement of Financial Position.

Government grant related to an asset
During the 2018 financial year, NIWA received $2.5 million from the Crown (through the National eScience Infrastructure platform) as a contribution towards the purchase of a new High Performance Computing Facility. For financial reporting purposes this contribution is treated as a Government Grant in terms of NZ IAS 20. The grant has been recognised as deferred income which will be recognised in profit and loss over the useful life of the asset.

Revenue and other gains

in thousands of New Zealand dollars	2019	2018
Research		
Strategic Funding	49,489	49,489
Rendering of services	45,412	42,027
Commercial Science		
Rendering of services	61,609	54,798
Sale of goods	4,781	5,101
Dividends	1	1
Total revenue and other gains	**161,292**	**151,416**

Revenue recognised in relation to contract liabilities (revenue in advance)

in thousands of New Zealand dollars	2019	2018
Revenue recognised that was included in the contract liability balance at the beginning of the year		
Rendering of services	**11,862**	**12,919**

2. Operating expenses

Employee benefits

in thousands of New Zealand dollars	2019	2018
Defined contribution plans	3,204	2,988
Termination benefits	104	171
Other employee benefits	70,231	66,920
Employee benefits expense	**73,539**	**70,079**

Other expenses

in thousands of New Zealand dollars	2019	2018
Materials and supplies	10,063	9,176
Research collaboration	18,636	19,969
Property occupancy costs	5,804	6,020
Information technology	7,268	5,680
Remuneration of directors	298	299
Foreign currency (gain)/loss	(69)	(48)
Movement within doubtful debt provision	158	(6)
Bad debts written off	9	–
Change in the fair value of derivatives	11	(16)
Other expenses	18,022	16,413
Total other expenses	**60,200**	**57,487**

Auditor's remuneration

in thousands of New Zealand dollars	2019	2018
Auditor's remuneration comprises:		
Audit of the financial statements (Group)	158	150
Audit of the financial statements (Subsidiary)	22	27
Other assurance services (ACC audit)	–	5
Total auditor's remuneration	**180**	**182**

3. Employee entitlements

Liabilities for wages and salaries, including non-monetary benefits and annual leave, long service leave, retirement leave, and training leave are recognised when it is probable that settlement will be required and they are capable of being measured reliably. Provisions, in respect of employee benefits, are measured using the remuneration rate expected to apply at settlement. Employee benefits are separated into current and non-current liabilities. Current liabilities are those benefits that are expected to be settled within 12 months from balance date.
Provisions made in respect of employee benefits which are not expected to be settled within 12 months are measured at the present value of the estimated future cash outflows to be made by the Group in respect of services provided by employees up to the reporting date.

in thousands of New Zealand dollars	2019	2018
Remuneration		
Salary accrual	2,083	1,910
Annual leave	5,891	5,570
Training leave	155	190
Long service leave	796	853
Retirement leave	523	517
Total employee entitlements	**9,448**	**9,040**
Comprising:		
Current	8,516	8,168
Non-current	932	872

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

4. Property, plant and equipment

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

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

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

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

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

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

Major source of uncertainty

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

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

in thousands of New Zealand dollars	Land	Buildings & leasehold improvements	Vessels	Plant & equipment	IT equipment	Office equipment	Furniture & fittings	Motor vehicles	Small boats	Work in progress	Total
Cost											
Balance at 1 July 2018	15,656	52,914	41,228	96,706	31,213	7,029	1,433	4,568	3,455	5,423	259,625
Additions	357	4	1,158	6,511	1,353	453	221	196	143	10,667	21,063
Transfers	(245)	1,677	167	789	787	–	–	–	–	(3,629)	(454)
Disposals	–	(16)	(2,284)	(1,474)	(217)	(109)	(1)	(240)	(53)	–	(4,394)
Foreign currency adjustment	–	–	–	(4)	(7)	(1)	(3)	(1)	–	–	(16)
Balance at 30 June 2019	15,768	54,579	40,269	102,528	33,129	7,372	1,650	4,523	3,545	12,461	275,824
Accumulated depreciation and impairment losses											
Balance at 1 July 2018	–	31,465	24,559	67,696	10,960	5,821	1,160	3,160	1,912	–	146,733
Depreciation	–	3,731	2,101	6,852	4,425	475	46	447	183	–	18,260
Disposals	–	(16)	(2,267)	(1,345)	(194)	(119)	(1)	(240)	(40)	–	(4,222)
Foreign currency adjustment	–	–	–	(10)	(3)	(1)	(3)	(1)	–	–	(18)
Balance as at 30 June 2019	–	35,180	24,393	73,193	15,188	6,176	1,202	3,366	2,055	–	160,753
Net book value at 30 June 2019	**15,768**	**19,399**	**15,876**	**29,335**	**17,941**	**1,196**	**448**	**1,157**	**1,490**	**12,461**	**115,071**
Cost											
Balance at 1 July 2017	15,726	52,480	41,234	89,984	23,624	6,683	1,380	4,390	3,296	1,476	240,273
Additions	–	915	–	6,893	18,088	441	38	517	279	5,423	32,594
Transfers	(70)	212	–	640	291	–	15	–	136	(1,476)	(252)
Disposals	–	(693)	(6)	(818)	(10,796)	(93)	–	(340)	(256)	–	(13,002)
Foreign currency adjustment	–	–	–	7	6	(2)	–	1	–	–	12
Balance at 30 June 2018	15,656	52,914	41,228	96,706	31,213	7,029	1,433	4,568	3,455	5,423	259,625
Accumulated depreciation and impairment losses											
Balance at 1 July 2017	–	29,956	22,439	61,663	19,406	5,451	1,110	3,060	2,011	–	145,096
Depreciation	–	2,244	2,122	6,645	2,329	465	45	441	157	–	14,448
Transfers	–	(64)	–	–	–	–	–	–	–	–	(64)
Disposals	–	(671)	(2)	(611)	(10,784)	(97)	–	(340)	(256)	–	(12,761)
Foreign currency adjustment	–	–	–	(1)	9	2	5	(1)	–	–	14
Balance as at 30 June 2018	–	31,465	24,559	67,696	10,960	5,821	1,160	3,160	1,912	–	146,733
Net book value at 30 June 2018	**15,656**	**21,449**	**16,669**	**29,010**	**20,253**	**1,208**	**273**	**1,408**	**1,543**	**5,423**	**112,892**

5. Heritage assets

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

NIWA has the following heritage assets:

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

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

6. Identifiable intangibles

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

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

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

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

All other development and research costs are expensed as incurred.

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

in thousands of New Zealand dollars	Software	Copyrights	Development costs	Total
Cost				
Balance as at 1 July 2018	8,961	215	243	9,419
Additions	300	–	97	397
Disposals	–	–	–	–
Transfers	198	–	12	210
Balance as at 30 June 2019	9,459	215	352	10,026
Accumulated amortisation and impairment losses				
Balance as at 1 July 2018	7,300	215	36	7,551
Amortisation	1,008	–	21	1,029
Disposals	–	–	–	–
Foreign Currency Adjustment	–	–	7	7
Balance as at 30 June 2019	8,308	215	64	8,587
Net book value at 30 June 2019	**1,151**	**–**	**288**	**1,439**

in thousands of New Zealand dollars	Software	Copyrights	Development costs	Total
Cost				
Balance as at 1 July 2017	8,692	215	35	8,942
Additions	771	–	208	979
Disposals	(502)	–	–	(502)
Balance as at 30 June 2018	8,961	215	243	9,419
Accumulated amortisation and impairment losses				
Balance as at 1 July 2017	6,787	215	15	7,017
Amortisation	1,015	–	21	1,036
Disposals	(502)	–	–	(502)
Balance as at 30 June 2018	7,300	215	36	7,551
Net book value at 30 June 2018	**1,661**	**–**	**207**	**1,868**

7. Assets held for sale

Assets held for sale are stated at the lower of their carrying amount and fair value less costs to sell.

Assets with a carrying amount of $245k were reclassified as held for sale in 2019 (2018: $188k). The site at Mahanga Bay is in the process of being sold. The former Greymouth office and site were deemed surplus to the Group's requirements on 25 July 2017 following the construction of a new office. The sale was finalised in December 2018.

in thousands of New Zealand dollars	2019	2018
Land	245	70
Other Assets	–	118
Total	**245**	**188**

8. Receivables

Receivables are stated at amortised cost using the effective interest rate, less an allowance for expected losses.

A provision for doubtful debts is established when the assessment under NZ IFRS 9 deems a provision is required. Changes in the carrying amount of the provision are recognised in the Statement of Comprehensive Income. Debts which are known to be uncollectable are written off against the provision, once approved by the Board of Directors.

in thousands of New Zealand dollars	2019	2018
Trade receivables	19,839	17,739
Sundry receivables	59	108
Provision for doubtful debts	(153)	(4)
Total	**19,745**	**17,843**
Classified as:		
Non-current	–	–
Current	19,745	17,843
Total	**19,745**	**17,843**

Included in the Group's trade receivables balance at the end of the year is one Crown debtor's balance which equates to 21% of the Group's total receivables balance (2018: 20%). 99% of that debtor's balance is less than 60 days over-due and is deemed to be low credit risk (2018: 99%). A second debtor has a balance that is more than 60 days over-due and equates to 8% of the Group's total receivables balance. This debt is expected to be recoverable.

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

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

Included in the Group's trade receivable balance are debtors with a carrying amount of $3,080k (2018: $473k) which are more than 60 days past due at the reporting date. 53% of this balance relates to the second debtor identified above. The Group does not hold any collateral over past due or impaired balances.

NIWA has applied the simplified approach to providing for expected credit losses, which requires the recognition of a lifetime expected loss provision for trade receivables. To measure the expected credit losses, trade receivables have been grouped based on days past due. The expected loss rates are based on the payment profiles of customers on a lifetime basis and the corresponding historical credit losses over a period of five years before 30 June 2018, adjusted for any significant known amounts that are not receivable. In addition, an expected credit loss allowance provision has been separately calculated in respect of the second debtor identified above as the credit profile associated with this debt is not considered to be well represented by the Group's historical credit losses. The total expected credit loss allowance provision has been determined as $153k (2018 provision under NZ IAS 39: $4k) for the Group.

in thousands of New Zealand dollars *As at 30 June 2019*	Expected Loss Rate	Gross Carrying Amount	Loss Allowance Provision
Current	0.0%	14,646	–
Past due 1 – 30 days	0.0%	1,296	–
Past due 31 – 60 days	0.0%	816	–
Past due 61 – 90 days	0.0%	668	–
Past due >90 days	0.0%	773	–
Separately assessed debtor	9.3%	1,640	153
Total		**19,839**	**153**

9. Inventory

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

in thousands of New Zealand dollars	2019	2018
Consumables	572	535
Raw materials	222	206
Finished goods	1,839	1,733
Total	**2,633**	**2,474**

10. Income tax

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

The income tax expense is determined as follows:

in thousands of New Zealand dollars	2019	2018
Income tax expense		
Current tax	2,580	3,956
Deferred tax relating to temporary differences	(119)	(1,354)
Income tax expense	**2,461**	**2,602**

Reconciliation of income tax expense

in thousands of New Zealand dollars	2019	2018
Profit before income tax	**8,708**	**9,074**
Tax at current rate of 28%	2,438	2,541
Adjustments to taxation:		
Other non-deductible expenses	45	83
R&D tax concession	(20)	(29)
(Over)/under provision in previous year	(2)	7
Income tax expense	**2,461**	**2,602**

11. Deferred tax liability and assets

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

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

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

in thousands of New Zealand dollars *As at 30 June 2019*	Opening balance	Credited/ (charged) to profit or loss	Closing balance
Temporary differences			
Property, plant, and equipment	(6,085)	279	(5,806)
Library books	5	(1)	4
Uninvoiced receivables	(1,412)	(233)	(1,645)
Employee benefits	1,717	21	1,738
Unrealised forex gains/losses on creditors/debtors	(44)	28	(16)
Doubtful debts	1	42	43
R&D Tax credit	88	(17)	71
Total	**(5,730)**	**119**	**(5,611)**

in thousands of New Zealand dollars *As at 30 June 2018*	Opening balance	Credited/ (charged) to profit or loss	Closing balance
Temporary differences			
Property, plant, and equipment	(6,687)	602	(6,085)
Library books	8	(3)	5
Uninvoiced receivables	(2,218)	806	(1,412)
Employee benefits	1,747	(30)	1,717
Unrealised forex gains/losses on creditors/debtors	–	(44)	(44)
Doubtful debts	3	(2)	1
R&D Tax Credit	63	25	88
Total	**(7,084)**	**1,354**	**(5,730)**

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

12. Cash and cash flows

12a Cash and cash equivalents and other short-term investments

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

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

12 b) Reconciliation of the profit for the year to net cash from operating activities

in thousands of New Zealand dollars	2019	2018
Profit for the year	**6,247**	**6,472**
Add/(less) non-cash items		
Net loss on disposal of property, plant and equipment	20	81
Depreciation and impairment	18,260	14,448
Amortisation of identifiable intangibles	1,029	1,036
Net foreign currency loss	(38)	39
	19,271	**15,604**
Add/(less) movements in working capital		
Increase/(decrease) in payables and accruals and revenue in advance	864	839
Increase/(decrease) in employee entitlements	408	187
Decrease/(increase) in receivables and prepayments	(1,879)	(4,122)
Decrease/(increase) in inventory and uninvoiced receivables	(990)	2,559
Increase/(decrease) in taxation payable and receivable	(1,623)	1,171
Increase/(decrease) in forward exchange derivatives	11	(16)
	(3,209)	**618**
Net cash flows from operating activities	**22,309**	**22,694**

13. Subsidiaries

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

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

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

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

All subsidiaries have a balance date of 30 June.
No stake in any subsidiary was acquired or disposed of during the year.

14. Related party transactions

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

Key management personnel compensation

in thousands of New Zealand dollars	2019	2018
Short-term benefits	7,333	7,510

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

15. Financial Instruments and Risk Management

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

Financial assets

Classification

The Group classifies its financial assets in the following measurement categories: those to be measured at amortised costs and those to be measured subsequently at fair value (either through other comprehensive income, or through profit or loss). The classification depends on the Group's business model for managing the financial assets and the contractual terms of the cash flow.

For assets measured at fair value, gains and losses will be recorded in either profit or loss, or other comprehensive income. For investments in debt instruments, this will depend on the business model in which the investment is held. For investments in equity instruments, this will depend on whether the Group has made an irrevocable election at the time of initial recognition to account for the equity investment at fair value through other comprehensive income.

The Group reclassifies debt investments when, and only when, its business model for managing those assets changes.

Measurement

At initial recognition, the Group measures a financial asset at its fair value plus, in the case of a financial asset not at fair value through profit or loss (FVPL), transaction costs that are directly attributable to the acquisition of the financial asset. Transaction costs of financial assets carried at FVPL are expensed in profit or loss.

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

This category has two sub-categories: financial assets held for trading, and those designated at fair value through profit or loss at inception. A financial asset is classified in this category if acquired principally for the purpose of selling in the short term, or if so designated by management.

Derivatives are also categorised as held for trading unless they are designated as hedges. Assets in this category are classified as current assets if they are either held for trading or are expected to be realised within 12 months of the balance sheet date. After initial recognition, they are measured at their fair values. Gains or losses on re-measurement are recognised in the Statement of Comprehensive Income.

Financial Assets at Amortised Cost

The Group classifies its financial assets at amortised cost only if both of the following criteria are met:

- The asset is held to collect the contractual cash flows, and
- The contractual terms give rise to cash flows that are solely payments of principal and interest.

Impairment of financial assets

The Group assesses, on a forward-looking basis, the expected credit losses associated with its assets carried at amortised costs and fair value through other comprehensive income. The impairment methodology applied depends on whether there has been a significant increase in credit risk. Note 8 details how the Group determines whether there has been a significant increase in credit risk.

For trade receivables only, the Group applies the simplified approach permitted by NZ IFRS 9, which requires expected lifetime losses to be recognised from initial recognition of the receivables.

Capital management

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

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

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

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

The advance facility available from ANZ Bank (refer note 15 subsection financing facilities) is subject to two covenants:

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

Capital refers to the equity and borrowings of the Group.

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

Fair value of financial instruments

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

All of the Group's financial instruments are classified as being within level 2 of the fair value hierarchy as defined by NZ IFRS 13 Fair Value Measurement (2018: the same). Their fair value is determined with reference to quoted rates for identical instruments on active markets.

Credit risk

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

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

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

The Group does not require any collateral or security to support financial instruments, because of the quality of financial institutions and counterparties it deals with. There are no significant concentrations of credit risk other than with the New Zealand Government which the Group does not consider to represent a material credit risk.
The exposure to the Group to credit risk as at 30 June 2019 was $48,896k (total exposure to credit risk, comprising cash and cash equivalents $13,277k, other short-term investments $10,000k, uninvoiced receivables $5,874k, and receivables net of provisions $19,745k) (2018: $44,725k).

Further analysis on the receivables balance can be found in note 8.

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

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

in thousands of New Zealand dollars	2019	2018
New Zealand	45,307	42,185
Australia	1,199	1,107
USA	175	445
Other Asia Pacific countries	2,284	800
Other regions	84	192
Provision for doubtful debts	(153)	(4)
Total credit risk	**48,896**	**44,725**

Interest rate risk

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

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

	2019	2018
Cash (on call)	1.50%	1.75%
Other short-term investments	2.67% - 3.04%	2.49% - 3.38%

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

Currency risk

The Group undertakes transactions in foreign currencies from time to time, and, resulting from these activities, exposures in foreign currency arise. It is the Group's policy to hedge foreign currency trading transaction risks economically as they arise. To manage these exposures, the Group may use financial instruments such as forward foreign exchange contracts. At balance date, the Group had forward foreign exchange arrangements in place with a New Zealand dollar (NZD) fair value of $12k (2018: $1k).

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

in thousands of New Zealand dollars *30 June 2019*	AUD	EUR	USD	FJD	GBP	CAD
Cash balances	788	24	7	1	31	6
Trade receivables	447	70	81	168	–	–
Trade payables	(267)	(13)	(266)	–	(4)	(3)
Statement of financial position exposure	968	81	(178)	169	27	3

in thousands of New Zealand dollars *30 June 2019*	AUD	EUR	USD	FJD	GBP	CAD
Cash balances	305	1	2	–	13	2
Trade receivables	751	81	485	30	–	–
Trade payables	(236)	(45)	(55)	–	(7)	(3)
Statement of financial position exposure	820	37	432	30	6	(1)

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

Liquidity risks

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

Payables and accruals of $9.415 million (2018: $8.670 million) have a contractual maturity of less than one year. This is based upon the earliest date on which the Group can be required to pay.

Financing facilities

The Group has access to financing facilities made available by ANZ Bank with a total value of $10.5 million (2018: $10.5 million). This was undrawn at 30 June 2019 (2018: also undrawn). The total facility of $10.5 million relates to an overdraft facility of $0.5 million (on-call) and an overnight placement and short term advance facility of $10 million (2018: $10 million).

16. Leases

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

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

in thousands of New Zealand dollars	2019	2018
Lease expense recognised in the year	2,301	2,270
Obligations payable after balance date on non-cancellable operating leases:		
Within 1 year	2,788	2,636
Between 1 and 2 years	843	1,843
Between 2 and 5 years	474	915
Over 5 years	2,918	2,734
Total obligations payable	**7,023**	**8,128**

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

17. Capital commitments

in thousands of New Zealand dollars	2019	2018
Commitments for future capital expenditure		
Contracted, but not provided for	867	3,792

18. Contingent liabilities

The ground lease over the Hamilton office site includes a clause that requires the site to be restored at the end of the lease. Ongoing negotiations over the future use of the site mean that it was not yet probable at balance date that NIWA would be required to restore the site, therefore no provision for this was included in the financial statements for site restoration. Quantity surveyors have provided an estimate of the costs for restoring the site (including demolition of buildings) which is disclosed below as a contingent liability.

in thousands of New Zealand dollars	2019	2018
Site Restoration Lease Clause	500	500

19. Subsequent events

There are no material events occurring subsequent to 30 June 2019 which require adjustment or disclosure in the financial statements.

PREPARATION DISCLOSURES

Reporting entity

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

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

Nature of activities

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

Basis of preparation

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

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

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

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

The accounting policies have been applied in preparing the financial statements for the year ended 30 June 2019 and the comparative information for the year ended 30 June 2018.

The 2019 Statement of Corporate Intent (SCI) Budget that is used for comparative information is not audited.

Statement of compliance

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

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

Goods and services tax (GST)

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

Foreign currencies

Transactions

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

Translation of foreign operations

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

Adoption of new and revised standards

The following accounting standards were adopted from 1 July 2018.

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

The Group adopted NZ IFRS 9 on 1 July 2018. NZ IFRS 9 addresses the classification, measurement and recognition of financial assets and financial liabilities. It replaces the guidance in NZ IAS 39 that relates to the classification and measurement of financial instruments. Whilst there are some changes to classification and determination of impairment of financial assets, there is no material impact from the adoption of this standard.

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

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

The Group adopted NZ IFRS 15 on 1 July 2018 using the modified retrospective approach. The timing and recognition of revenue was not materially impacted by the implementation of the new standard.

On adoption of NZ IFRS 15, the Group has revised its accounting policies for revenue recognition (where applicable) which are disclosed in note 1.

The following accounting standard will be adopted from 1 July 2019.

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

Effective from 1 January 2019 NZ IFRS 16 replaces the current guidance in NZ IAS 17 Under NZ IFRS 16, a contract is, or contains, a lease if the contract conveys the right to control the use of an identified asset for a period of time in exchange for consideration. Under NZ IAS 17, a lessee was required to make a distinction between a finance lease (on-balance sheet) and an operating lease (off-balance sheet). NZ IFRS 16 requires a lessee to recognise a lease liability reflecting future lease payments and a right-of-use asset for virtually all lease contracts. An optional exemption is included for certain short-term leases and leases of low-value assets; however, this exemption can only be applied by lessees.

The Group intends to adopt NZ IFRS 16 retrospectively from 1 July 2019, but will not restate the comparatives for the 2019 reporting period, as permitted under the specific transition provisions in the standard.

The Group expects to recognise right-of-use assets of approximately $7.8m on 1 July 2019, and lease liabilities of $11.2m. In addition, the Group expects to classify $1.03m that would previously have been recognised as rental expense, as depreciation and interest expense.

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

AUDITOR'S REPORT

Independent auditor's report

To the readers of National Institute of Water and Atmospheric Research Limited' s Group Financial Statements for the year ended 30 June 2019

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

Our opinion

We have audited the financial statements of the Group on pages 53 to 66, that comprise the statement of financial position as at 30 June 2019, the statement of comprehensive income, statement of changes in equity and cash flow statement for the year ended on that date and the notes to the financial statements that include accounting policies and other explanatory information.

In our opinion, the financial statements of the Group:

- present fairly, in all material respects:
  - its financial position as at 30 June 2019; and
  - its financial performance and cash flows for the year then ended; and
- comply with generally accepted accounting practice in New Zealand in accordance with New Zealand Equivalents to International Financial Reporting Standards (NZ IFRS) and International Financial Reporting Standards.

Our audit was completed on 16 August 2019. This is the date at which our opinion is expressed.

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

Basis for our opinion

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

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

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

Responsibilities of the Board of Directors for the financial statements

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

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

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

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

Responsibilities of the auditor for the audit of the financial statements

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

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

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

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

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

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

Our responsibilities arise from the Public Audit Act 2001.

Other information

The Board of Directors is responsible for the other information. The other information comprises the information included on pages 3 to 51, and 68 to 69, but does not include the financial statements, and our auditor's report thereon.

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

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

Independence

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

Other than the audit, we have no relationship with, or interests in, the Group.

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

CORPORATE GOVERNANCE AND DISCLOSURES

Board and committee meeting attendance

The Board held eight meetings during the year. The Audit, Legislative Compliance and Risk Committee (ALCR Committee) held four meetings during the year. The People & Culture Committee and the Future Property Programme Governance Committee were both established during the year, holding one and three meetings respectively. The table below shows director attendance at these Board meetings and committee member attendance at committee meetings. In addition, any director may attend any committee meeting.

Director	Board meetings	ALRC Committee*	People & Culture Committee*	Future Property Programme Governance Committee*
Barry Harris *(Chairman)*	8	3**	1**	–
Nicholas Main *(Deputy Chairman)*	8	4	–	3
Dr Helen Anderson	7	–	1	–
Dr Tracey Batten	7	3	–	–
Prof. Gillian Lewis	6	–	1	3
Mary-Anne MacLeod	8	–	1	–
Michael Pohio	8	4	–	2

* Only attendances by Committee members and Chairman are recorded

**Barry Harris attends Committee meetings in an ex officio capacity.

Directors' remuneration

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

in thousands of New Zealand dollars	2019	2018
Barry Harris *(Chairman from 1 July 2018)*	72	–
Sir Christopher Mace, KNZM *(Chairman to 30 June 2018)*	–	72
Nicholas Main *(Deputy Chairman)*	45	45
Dr Helen Anderson	36	36
Dr Tracey Batten	36	–
Prof. Keith Hunter	–	36
Prof. Gillian Lewis	36	36
Mary-Anne Macleod	36	–
Michael Pohio	36	36
Jason Shoebridge	–	36

Subsidiary company directors

The following people held office as directors of NIWA's subsidiary companies at 30 June 2019:

Subsidiary Company	Directors
NIWA Vessel Management Ltd	B Harris, N Main, H Anderson, T Batten, G Lewis, M-A Macleod, M Pohio
Unidata Pty Ltd	B Cooper[1], B Biggs[1], D Saunders[2]
EcoConnect Ltd	J Morgan[1], P Baker[1]
NIWA Australia Pty Ltd	B Harris, N Main, H Anderson, T Batten, G Lewis, M-A Macleod, M Pohio
NIWA Environmental Research Institute	B Harris, N Main, H Anderson, T Batten, G Lewis, M-A Macleod, M Pohio
NIWA Natural Solutions Ltd	J Morgan[1], P Baker[1]

1. Employee of the Group's parent company

2. Appointed by the minority ownership interest in Unidata Pty Ltd

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

Insurance for directors and employees

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

Auditors

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

Interests register

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

Interested transactions

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

Directors' remuneration

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

Use of company information by directors

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

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

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

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

	2019
100,000–109,999	84
110,000–119,999	50
120,000–129,999	42
130,000–139,999	29
140,000–149,999	12
150,000–159,999	9
160,000–169,999	9
170,000–179,999	7
180,000–189,999	7
190,000–199,999	6
200,000–209,999	4
220,000–229,999	3
240,000–249,999	1
290,000–299,999	1
310,000–319,999	1
330,000–339,999	2
350,000–359,999	1
640,000–649,999	1

The remuneration reflected in the above table comprises base salary and at-risk salary components. This excludes payments in respect of superannuation or in respect of the cessation of employment of employees.

In 2019, the Group made payments of $104k for compensation or other benefits in respect of the cessation of employment of employees (2018: $171k).

Donations
Donations of $1,563 were made during the year (2018: $3,957).

STATEMENT OF RESPONSIBILITY

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

1. The Board of the Company is responsible for the preparation of these financial statements and the judgements used therein.
2. The Board of the Company is responsible for establishing and maintaining a system of internal controls designed to provide reasonable assurance as to the integrity and reliability of financial reporting.
3. In the opinion of the Board, these financial statements reflect a true and fair view of the financial position and operations of the Group for the year ended 30 June 2019.

Barry Harris
Chairman

Nicholas Main
Deputy Chairman

16 August 2019

Top
Sam Parkes doing the hard work – preparing anchors for sea-level and wave-monitoring equipment in Tonga. Winner of the Our People category in the 2019 NIWA Photography Awards. *[Jochen Bind]*

DIRECTORY

Directors

Barry Harris *Chairman*
Nicholas Main *Deputy Chairman*
Dr Helen Anderson
Dr Tracey Batten
Prof. Gillian Lewis
Mary-Anne Macleod
Michael Pohio

Executive Team

John Morgan *Chief Executive*
Geoff Baird *General Manager, Communications & Marketing*
Patrick Baker *Chief Financial Officer*
Dr Barry Biggs *General Manager, Technology & Innovation*
Dr Bryce Cooper *General Manager, Strategy*
Dr Mary-Anne Dehar *General Manager, People & Capability*
Dr Rob Murdoch *General Manager, Research*
Dr Helen Neil *General Manager, Operations*
Marino Tahi *General Manager, Māori Strategy & Partnerships*

Registered office and address for service

41 Market Place
Auckland Central 1010
New Zealand

Auditor

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

Bankers

ANZ Bank New Zealand Ltd

Solicitors

Meredith Connell
Atkins Holm Majurey

Insurance broker

Marsh Ltd

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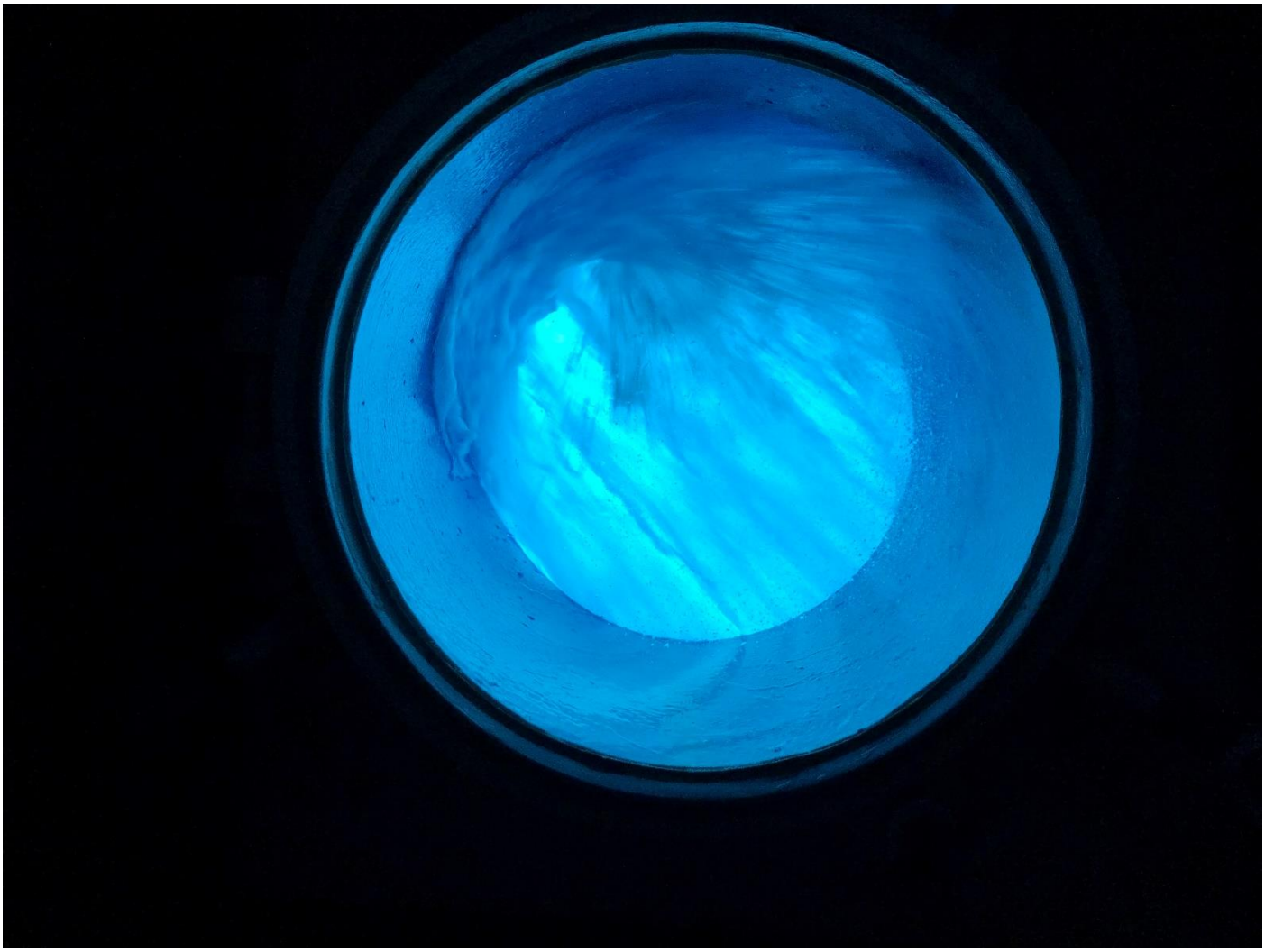
twitter.com/niwaweather
linkedin.com/company/niwa



Top
'I think it's calming down now, yeah right!'
Rough seas lash the porthole of *Tangaroa.* Winner of the Special Award category in the 2019 NIWA Photography Awards.
[Sarah Searson]

Science working for New Zealand

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