

New Zealand Freshwater Sciences Society Newsletter



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Introduction to the society

The New Zealand Limnological Society was formed at a meeting in Christchurch in January 1968. It was renamed the New Zealand Freshwater Sciences Society (NZFSS) in 2005 to reflect the broad interests of the membership. Its fundamental aims since inception have been to promote a common meeting ground for freshwater workers in New Zealand and to encourage and promote the exchange of news and views among them. In particular, a newsletter and a list of research workers and their interests is compiled and circulated at least once a year and an annual conference is held. The 2011 subscription is \$40.00 per annum, or \$10 for students, the unwaged or retired persons.

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2011 Conference Convenor

Not applicable – joint conference with the
Australian Society for Limnology

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2005-08	Dr N. Phillips

Editorial

IS THERE A PLACE FOR VALUES AND BELIEFS IN FRESHWATER SCIENCE AND MANAGEMENT?

Recently a local business had an application to discharge condensate of whey into the Whanganui River estuary declined. Having submitted in opposition to the discharge, I was rather pleased at the outcome. But the actual decision got me thinking. The commissioners declined the application not so much on the science involved, but on the values around the river, in particular the cultural and community values.

Our district council (and therefore our ratepayers) have, in the last decade, spent a substantial sum on building a brand new sewage treatment plant. The community went from unscreened, untreated sewage discharges to full treatment within ten years, and as a consequence they have reconnected with a once 'filthy' river. People are proud. Visits to the plant go annually by the (full) busload. Schools take trips there. People now swim in the river; they race on it and fish from it. In short, they value it.

This was evident in the large community response in opposition to the proposed discharge. Our pre-hearing meeting was on a Friday afternoon, when most people are usually settling in for after work drinks, yet the room was full. Even the regional council officer commented on the turnout. At the hearing, submissions were extensive, well prepared and heart-felt. The hearing panel did not fail to notice this, and it was reflected in their decision statement. It was fairly clear that the declining of the application was based more on the iwi and wider community connection to the river, and strong, values-based opposition to the discharge, and somewhat less on the science (although the science was still important).

However, as for the application process, what concerned me was the way the science was able to be mitigated. The company took concerns around elevated temperatures and oil and grease inputs and 'solved' the problems through technological additions. This may sound satisfactory, but without the cultural concerns raised by iwi and the community, this could have meant an approval of the application. I will openly state that I would have been uncomfortable with the granting of that application because I do not believe that waterways ought to be used as a discharge for industrial waste of any form. Thankfully, because I was submitting in a personal capacity, I was able to say as much in my evidence, alongside my technical evidence.

I have a hunch that many of us involved in freshwater matters do so because once, somewhere, we developed a love of the creatures that inhabit the myriad waters of our soaked land. How many of us came to this place because someone proved that x input affects biota y in z way? Or how many came because we once explored the recesses of quiet banks for unseen inhabitants? I suspect for many of us it is the latter.

I suspect too that deep down that odd love, that crazy passion still stirs. It's because of this love that we have spent so much time up to our waists in water, our hands in the mud, and our eyes glued to the bottom of slimy rocks. And we know the environments we work in. Perhaps more than any hard evidence, it might be our value of and love for these environments that wins the battles to save them. We might have no hard evidence to prove there will be an effect; we might, in our scientific capacity, have to declare that the mitigated effects will be 'less than minor'. But we may also have a hunch that we can't know everything, and that there may be effects we haven't thought of, and that in the end we just don't believe there should be a discharge to something we value so dearly. Then, perhaps, we might need to talk values.

I am not, of course advocating that we abdicate our responsibilities as scientists to provide robust evidence as to the effects and impacts of particular activities. And of course we need to be reticent of the fact that declaring overall beliefs can undermine our scientific evidence. But if we don't hold values about the places we work in, if we don't declare that our intimate knowledge of the places we are privileged to visit

leads us to the belief they should be protected, who will say these things? We are a part of the places we work in as much as the communities who live there. We know, perhaps more than most, what lives there. If we don't say that we value them, that we believe they need protection, who will? Will we leave it just to iwi and community groups? If we had had a less understanding panel, such a move might in our case have meant we had a new discharge to the river, with all the precedents that offers to other applicants in upcoming years. I am glad I stood on my values on this one, and would do so again if need be. It is something for all of us to ponder as we write up submissions and fight for the waters we value.



On slightly lighter matters, I would like to again congratulate fellow NZFSS members for another year of exciting and inspiring research. If some of the NZFSS work was on Facebook, I would be reaching for the mouse to 'Like' it. My editing notes (which unfortunately can't justifiably be included in the final edition) are full of pen marks saying, 'cool!', 'wow', and 'mean!' Having to do pest fish eradications at work, I would like to particularly mention Environment Waikato for their plan to convert koi carp flesh into potting mix. I'll buy some! I would also like to suggest that an award for the most complex experimental set-up goes to Jeremy 'Jay' Piggott of Otago University (page 35). It is possible that Jay is single-handedly propping up the plumbing industry – well done!

Hannah Rainforth, Editor

President's piece

As the newly-elected President I would first of all like to pay tribute to the recent past President Kevin Collier and his executive committee, especially those whose terms also ended in the past year. Kevin did much to promote NZFSS and heralded in an era of increasing involvement by the Society in management of freshwaters regionally and nationally. The Society and Kevin helped to lobby for the need for, and importance of, a national policy statement (NPS) in freshwater management. And we finally have one! The Land and Water Forum report set the scene for a slightly watered-down NPS. The NPS in freshwater management will take a limits-based approach to quantity and quality but appears to provide an inordinately long time – potentially up to the end of 2030 – for less active councils to implement standards and have regulations in place. I coordinated a media statement to say as much but it appeared to fall between the cracks as more polarised opinions took precedence. Nevertheless I would like to prompt members to consider to what extent the Society should involve itself in the political arena of freshwater management at a time when decisions with potentially long-lasting effects, particularly around land use, are being made. It is my intention that the expertise in the Society should be used to maintain a focus on the deterioration of NZ lakes, following on from the NIWA report released by the Ministry for the Environment (MfE) last year, the appalling declines observed in water quality and 'integrity' of most of NZ's RAMSAR wetlands, and concerns about how effective an NPS can be that promotes publicly-funded irrigation schemes alongside freshwater management. My concerns about the effectiveness and voice of NZFSS at a national level have to some extent been reinforced by lack of voice and participation at a (very expensive) annual conference known as the Freshwater Management Forum. Only after some negotiation was the Society able to be represented this year by Clive Howard-Williams (NIWA).

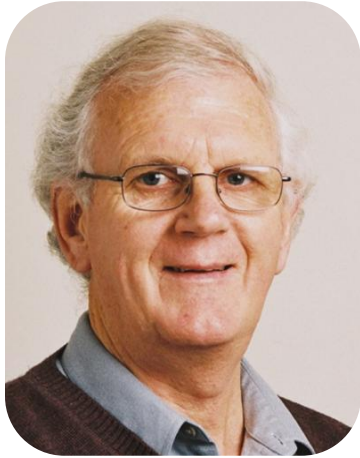
The Executive Committee has been expanded slightly and in addition to the student representative (Kristy Hogsden) also includes a representative for Māori (Jane Kitson) as well as newly elected member Susie Wood. We have several other co-opted members but I would like to make particular mention of two people. Jay Piggott is website manager who has made sure that material is put onto the Society's web site in a timely and well-presented manner. Ian Maxwell has coordinated recent submissions by the Society, including the National Policy Statement (NPS) in Freshwater Management and the NPS in Biodiversity.

Last year the Society held a highly successful and well-organised conference in Christchurch. Most felt comforted at that time that a major earthquake had passed. As we know other events have transpired and on behalf of the Society, I extend best wishes to our Christchurch colleagues in the rebuild. This year's conference was our quadrennial one with the Australian Society for Limnology, held in Brisbane in conjunction with the annual River Symposium. There were some raised eyebrows about the registration costs, but after our Ozzie colleagues arranged some dispensation for NZFSS members travelling from New Zealand to be eligible for a discounted early bird rate, we saw a small but strong turnout of members. For those who were unable to attend we hope to use the NZFSS web site as a means to air some of the material presented at the conference. Next year we return again to the South Island and will be hosted by our Dunedin members. I am looking forward to seeing you there.



David Hamilton, President

He Maimai Aroha – Farewells



Robert (Bob) McDowall 1939 – 2011

By Don Jellyman

The well-known fisheries scientist, Bob McDowall died earlier this year after a short illness. Bob was the father of freshwater fish research and fisheries in New Zealand, and was a life member of the New Zealand Freshwater Sciences Society. Although he had retired from the National Institute of Water and Atmosphere (NIWA), he continued to work most days at NIWA's Christchurch laboratory until shortly before his death in February.

Bob's academic career started at Victoria University of Wellington (1958-62) and he studied for a PhD at Harvard University, USA (1965-68). His thesis on the taxonomy of whitebait and related genera was regarded as one of the best submitted at that time. Upon return to New Zealand he commenced work on whitebait migrations. He also worked on describing all New Zealand's freshwater fish and published his first book in 1978. This was the forerunner of another 13 books he would complete over the next 33 years.

He moved from Wellington to Christchurch in 1979 to run the expanding laboratory at Kyle Street (the present NIWA campus) and eventually had control of 60 freshwater science staff throughout NZ. These were his 'bureaucratic wilderness' years as he had little time for research. A turning point for Bob was in 1985 when he was invited to be a keynote speaker at the first international conference on diadromy, the movements of fish between fresh and saltwater environments (Boston, March 1986). Another book followed but so did a period of productive research on the biogeography and dispersal of fish which continued until the present. In the limited New Zealand freshwater fish fauna, Bob realised he had the opportunity to explore biogeographical patterns and processes in a way that would have been more difficult with a larger fauna. He rapidly asserted himself as a staunch defender of oceanic dispersal as the dominant process for the distribution and colonisation of Southern Hemisphere freshwater fishes.

Bob was an enormously productive scientist, publishing over 240 papers, 14 books and roughly 300 popular articles and reports. He worked at institutes in Australia, South Africa, South America, USA and the Falkland Islands, and received many accolades and awards throughout his distinguished career, including being made a Fellow of the Royal Society of New Zealand and being awarded a James Cook Fellowship. He gained election to the New Zealand Conservation Authority for two years until ill-health forced his retirement last year. He served as co-editor on a number of scientific journals and refereed many papers, including 50 in the last year alone.

Bob had a passion for discovering and disseminating knowledge and popularising science. For him, it was a privilege exploring biology and understanding relationships. He recognised that he was the right person in the right place at the right time. While he leaves a huge gap in fisheries science, his written legacy is enormous; he also influenced many younger scientists who will be grateful they knew this remarkable man. His widow, Ainslie, has provided an endowment fund that will bear Bob's name, and will assist young freshwater scientists in furthering their careers.

The journey from biomonitoring data to fish and chip wrapper

By Rosemary Miller

In July of this year, the Taranaki Daily news announced that, according to a 15 year study of the region's waterways by the Taranaki Regional Council, there had been 'widespread ecological and biological improvement', and that these coincided with the Council's regional freshwater plan and the commencement of their riparian programme.

The 15 year study was none other than the technical annual report of the Council's biological state of environment monitoring (TRC, 2011). The paper presented to the Council committee on the report stated the following:

'The results are overall very encouraging, while indicating some matters still to be addressed. Ecosystem health across the region is demonstrably improving or stable, on a widespread basis. This is a fundamental and substantial vindication of the freshwater management initiatives by the Council and the regional community.'

So, to be fair, the media had reported only the conclusions set out in the paper to the Council committee. However, I wondered whether this was a fair and accurate reflection of the technical report itself, and the conclusions drawn by the authors? I sought a copy of the 230 page report in order to have a closer look.

The executive summary states that biological surveys were carried out in spring and summer at 57 sites in 25 rivers and streams. The sites were chosen for location, variation in river environment, position within a catchment and

surrounding land use. Some sites were selected in order to evaluate the effects of riparian management, others were selected to monitor recovery from improvements to point source discharges.

This raises problem number one: one of the basic statistical rules is that for generalisations to be made about a population as a whole (or in this case, a region) a 'probability based' approach to site selection needs to be taken, i.e. every river reach within the region needs to have had an equal probability of being selected. Without this, it is not statistically appropriate to draw conclusions about the 'ecological health across the region'; it is only appropriate to report on trends at those specific sites. If all the trends are in a certain direction, then maybe careful extrapolations to the wider region might be fair, but only by stating the statistical limitations of the survey design.

TRC's technical report attempts to avoid this mistake by laboriously reporting and discussing the results for each of the 57 sites as a long series of case studies. However, there were no such reservations in the paper presented to the Council, and therefore picked up by the sound-bite loving media.

Lesson number one for us as freshwater scientists is to ensure that clear limitations are set out around our results, to safeguard them from misuse by managers. Alternatively, reviewing, and amending the design of even long-term monitoring programmes should be considered, such as undertaken by the Waikato Regional Council in 2009 which will enable 'unbiased

estimates of the condition of wadable streams draining developed catchments in the Waikato region' (Collier and Hamer 2010).

The second problem I thought worth discussing was that of the Council's determination to attribute the results to the effects of their management. The technical report, whilst noting where improvements to discharges might be the cause behind trends in individual sites, does not propose reasons for all the trends found, nor does it generalise across the region. The technical report did not undertake any analysis of the temporal changes in relation to any of the potential causes for those trends, such as number of consents, changes in stock numbers, water quality trends, changes in riparian re-vegetation upstream, frequency of floods or major disturbance events, as was carried out by Collier and Hamer (2010) for their macroinvertebrate data. However, as recorded above, the paper to the Council attributed trends to the results of Council's management.

So lesson number two – where interesting, statistically and ecologically

significant trends in macroinvertebrate communities are found, it is crucial for scientists to systematically test possible causes in a statistically robust manner. To omit this runs the risk of resource managers or the media making it up for themselves.

Finally, perhaps understandably, the technical report contained other fascinating information that failed to make it to the paper for Council, such as the rapid decline of macroinvertebrate community health down the catchments, the proportion of sites that rated as being less than 'fair' (i.e with an MCI of less than 100), and the number of sites with MCI values less than or greater than those predicted through three predictive models.

Perhaps leading us to lesson number three – the importance of ensuring that conclusions are clearly set out in the executive summary knowing that managers, and therefore the media, rarely stray far into the depths of technical reports!

Rosemary Miller is back working for the Department of Conservation (pending the outcomes of the current review!) after a spell of 3 years of working for Taranaki Regional Council. During this time she project managed the compilation of the 2009 State of Environment Report, attempting to reconcile the desire by Council scientists to preserve the integrity of their work with the desire by Council managers to 'tell good news stories'.

References

- Collier, K; Hamer, M. 2010. Spatial and Temporal Patterns in the Condition of Waikato Streams Based on the Regional Ecological Monitoring of Streams (REMS) Programme.
- Taranaki Regional Council. 2011. Fresh Water Macroinvertebrate Fauna Biological Monitoring Programme Annual State of the Environment Monitoring Report 2009-2010. Technical Report 2010-16 (and Report CF490).

Sewage overflows in Christchurch's iconic rivers

By Shelley McMurtrie

EOS Ecology

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The 22 February and 13 June 2011 earthquakes will remain in the memory of Christchurch as perhaps the most traumatic experience of our generation. Below the surface of the city's rivers the impact was no less severe, with inputs of liquefaction sand/silt, bank slumping, uplifting of streambeds, and inputs of raw wastewater from a broken and crippled sewerage infrastructure. Following the February and June earthquakes around 50 000 m³ of raw sewage entered the city's rivers on a daily basis. The tireless work of City Council staff and contractors soon reduced this level to 20,000 m³/day within the ensuing months, but almost 10,000 m³/day of sewage continues to enter the rivers as ongoing tremors and then heavy snow falls hindered the repair to the city's infrastructure. Inputs of untreated human waste into surface waterways is thankfully no longer the norm in New Zealand, and thus the scale of the inputs and knowledge of their effects was relatively unprecedented and warranted investigation. The amount and duration of sewage inputs entering the lower non-wadeable portion of the Avon and Heathcote Rivers following the February earthquake led the Christchurch City Council to commission a study on the impact on the river's inhabitants. With little pre-earthquake data on the lower non-wadeable portions of the rivers (traditionally a no-go area for most freshwater surveys programmes due to the difficulty of sampling) a bioassay experiment was decided as the best means to initially determine

the level of impact to the rivers' aquatic inhabitants.

Approximately 2.5 months after the February earthquake, the EOS Ecology crew housed specimens of *Paracalliope*, *Potamopyrgus*, and *Paratya* in cages in the Avon and Heathcote Rivers at a site upstream (control) and downstream (impact) of sewage discharges, and checked their survival after 2, 6, and 12 days. During the 12 day experiment there was an estimated daily overflow volume of 4,800 m³/day of raw sewage to the Avon River upstream of the impact site, with the nearest regular discharge 1 km upstream and an intermittent discharge 150 m upstream of this site. On the Heathcote River 2,700 m³/day discharged from one overflow point, approximately 1 km upstream of the impact site.

Survival of all three species was not significantly lower at the downstream site on the



Bioassay cages at the upstream control site in the Avon River. Photo Shelley McMurtrie

Heathcote River, but there was a decrease in survival of *Paracalliope* and *Potamopyrgus* at the downstream site on the Avon River over time. Survival of *Paracalliope* dropped to around 60% at the downstream impact site after six days, indicating a short-term susceptibility to the conditions. While survival continued to decrease after 12 days, a similar mortality spike at the upstream control site indicated cage effects weighing in during this latter time period. While not as dramatic at only 10%, the mortality of *Potamopyrgus* over the 12 day period may indicate an there was an impact on these snails over a longer period of time. The significantly lower dissolved oxygen levels and elevated ammonia levels at this site are the most likely cause of the decreased survival for these two species.

The dissolved oxygen levels at the downstream site were below the acute guideline value of 3 ppm for the duration of the 12 day experiment. Ammonia levels fluctuated widely at this site but at times reached levels greater than the concentration found to be toxic to at least *Paracalliope* and *Potamopyrgus* in laboratory studies. It is also probable that tolerance levels would be lower than what has been found in laboratory tests, given the long duration of the sewage overflows into the Avon and Heathcote Rivers (over two months at the time of the bioassay experiment).

The higher inputs of sewage during the first few weeks of the February earthquake (estimated at almost 35,000 m³/day for the Avon River and 12,500 m³/day for the Heathcote River three weeks after the quake) would have presumably created a more widespread die-off of invertebrate fauna. However, the lower inputs of sewage that was continuing to discharge into the Avon River over two months after the February earthquake still appears to have been sufficient to cause problems for more sensitive invertebrates such as the amphipod *Paracalliope*, and for species typically regarded as being more hardy, such as the snail *Potamopyrgus*. Given the duration of the overflows, which currently stands at six months, invertebrates remaining in the lower reaches of both rivers may well be exposed to chronic (sub-lethal) effects, with long-term impacts such as increased susceptibility to disease, impaired reproduction, and altered biotic interactions. With the most recent 13 June 2011 earthquake the sewage inputs to the Heathcote and Avon Rivers returned to similar levels as for the days following the 22 February earthquake, putting additional stress on a system already stressed from months of sewage overflows.

We can probably all agree that while the sewage inputs remain there is going to be an impact on the fauna in the lower reaches of our much loved rivers. The interesting question is what can we do about this? Providing some level



Removing invertebrate bioassay cages in the Avon River upstream (left) and downstream (right) of sewage inputs. Photos: Shelley McMurtrie

of re-oxygenation is tricky to realise in such large, deep, and slow flowing rivers. Diverting the sewage overflows to 'somewhere else' is certainly not an option – the choice between sewage backing up in the streets or peoples' back yards versus overflowing to the nearest open waterway is an easy one to make if it is your back yard that is going to become a poo pond. In this regard we can be thankful that Christchurch is able to avoid the human health implications of sewage in the streets

and should reflect on yet another unquantified ecosystem service our waterways provide. So in some cases all we can do is watch and wait, and use this time to gain as much understanding as we can as to the effect on, and eventual recovery of, these systems.

For a copy of the EOS Ecology report go to:
<http://ecan.govt.nz/publications/Reports/eq-effects-invertebrates-lower-rivers-eos.pdf>



The three invertebrate species used in the bioassay experiment in the Avon and Heathcote Rivers following the 22 February earthquake (left to right): *Potamopyrgus antipodarum*, *Paracalliope fluviatilis* and *Paratya curvirostris*. Photos: Shelley McMurtrie

Student News

By Kristy Hogsden

Let's think back to November and the conference in Christchurch ... We had our first student-mentor lunch and over 40 people enjoyed the chance to talk in small groups about a variety of topics from research interests to finding the right job after university. The room was buzzing with a great energy! We received good feedback and requests for this to become an annual event at the conference. Did you participate in the lunch? Do you have any comments or suggestions on how we could improve this event? It was great to see so many people out at the pub quiz too!

Congratulations to Hamish Greig who won the inaugural Best Student Paper Award. This is a new award given out by NZFSS to highlight the

importance of students communicating science by publishing in peer-reviewed scientific journals. Check out the website for information and to submit your upcoming papers:

<http://limsoc.rsnz.org/index.php/students/>.

We look forward to hearing back from the students who headed across the ditch for the joint conference with ASL in Brisbane. It will be great to know about what you learnt and experienced.

The role of students in the society is an important one. If you have any ideas, concerns, or suggestions about student involvement in NZFSS, I would be happy to hear from you. You can contact me at: kristy.hogsden@pg.canterbury.ac.nz.

Introducing Jane Kitson – your Māori representative on the NZFSS Executive

At last year's AGM, a motion was put forward and accepted to elect a Māori representative to the NZFSS Executive Committee. The purpose of this role was to provide a Māori viewpoint at the executive level, facilitate member communication with the wider Māori scientific community, and to provide input into upcoming events (such as NZFSS conferences) so that Māori content streams could be offered to members, and tikanga honoured. Jane's role will also involve setting up a network for Māori NZFSS members. You can read about Jane below.

Dr Jane Kitson (Ngāi Tahu, Ngāti Mamoe, Waitaha) is the senior scientist at Environment Southland in Invercargill. Previously an ecologist at Te Ao Mārama Incorporated, Jane has worked on a range of research and management projects including: PhD research on traditional ecological knowledge and harvest management of tītī (*Puffinus griseus*), MSc research on microbial food webs in lakes, and eight years working in coastal and freshwater environmental science. She is currently involved in:

- finishing the compilation of Southland's State of the Environment Report on Freshwater. This is co-authored by Environment Southland and Te Ao Marama Inc;
- writing up kanakana/piharau/lamprey research for Te Ao Marama Inc and funded by Ngā Pae o te Maramatanga; and
- helping to co-ordinate the science of Waituna Lagoon (which has been shown to be close to 'flipping' into an algae-dominated state).

Jane is married to Zane Moss and they have two young boys – Luke who is 5 and Trent who is 3. The Moss/Kitson whānau live adjacent to the New River Estuary in Otatara, Invercargill, and their life generally revolves around hunting and fishing seasons, and the harvest of tītī/muttonbirds. Jane is contactable on Jane.Kitson@es.govt.nz



Luke and Jane harvesting toheroa at Oreti Beach.
Photo: Zane Moss

Homai te waiora, kia pakari ai au Give me the living waters, that I might thrive

Dr Jane Kitson, the current NZFSS Māori representative, was invited to write an article on freshwater issues in 2011 from a Māori perspective. Jane asked colleague Dr Philippa Pehi from Ngā Puhī to join her, so that views from different iwi and parts of the island could be presented. Dr Jane Kitson, Ngāi Tahu, is an environmental scientist at Environment Southland, based in Invercargill. You can read more about Jane above. Dr Philippa Pehi, Ngā Puhī and Ngā Ruahine, is a social and clinical psychologist currently working as a senior lecturer at Te Whare Wānanga o Awanuiārangī. She has a wide range of research and clinical experience in areas such as: environmental science, offender rehabilitation, Te Ao Māori matters, indigenous knowledge, and youth and tertiary education. Her passion, however, is the health and well-being of our whenua and of people.

Dr Jane Kitson

*Ko Hananui te maunga, Oreti te awa, Ko Ngāi Tahu,
Ngāti Mamoe, Waitaha me Ngāti Pākehā ngā iwi.
Nō Murihiku ahau.*

As the current NZFSS Māori representative I have been asked to provide a brief personal perspective of waimāori/freshwater events in 2011. This perspective is influenced by who I am and the

environment that forms my identity and that of my whānau. Murihiku/Southland is part of me, and unashamedly it is the main focal point for my piece.

I am also shaped by my mahi (work) as a scientist at our regional council (Environment Southland). My year has been dominated with State of Environment (SOE) reporting and the council's response concerning Waituna lagoon (see the Environment Southland update later in the newsletter). Mana whenua (the iwi connected with and responsible for an area) are affected and heavily involved in both these work areas. Here, I write from my mana whenua perspective, trying to disconnect my 'science' self. I don't mean to sound like I have a split personality, however, I wear two hats and live in two distinct, and sometimes conflicting, worlds.

Central to Ngāi Tahu whānui cultural identity is the concept of mahinga kai – the food and places for obtaining natural foods and the methods and cultural activities involved. This activity connects us to these sites and the mātauranga (knowledge) and the rules and constraints around the harvest, which is passed on through the generations and links us to our tūpuna (ancestors), our children and the generations to come.

Mahinga kai also provides sustenance and food to share (manaakitanga). The deterioration of these resources and harvest sites diminishes our mana and threatens our cultural wellbeing. Lowland stretches of rivers and estuaries are crucially important to mahinga kai practices (Tipa 2011), yet are the most degraded and are continuing to degrade.

As part of the SOE reporting process, Te Ao Mārama Inc (the organisation that is mandated by mana whenua to work on resource management issues in Murihiku) conducted a survey of mahinga kai gatherers in Murihiku. They most commonly identified the degraded environment and/or that the species were no longer present as barriers to gathering kai (Environment Southland and Te Ao Mārama Inc 2010).

In the Southland Regional Water Plan the standards set for lowland water bodies are less stringent than upland waters e.g. < 1,000 faecal coliforms per 100 mls is deemed acceptable. Our SOE monitoring shows that the majority of lowland sites frequently breach this standard (Environment Southland and Te Ao Mārama Inc 2010). Mana whenua eat from these waters – our health and indeed our cultural survival is dependent on the quality of these waters. Yet, when we report on these waters it seems almost accepted that these sites are degraded, and that this will continue to be the case.

The 'Our Ecosystems' State of Southland's Freshwater Environment report was released in September 2011. This report paints a gloomy picture for wai māori (freshwater) in Murihiku. When I have presented the results to mana whenua I see grief in their faces, I feel grief in my heart, and I look at my children and fear for the taonga (treasures) that they may never know. I grew up with swimming and fishing in a river where I cannot take my children; these trends cannot continue.

As a country we need to value our lowland freshwater ecosystems more (in fact all freshwater ecosystems) and set an intergenerational vision of what our environment should be like. This intergenerational vision must be kept in mind if we are to avoid continually shifting our environmental goal posts as those claiming 'progress' continue to propose just a little bit more harm to the freshwater environment.

How many ambulances at the bottom of the cliff will be required to clean up or avert environmental disaster before we recognise we need a few speed bumps at the top of the cliff?

At the 2010 NZFSS conference in Christchurch a keynote address challenged freshwater scientists to communicate to the public (not just our peers) on freshwater issues. My wero (challenge) to the NZFSS society is that as a collective we should bring this issue of freshwater deterioration to the nation, rather than leaving it to one or two scientists who have been prepared to step up.

In generations to come, could we look back at 2011 as a time of change when we identified that enough was enough, and we spoke up about the need to halt the deterioration of freshwater

ecosystems? Surely that's better than telling our mokopuna (grandchildren) that we just measured and reported its death?

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Dr Phillipa Pehi

The health of a people is always dependent on the environment within which they live, whether they are aware of it or not. All that sustains the physical body (and many would argue the spiritual and psychological dimensions too) originates from the earth. Even more than this, the place we chose to call home helps to form our identity. Who we are as people is often influenced and determined by where we live, and what environment surrounds us. This is as true for non-Māori as it is for Māori.

In our modern lifestyle it appears we have forgotten that basic fact. In the research I have been privileged to be a part of, I have been forcibly reminded of this fundamental truth. This research has taken me from one end of the country to the other, and every place I have been, the local people active in their environment have expressed concern over what they perceive as the decrease in freshwater quality *and* quantity. Recent droughts in many parts of the country have emphasised this experience for many, with others experiencing flood damage from too much rain. Most are in agreement that these extreme weather patterns are occurring more regularly and are often of greater severity, with the scientific community arguing that the extremity and increases are a direct consequence of climate

change (e.g. Anthes, Corell, Holland, Hurrell, MacCracken, & Trenberth, 2006).

In these modern times, the sustenance from a place often times is taken and given to people in another place. Aotearoa has long been a farming colony with produce being sent all over the world to sustain others. Neo-liberalism and capitalistic approaches have seen that this practice is matched with the people of Aotearoa having to often pay *more* for an *inferior* quality of produce than on the other side of the world (e.g. market price for kahawai, apples and lamb in London c.f. in Hawke's Bay), or to pay less for a product from the other side of the world (e.g. prices of Chinese garlic being *cheaper* than New Zealand garlic). Freshwater is now on the agenda to be traded as a commodity that can be bought and sold (Nicolson, 2010). That will then likely result in a similar scenario to the agricultural produce examples provided above. This approach will then further impact on the fierce competition that is occurring currently in this country between major commercial interests for dwindling water supplies (e.g. see Mercer, 2010: Fonterra v Trustpower). More importantly perhaps, this will impact on the health and well-being of *all* people in Aotearoa, with a decrease in access to clean water and an increase in cost. Furthermore, this negative effect will include impacts on the great outdoor 'Kiwi' lifestyle (e.g. fishing, swimming),

and economic interests such as tourism and commercial fishing.

My opinion is that we are facing an environmental crisis in Aotearoa of a degree that constitutes a civil emergency. The state of our waterways is an important and essential part of our environment (and therefore our health), and yet the exponential degradation of these waterways is going greatly unheralded or unaddressed. Why? Some factors that I believe may have an influence are listed below.

- Dependence on science and research to 'prove' that problems/issues exist. Creates long time-delays due to time and funding required (which is often limited), and also lack of researchers/scientists able and/or interested to conduct the required science. Basic studies of water quality (particularly ongoing longitudinal monitoring) are often deemed not groundbreaking or publishable within the scientific/academic community, and therefore not likely to be funded, and therefore not pursued by scientists/researchers.
- Competing interests of big business and transnational corporations taking precedence over health and well-being of the general populace (compounded by the burgeoning number of such commercial enterprises who have no local connection or sense of responsibility to the local people supported by the New Zealand government e.g. foreign investments and companies).
- Lack of mass media coverage or concern about the state of our freshwater (and environment in general).
- Lack of credibility given to local peoples' (including tangata whenua) valid knowledge about their environment (often gained over many years and sometimes generations of experience and connection to land), and therefore this knowledge is not acted upon.
- Lack of general populace active and physical connection to the environment and/or education on the issues, and therefore lack of concern.
- Lack of support by government bodies to prioritise environmental concerns, including further education of general populace (e.g. cuts in funding to Enviroschools in the current government regime).
- Often a lack of historical context, that is, how does water quality today compare with two decades ago, or three generations ago? Without a comparison, many people are unaware of the rate of degradation or urgency of the situation, and again, lack of scientific evidence is often cited to discredit the historical local knowledge within a place.

It hardly needs to be stated that water is life. The protection and care of our waterways should be paramount in this country. But is it? Are we doing enough? How bad does the situation need to be before we as New Zealanders are motivated to take action?

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Fracking and freshwater – fissures of uncertainty

Many of you will be aware of fracking and its surrounding debate through recent media coverage. As possibly one of the largest issues for freshwater in the United States, and looking like it is on the increase in New Zealand, I asked a New Zealand group to provide an article for the benefit of NZFSS members. – Ed

By Robyn Harris-Iles

In the past decade the Ministry of Economic Development has issued many permits for both onshore and offshore petroleum and gas exploration throughout New Zealand. Hydraulic fracturing, or fracking as it is commonly known, is a technique used by the oil, gas and coal seam gas industry to extract hydrocarbons from shale rock formations deep under ground. The process has only taken place in Taranaki so far but exploration continues apace and the industry plans to use this extraction technique in many regions where mineral exploration has resulted in substantial, potentially lucrative, oil and gas finds.

Until around 20 years ago, vertical wells were the mainstay of oil and gas production but now that supplies of easily accessed hydrocarbons are diminishing, the industry has updated their extraction technology with horizontal, or unconventional, wells and by further developing hydraulic fracturing processes. When gas or oil is discovered, a well site is established and the well drilled to the target depth; the drill bit is then turned and drilled horizontally. There are various methods used in the fracking process but basically steel pipe and concrete casing is constructed around the wellhead and perforated pipe is fed into the well. A mixture of water, sand and chemicals is injected down the well under extreme pressure, fracturing and creating fissures in the rock formation and releasing gas or oil into the well. The sand acts as a prop to keep the fissures open and the chemicals perform various functions such as destroying bacteria and decreasing or increasing viscosity. Chemicals typically constitute around four percent of the fracking fluid, although the amount varies between companies and wellsite requirements. Benzene or diesel, previously used in the fracking process, has mostly been replaced by water and synthetics but hydrocarbons are still used, and often preferred in Taranaki frack jobs, depending on the operator and the job at hand. The diesel, water or synthetic substance is blended with a number of chemicals including gelling agents and surfactants to produce a thick gel. Diesel gel is more effective than water-based fracturing fluids for some applications, particularly where the target fluid is similar in composition to diesel. While the use of diesel may ease pressure on water takes, it raises other issues, not least the migration of diesel into the groundwater. It is not unusual for one well to be fracked ten times or more and for many gas



Fracking well site with condensate tanks, landfarming and adjacent wastewater pit. Wade County, Texas. Photo: Bluedaze.

wells to be drilled on one well pad. The establishment of the well site also includes construction of wastewater pits to contain the 60% of fluids and sludge that flow back up the well to the surface during the fracking process.

In this article we examine the chemicals reported by the Taranaki Regional Council (TRC) as having been used in fracking projects in that region; the potential impacts of fracking on groundwater, streams and rivers; and current policy and regulation and the amount of fresh water taken to be used in the process. Fracking also has environmental impacts on air quality and land and there are reports from the USA and the UK suggesting a link with induced seismicity, but we will focus our attention on fresh water concerns.

Chemical components

In April of this year, following numerous reports of the adverse effects from fracking in many parts of America, the Committee on Energy and Commerce reported to the United States House of Representatives regarding chemicals used in the process. The report found that over a period of four years (2005 - 2009) 14 of the leading oil and gas companies in the USA used more than 2,500 hydraulic fracturing products containing 750 chemicals or other compounds. Some of the components were common and generally harmless, such as salt and citric acid, some were unusual, such as instant coffee and walnut hulls, and some were extremely toxic, such as benzene and lead. Twenty nine of the chemicals used in fracking formulations in the USA were: (1) known carcinogens, (2) regulated under the US Safe Water Act for their risks to human health, or (3) listed as hazardous air pollutants under the US Clean Air Act. These 29 chemicals were components of 652 different products used in fracking during that time.

Accurate information on the exact components of fracking fluid is not easy to come by in New Zealand. The industry remains tight-lipped about providing full disclosure of chemicals and has stated that methods of fracking in Taranaki are not the same as the methods used overseas. Many multi-national companies involved in the oil and gas industry here also use fracking technology in other parts of the world and it is difficult to comprehend why the processes would differ when the regulatory framework has, to date, been very accommodating. Industry representatives John Pfahlert of the Petroleum Exploration and Production Association (PEPANZ) and Bernie Napp of Stratterra, contend that fracking chemicals are safe and can be found in any kitchen. The information contained in Taranaki Regional Council monitoring reports suggests more chemicals are involved than the nine listed by TRC following an Official Information Act request (see Table 1).

While a look at the product labels and Material Safety Data Sheets for these components does lead one to agree with Mr Pfahlert and Mr Napp for some products, there are other products that I for one would not want either discharged to my local groundwater system, or to end up in my drinking water – and they are certainly not found in my kitchen. Of these, ethylene glycol (found in Inflo-150) is of the greatest concern. The Material Safety Data Sheet for ethylene glycol states that for humans:

Excessive exposure (swallowing large amounts) may cause gastrointestinal tract irritation with nausea, vomiting, abdominal discomfort, diarrhea. It can affect behavior/central nervous system within 0.5 to 12 hours after ingestion. A transient inebriation with excitement, stupor, headache, slurred speech, ataxia, somnolence, and euphoria, similar to ethanol intoxication, can occur within the first several hours. As the Ethylene Glycol is metabolized, metabolic acidosis and further central nervous system depression (convulsions, muscle weakness) develop. Serious intoxication may develop to coma associated with hypotonia, hyporeflexia, and less commonly seizures, and meningismus.

Reports from the USA detail groundwater contamination where fracking fluids and/or methane gas have migrated into drinking water supplies and in these cases ingestion of 'large amounts' of contaminants is not beyond the realm of possibility. Although drilling companies deny any link, residents report adverse

health effects in humans, pets and livestock as a result of contaminated water wells and streams, following the introduction of drilling and fracking to their neighbourhoods.

Table 1. A limited list of chemicals known to be utilised in hydraulic fracturing in New Zealand.

Brand name as supplied in response to an Official Information Act request	Product information, sourced either from product label or relevant Material Safety Data Sheet (MSDS).
Xcide 102 (a biocide Claytrol as a clay stabilizer). Active ingredient: Glutaraldehyd	This product is toxic to fish and wildlife. Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans or other waters, unless in accordance with the requirements of a National Pollutant Discharge Elimination System (NPDES) permit and the permitting authority has been notified in writing prior to discharge. Do not discharge effluent containing this product to sewer systems without previously notifying the local sewage treatment plant authority. No LC50 data available; no LD50 data available; No ecological data available.
GS-1 (a gel stabiliser)	No product label found or MSDS available.
GLFC-1b (a gelling agent: natural guar gum)	Not regarded as dangerous for the environment. LD50 (Ingestion): 6000 mg/kg (Hamster), TDLo (Ingestion): 228,000 mg/kg/13 weeks continuous (rat)
Inflo-150 (a friction reducer)	Contains methanol, ethylene glycol, oxyalkylated alcohol. LD(50) Methanol: 5628 mg/kg (oral rat), LC(50) Methanol: 64000 ppm/4hr (inhal rat)
BF-7LD (a borate buffer fluid: potassium carbonate)	No MSDS sheet available; no product information available. However, MSDS for potassium carbonate states: (LD50): 1870 mg/kg (rat). Toxic to mucous membranes.
XLW-56 (a crosslinking agent)	LD 50 500 mg/kg (oral-rabbit)
GBW-41L (a gel breaker: hydrogen peroxide)	No MSDS sheet available; no product information available. However, MSDS for hydrogen peroxide states: Acute oral toxicity (LD50): 6667 mg/kg (mouse). Acute dermal toxicity (LD50): 6667 mg/kg (pig). Carcinogenic and mutagenic.
GBW-12cd (an hemicellulase enzyme)	No hazardous ingredients; LD(50) > 2g/kg (rat)
GBW-5 (a gel breaker: ammonium persulphate)	Toxicity data for ammonium persulphate: Ingestion (LD50): 742 mg/kg (male rat); Inhalation (LC50): 2.95 mg/l (4h)(rat); Skin (LD50): 2000 mg/kg (rabbit). Avoid runoff into storms and sewers, which lead into waterways. Water runoff can cause environmental damage.

Testing of fracking fluids and sludge outflows in the USA has revealed the presence of heavy metals and radioactive particles from drilling through radon-bearing granite. In some cases the amount of radiation found in 'produced water' is thousands of times the safe level limit for drinking water. Hexavalent chromium, hydrochloric acid, ethylenes and tuolene are also components found in fracking wastewater. The following information from the USA House of Representatives report details the 29 chemical components of concern used in USA fracking formulations (Table 2).

Groundwater Fraquifers?

One method of disposal for the fracking fluid flowing out of the well is to re-inject it into disused wells, or into re-injection wells drilled specifically for the purpose. This method creates a permanent deposition of chemical components to the ground with very little certainty about where those fluids might migrate to, particularly in the event of seismic activity. There is at least one re-injection well operating in Taranaki.

The deliberate injection of fracking waste to ground, along with both the presence of fracking fluids during a frack operation and the 40% that is unable to be extracted post frack, allows for fracking fluids to enter the groundwater system through either direct connection through fissures in rock formations, leaks in

well casings, or through migration of fluid up the outside of well casings. Seismic activity increases the possibility of contamination.

Table 2. Chemicals Components of Concern: Carcinogens, SDWA-Regulated Chemicals, and Hazardous Air Pollutants

Chemical Component	Chemical Category	No. of products
Methanol (Methyl alcohol)	HAP	342
Ethylene glycol (1,2-ethanediol)	HAP	119
Diesel	Carcinogen, SDWA, HAP	51
Naphthalene	Carcinogen, HAP	44
Xylene	SDWA, HAP	44
Hydrogen chloride (Hydrochloric acid)	HAP	42
Toluene	SDWA, HAP	29
Ethylbenzene	SDWA, HAP	28
Diethanolamine (2,2-iminodiethanol)	HAP	14
Formaldehyde	Carcinogen, HAP	12
Sulfuric acid	Carcinogen	9
Thiourea	Carcinogen	9
Benzyl chloride	Carcinogen, HAP	8
Cumene	HAP	6
Nitrilotriacetic acid	Carcinogen	6
Dimethyl formamide	HAP	5
Phenol	HAP	5
Benzene	Carcinogen, SDWA, HAP	3
Di (2-ethylhexyl) phthalate	Carcinogen, SDWA, HAP	3
Acrylamide	Carcinogen, SDWA, HAP	2
Hydrogen fluoride (Hydrofluoric acid)	HAP	2
Phthalic anhydride	HAP	2
Acetaldehyde	Carcinogen, HAP	1
Acetophenone	HAP	1
Copper	SDWA	1
Ethylene oxide	Carcinogen, HAP	1
Lead	Carcinogen, SDWA, HAP	1
Propylene oxide	Carcinogen, HAP	1
p-Xylene	HAP	1
Number of Products Containing a Component of Concern		652

The argument postulated by fracking proponents is that the amounts of chemicals used are of a quantity that cannot result in negative effects. However, there are two main issues with this argument. Firstly, because fracking wells rarely occur in singular form any figures quoted about the amount of chemicals must be multiplied by the number of wells drilled through the groundwater aquifer and again by the number of times each well is fracked. Secondly, there is a dearth of information around our groundwater supplies, including a limited understanding of the extent of groundwater locations in New Zealand, the depth of aquifers, their interconnectedness and size. Calculations as to the dilution or otherwise of fracking chemicals and other contaminants, if they enter groundwater, cannot be made with any certainty and assurances of safety in this regard must be taken with more than a grain of salt. Furthermore, dilution of any toxic contaminant is no longer justification or a solution for pollution.

Safety at depth?

The extraction industry assures us fracking depths in New Zealand are beyond the reach of groundwater aquifers. Representatives state that because our aquifers lie so far above the level at which horizontal hydraulic fracturing occurs there is no possibility the fracking fissures and fracking fluid will be able to reach the water supplies. There are several reasons why this assurance may not be correct: the aforementioned dearth of information regarding the position, size and depth of our groundwater aquifers, and the inability to calculate the extent of the fissures created in shale formations during the fracking process. Taranaki oil and gas reservoirs are typically between 2500 m and 4500 m below the land surface. Potable groundwater aquifers in the region have been calculated at a depth of 600 m or above. Calculations regarding the length of fissures created by fracking have been quoted at a maximum of 700 m. While these figures may support the argument that fracking is occurring underground at a 'safe' level, TAG Oil (who are currently producing oil and gas in Taranaki and hold exploration permits in the East Coast, Hawke's Bay and Wairarapa) have recently confirmed they are drilling at relatively more shallow depths of 1400 m to 1800 m at their Cheal well site near Stratford. Clearly, great uncertainty exists around the assertion that no frack fissure will penetrate a groundwater aquifer.

Furthermore, groundwater aquifers are penetrated in the drilling process, with the drill bit running through the groundwater aquifer on its way to depth. Subsequently, pipes and casings are inserted into and through the aquifer. In the USA concrete casings around wellheads have cracked and failed and steel pipes have rusted through over time, allowing contaminants to enter groundwater. The regular seismic activity we experience in New Zealand would also compromise the durability of casings and pipes.

Methane Leaks, Seepage and Impact on Streams

Returning to the process – fracking fluid and sand is pumped into the well under extreme pressure, creating fissures and causing gas and oil to flow from deposits where it was previously trapped and into the well. Gas can be inadvertently released to groundwater or air during this high pressure process in a number of ways:

- forced upwards along the outside of the well casing
- forced upwards through existent fissures or those created by fracking
- forced out of the well due to casing failure
- deliberately vented to air to reduce pressure (off-gassing) prior to flaring.

Filming at well sites and gas compressor stations in the USA with a FLIR camera shows considerable amounts of gas are released to air, both during fracking and afterwards, through deliberate venting and accidental ongoing discharges. From a freshwater perspective the seepage of methane gas into groundwater and streambeds is our greatest concern. Reports from the USA detail methane gas escapes into ponds, household bores and streams following fracking. This has allegedly caused die off of local fish populations and riparian vegetation.

Landfarming and Misting

The main method of disposal of contaminated fracking sludge, as well as drilling 'muds' used in conventional extraction, is a process known as landfarming. In Taranaki there has been a recorded instance when drilling sludge was applied directly to pasture. A TRC report details the efficiency of



Unlined wastewater pit, Inglewood landfarm, Taranaki. Photo: TRC.

this method of disposal because the cows, being put out to graze the pasture, trampled the drilling sludge into the ground with their hoofs. More commonly used is the removal of the topsoil layer, spreading the drilling sludge onto the land, followed by replacement of the topsoil and repasturing. Landfarms in Taranaki also dispose of contaminated fracking wastewater through a series of unlined holding ponds and by spraying it onto the ground. Many landfarms in the region are situated along the Taranaki coast, directly next to the sea.



Illegally dumped sludge, Inglewood landfarm. Photo: TRC.

In the USA large pits are used to store contaminated water, which is also sprayed into the air in a process called ‘misting’, in order to facilitate evaporation. While the wastewater pits are lined, the liners often fail allowing contaminated water to drain into the ground. The extent of gas drilling is widespread in many states and sludge is buried in huge landfarms. Fracking wastewater has been incorporated into sewage disposal, pumped directly into streams and rivers, re-injected, sprayed onto roads and there are also numerous documented cases of illegal dumping.

Water Use

Fracking typically uses around 20 million litres of water for each frack job. Chemicals and sand are added at different stages of the process and approximately 60% of this mixture is forcefully ejected from the well and needs to be managed as a hazardous substance. While some efforts are now being made to recycle fracking wastewater, this is often not the case in an industry where maximum profit for minimum input is the ultimate goal and in the USA only 1.5% is recycled for further fracking. Consequently, every time a well is fracked a large amount of freshwater is permanently removed from circulation in the environment. Along with the vast quantities of water required in the process, sand mining is a recent concern in the USA where water is also required to clean the sand ready for fracking.

Government Policy and Regulation

Apart from an outdated policy guideline and the Resource Management Act (RMA), there are no regulations specifically governing fracking. In Taranaki where fracking is taking place, regulations are loosely applied under the RMA with regard to the discharge of stormwater (run off from frack sites), produced water, drilling muds or sludge and discharges to air. Until recently the industry was not required to obtain resource consents for drilling and fracking in Taranaki, but public pressure from concerned community groups and local hapū has led TRC to change this policy. Even so, all drilling and fracking resource consents are still ‘non-notified’ because TRC contends the industry is a ‘low impact activity’. Unless a well site or landfarm is established in their immediate vicinity, people will not know when a consent is being considered or granted (unless by word of mouth) until after the process is complete, despite the fact they may live downstream from, or in fairly close proximity to, the site.

Mineral extraction is a key component of this and the previous government’s energy strategy and large blocks of land have been opened for exploration over much of the country, including vast tracts of public land administered by the Department of Conservation. While National Parks have been exempted from the mineral extraction programme, much of the conservation estate opened for drilling and mining is comprised of pristine native forestland, watershed and wilderness areas.

Acting Minister of Energy and Resources, Hekia Parata, has stated the Crown Minerals Act 1991 is currently under review and will be open for submissions in the near future (*Marae Investigates* TV1 25 September 2011).

New Zealand's Environmental Protection Authority (EPA) was established this year to oversee resource consents of 'significant national importance' but critics have voiced concerns about the centralisation of decision-making in Wellington and how this might exclude regional aspirations, expectations and accountability in terms of protecting local environments.

Compliance

While the industry is promoting the line that New Zealand's regulatory bodies sufficiently protect our water resources, the track record shows little to support this claim. In Taranaki, chemical components in discharges from the drilling industry are often monitored and recorded by the drillers themselves. Fracking and drilling wastewater is stored in unlined pits, discharged onto land where it drains into waterways or discharged directly into streams and rivers. Resource consents issued by the Taranaki Regional Council allow these types of discharges and, despite breaches of compliance, consents are often renewed. In the case of a landfarm near Inglewood TRC reported non-compliance on the following issues:

- disposal of drilling waste within six metres of a waterway
- substandard wastewater pit construction that resulted in hydrocarbon contamination of a stream via an underground spring
- recorded barium levels double the amount in Canadian guidelines used by TRC as their benchmark
- increased levels of chloride, nitrate and barium in the groundwater
- hydrocarbon contamination seven times the consent limit.

Taranaki Regional Council noted that barium is 'a contaminant of concern' on the landfarm site. Despite these serious non-compliance issues TRC reported that the operation has 'achieved a good level of compliance with resource consents' and promptly renewed the landfarm consents, with reduced reporting requirements and less frequent TRC inspection and monitoring visits.



Gasfields along the Colorado River show the extent of fracking related activity. Photo: Hunter Valley Protection Alliance.

Freshwater?

Human activities have led to a rapid decline of water quality in our rivers, lakes and streams, due mainly to industrial and agricultural pollutants. When we consider how best we might conserve and preserve the quality of our water we should look to the USA for a salutary lesson; streams and rivers have disappeared in some areas, including the entire Colorado River delta, where the river no longer enters the sea.

In the midst of the debate around fracking, one thing is clear: information as to the safety and long-term impacts of the practice on our freshwater environments is uncertain at best, frightening at worst. That we can't guarantee with confidence the water we pull from our aquifers will be uncontaminated should give us the certainty we need to follow in the footsteps of the likes of France, South Africa, New South Wales, Quebec, New York and others who have all moved to protect their freshwater environments by either banning or placing moratoriums on the practice on fracking. Let us keep our freshwater fresh.

Water Issues and the Farming Industry

In a small country hall hoedown, complete with a cider competition and a bake off, I met our local Federated Farmers president. I had heard he was a decent bloke, but when so often there are less-than-jovial interactions between Fed Farmers and freshwater managers and scientists (particularly through the RMA process and the media) I approached Brian not without a little trepidation. I think he may have felt a tad similar when I said I work at the Department of Conservation. But after a short while and a few too many meringues, we both found we had quite a lot to talk about. I enjoyed the yarn and decided to invite Brian to offer his perspective on water issues for NZFSS members, from what is often considered 'the other side of the fence'. – Ed.

By Brian Doughty

President, Federated Farmers, Whanganui

Water has for many years been the life blood of New Zealand farming, not only for stock but also used in household situations, in large amounts on the dairy farm, and in processing for all agricultural industries. Like most sections of agriculture, years ago I suspect not much thought was given as to where this water came from or even how long the supply might last. To think at that time we would even consider where our run off from fertilizer use or dairy shed effluent went to was probably never in the mix, much like the early hill country settlers with vegetation clearance.

So we get to today where our rivers and streams in some areas are being polluted by ground and point source contamination from a host of industries with rural and urban backgrounds. Again like all issues, take out the fringe opponents who want to see NZ like it was 200 years ago (as this would almost be impossible), to the other side of those who continue to deny any such pollution is being caused by them. Enter the Land and Water Forum set up over recent times in an attempt to bring together all those who have an interest in water quality and quantity issues in an effort to set

national standards for the future use of our most valuable resource.

As an industry, dairy has been leading the charge to clean up our waterways, with Taranaki Regional Council one of the councils to show leadership in encouraging farmers to exclude stock from waterways, carry out riparian plantings, have a current nutrient management plan, and improve effluent management, along with a bucket of other options.

This has all been achieved by the council working with farmers rather than by presenting them with a host of regulations and over-enthusiastic field staff willing to beat the polluter into submission. This method has never worked, and never will.

While farmers can be seen as custodians of our land and water resources, water allocation, management, and quality are all issues that will need the commitment of those involved.

Water quality is a critical factor in our urban-rural relationship. It needs good, objective science, and practical economic solutions, rather than emotive politics.

Opportunities Abound in the Freshwater Biological Association of the United Kingdom

After moving back to New Zealand, David Le Cren spent some time collating his thoughts on the FBA. From David's reflections below, readers will see that the FBA provides some useful resources and good opportunities for NZFSS members and other freshwater researchers. Sadly, David passed away on September 9 2011 at his home in Christchurch, aged 88. As the article denotes, right up until his death he still maintained an active interest in freshwater science, including as a member of NZFSS and S.I.L. An obituary will follow in the next issue of the newsletter. – Ed, and the President

The FBA is an independent, non-profit-making company and registered charity. Its income now comes from research and development grants, membership fees, publications, rental of laboratories and research facilities, and various other sources. It owns and occupies a modern laboratory and associated facilities on the shores of Windermere in the English Lake District, as well as the River Laboratory in the south of England. The FBA still maintains a library that is global in coverage and is one of the richest in the world in many aspects of freshwater research. The FBA can provide good facilities for a variety of researchers: former employees (known as Honorary Research Fellows), visiting workers supported by universities and a variety of other organisations, and several postgraduate research students.

The FBA was a major research institute in its own right until 1989, when most of its research staff transferred to a new institute, the 'Centre for Ecology and Hydrology' ('CEH'), a component body of the UK's Natural Environment Research Council. The FBA now concentrates its activities in meeting the information and other needs of researchers in freshwater and those managing freshwater, providing facilities for freshwater research and generally supporting the needs of its members. This it does by maintaining its two laboratories, publishing taxonomic keys and other useful information, maintaining a good library and

an expanding on-line information service, running short specialist courses, organising meetings and publishing peer-reviewed journals. Recently, it has taken on the publication for SIL (the International Society for Limnology) of a new journal – Inland Waters. It is continuing a conservation and research project that studies and breeds the endangered bivalve the pearl mussel (*Margaritifera margaritifera*), whose larvae are parasitic on the gills of salmonid fishes. Meetings on freshwater topics are arranged in collaboration with European, national, regional and local organisations. Recently, one of these was sponsored to celebrate and assess the 65 years of regular sampling in Windermere and a few nearby lakes. This sampling was initiated and carried out for the first 44 years by the FBA. The contributions to the meeting will be published in a special edition of Freshwater Biology, and will emphasise the value of such long-term projects. Finally, the FBA is moving back into a small research portfolio of its own, concentrating on endangered species, the lake littoral (including reedbeds), and the value of wider community involvement in freshwater monitoring. To contact the FBA see www.fba.org.uk or facebook.com/freshwaterbio.

David thanks Dr Mike Dobson for his input into this article.

Conference hears from a diverse group on freshwater issues

This year, Forest and Bird made freshwater the theme of their annual conference. Entitled Freshwater for Life, the group heard from researchers, managers and industry members alike.

By Marina Skinner

The Wellington Forest & Bird conference in June heard several different perspectives on freshwater from Dr Mike Joy, other academics, Fonterra, the Land and Water Forum and recreation and conservation groups. Massey University's Dr Joy has been speaking up about the deterioration of our freshwater for 15 years and he is frustrated and angry the situation keeps getting worse. His presentation was centred on five myths surrounding our environment:

- New Zealand is clean and green and 100% Pure
- Biodiversity and the environment are looked after by central government
- We are 100% Pure compared with the rest of the world
- Dairy farming in New Zealand is sustainable
- The Resource Management Act protects the environment.

Dr Joy told the conference, 'The golden goose for our tourism and exports is the 100% Pure branding. Well, I reckon our goose is cooked. We need an inquiry into the true value of the intensification of farming to New Zealand. I think we have been sold a dud. When we lose our clean, green image we don't have anything else really. We have to wake up and do something now.'

Professor Ken Hughey of Lincoln University spoke about how there is almost universal support from New Zealanders for ensuring there are no further significant pollution discharges into our waterways and for ensuring almost all our rivers are safe to swim in.

Perception surveys done by Professor Hughey and colleagues over the last decade also showed the number of people who perceived farming to be a major cause of damage to freshwater grew from 20 per cent to 50 per cent between 2000 and 2010.

Fonterra Sustainability Field Team Manager Emma Parsons told the conference the company's customers were demanding the company deliver on sustainability and she added the company was responding to those demands. The Clean Streams Accord had prodded farmers into better management of their effluent, but more commitment was still needed.

Land and Water Forum chairman Alastair Bisley said the forum found there needed to be limits on water quantities and quality and a better way of allocating it. The government-backed forum reported recommendations last year on how to improve water management. 'The problems are not a lack of technical solutions but a lack of agreement on which way we should travel to maximise the benefits of water, including the benefits of conservation and recreation as well as economic interests,' he said.

Forest & Bird Advocacy Manager Kevin Hackwell, who has been closely involved in the Land & Water Forum's work, agreed with Mr Bisley that taking part in a collaborative process such as the forum meant every participant had to give up a little power but in return they expected a more durable solution to emerge. He added that NGOs such as Forest & Bird are representing the public interest in freshwater issues and are

responsible for holding authorities to account, saying 'These are our water resources and we demand they are managed better.'

Economic commentator Rod Oram said proposals for 14 major water storage projects to more than double the amount of irrigated land in New Zealand did not make a lot of economic sense and would produce a relatively low rate of return

of only 6.4% to the government. The government announced as part of its Fresh Start for Fresh Water package in May it would give \$35 million to get these projects started and it would invest \$400 in irrigation infrastructure. New Zealand had to move beyond producing increasing amounts of commodities if it was to secure a strong economic future, Mr Oram said.



Nicola Vallance from Forest & Bird and Phil Teal from Fish & Game listen as Mike Joy speaks to the Forest and Bird annual conference.

Critter of the Year

By Stephen Moore

Glyptophysa

Here's one NZFSS members might be able to help us with. The native freshwater snail *Glyptophysa* (which we once called *Physastra*) belongs to the family Planorbidae – the same family as that of the introduced 'rams horn' snails you often find in the aquarium trade. Planorbids are among the pulmonates, which are air-breathing snails usually lacking an operculum (the hardened 'trap door'

that closes off the shell aperture of other snail groups).

At first glance the 'left-handed' shell could be mistaken for the common introduced *Physa/Physella*, but *Glyptophysa* has a sharpish ridge around the edge/ridge of the whorls, sometimes with rings of small bumps/nodules along



that edge. Sometimes there is more than one ring of these nodules on the body whorl (see photo).

Glyptophysa (*G. variabilis* is the one known species in NZ) seems to be rarely recorded in recent years (we sometimes find them in wetlands) and there have been suggestions that this native species may not be able to compete well with the far more common introduced *Physa*. In fact there are so few recent records of *Glyptophysa* that if you do collect them, please don't throw them away! Bruce Marshall at Te Papa would be grateful for specimens in >90% ethanol (or deep freeze them in a block of ice then contact Bruce). Please send specimens (with site location details) to Bruce at Museum of New Zealand Te Papa Tongarewa, 169 Tory Street, Wellington.

Thanks!
Stephen Moore



New distribution records for freshwater polychaete and notonemourid stonefly

by Alex James and Amber Sinton, EOS Ecology

Namanereis tiriteae

New Zealand's freshwater polychaete worm has previously only been recorded from four North Island rivers (Waiapu, Tukituki, Manawatū, and Ngaruroro) and some of their tributaries. While processing macroinvertebrate samples for the Greater Wellington Regional Council's (GWRC) annual State of the Environment monitoring we came across two well preserved polychaetes in a Waikanae River sample. After a visit from taxonomy guru Mike Winterbourn our supposition that they were not estuarine polychaetes that had ventured upstream but were the true freshwater polychaete *Namanereis tiriteae* was confirmed. This is the most southerly record of *N. tiriteae* (the Waikanae River is just north of Paraparaumu) and the collection site was much nearer to the coast than previous collection locations.



Namanereis tiriteae anterior, dorsal view (above) and lateral view (below).

Spaniocercoides watti

Despite the Greater Wellington area being reasonably well sampled for freshwater taxa, we have found a new record for the stonefly nymph *Spaniocercoides watti* (Notomemouridae). Identification was thanks to Mike Winterbourn and was made using the developing genitalia of a final instar female. *Spaniocercoides watti* had previously only been recorded from Northland and Raglan, whereas these specimens were found in a sample collected by the Greater Wellington Regional Council from a small stream in the hills above York Bay (across the harbour from Wellington's CBD). Comments on the very helpful website www.stoneflies.org.nz indicate this species may be rarely collected due to the nymph possibly preferring the hyporheic zone. This seems to conform with the environment in which these specimens were found: a well forested seepage that could only be euphemistically regarded as a stream.



Spaniocercoides watti female, with ventral view of abdomen and developing genitalia.



Research News

OTAGO UNIVERSITY

Despite valid assumptions that the cold weather down in Dunedin has a numbing effect, it also has the advantage of needing to keep brains, bodies, and budgets HOT and on the move to stay mildly functional! So in between boiling the jug and knitting woolly ear muffs, the freshwater team at Otago University have been putting their brains, bodies, and budgets to work, resulting in a suite of interesting and innovative research ...

Reality TV, Galaxiid style. NOW IN 3D!!

Aurélien Vivancos is exploring the social structure characteristics of juvenile galaxiid shoals in his PhD by using an innovative software tool called VidSync that will allow him to model in 3D fish movements and behaviour from stereo video footage. This will make a new range of quantitative data accessible to investigate fish behaviour and social structures.

Induced disturbance and heavy irrigation = galaxiid safe-havens?

Heavily irrigated sections of streams may provide refuge for native galaxiids by creating unfavourable conditions (eg low oxygen, high temperature) for their primary predators, brown trout (*Salmo trutta*). **James Shelley** is investigating this phenomenon in the intermittent Ida Burn catchment, a tributary of the Manuherikia River, throughout summer, over three spatial scales: catchment, reach, and hydromorphological unit (e.g. riffle, pool). In 2021 water leases in the Ida Burn will be renegotiated with a potential outcome being the return of minimum flows, so there is a pressing need to better understand the processes acting to maintain galaxiid populations within the catchment.

For the first time in NZ, the use of the piscicide rotenone has been trialled by DOC to remove brown trout in two streams within the Zealandia sanctuary in Wellington, refreshingly extending the rehabilitation of native ecosystems in sanctuaries beyond the birds and into the water. **Lan Pham** is using this opportunity of major disturbance to study the recolonisation of invertebrates at small spatial scales, and the effects on the galaxiids which were re-introduced to the treated streams. The results and lessons



This picturesque stream within Wellington's Zealandia (Karori Wildlife Sanctuary) was treated with rotenone slurry in a DOC-lead project trialling the use of the piscicide in flowing water to eradicate trout. Photo: Lan Pham

learnt from this project have implications for using rotenone as a management tool to remove exotic species from threatened galaxiid habitats.

Peter Jones is carrying out an evaluation of the implications for future galaxiid species management and conservation by looking at the role of life history strategies in determining the distributions of native galaxiid species in Otago and Southland. His work will involve an analysis of the importance of amphidromy, fecundity and recruitment traits in influencing species' spatial distributions and abilities to co-occur with trout.

A rather unusual case of sex change?

Manna Warburton is wondering why there are more female torrentfish in the upper reaches of the rivers they live in. Torrentfish may have retained a marine sex determination system shared with the sandperch (Pinguipedidae) that allows them to change sex at a specific point in their life history. Manna is planning to investigate this possibility, which would be extremely unusual for a freshwater fish, as part of his PhD thesis.



Torrentfish may have retained a marine sex determination system that allows them to change sex at a specific point in their life history. Photo: Manna Warbuton..

Delving deeper into our knowledge of native freshwater species

A decline in population density of the endemic fish, banded kōkopu (*Galaxias fasciatus*), has been reported since European settlement in New Zealand. Habitat degradation due to land use practices is believed to have caused this decline. **Abbas Akbaripasand** is looking at the interactions between fish density, habitat characteristics and food webs in some small streams in Otago, questioning the drivers of habitat selection in fish populations. What is the relative importance of habitat structures (physical and chemical factors) and food abundance in habitat selection? Abbas is also investigating the calorific value of prey in fish diet to gain a better understanding of its role in food selection.

Jeff Vanderpham is currently in the final stages of his research on common bully morphological variation/plasticity and feeding behaviour. Several patterns in morphology related to life histories and habitat conditions, as well as a few anomalies, have been identified. The final results promise to provide some interesting new details about one of New Zealand's most common freshwater species, as well as a better understanding of generalist morphology and phenotypic plasticity.

Gerry Closs is catching up with various items of work after a period of sick leave – he managed to break his leg in February by crashing his bike where roadwork was in progress to make cycling safer. Final drafts of a paper co-authored with **Andy Hicks** and **Phil Jellyman** examining the role of amphidromy are being reviewed, and the results of the Fiordland amphidromous fish recruitment work are being analysed and the results written up.

Andy Hicks has submitted his PhD thesis, and is awaiting the decision of the examiners. Andy is currently working with DOC Southland as a freshwater technical support officer while Emily Funnell is on maternity leave. **Nicholas Dunn** is also close to finishing his PhD examining the role of hydrology in shaping galaxiid morphology.

This is your life, Brook Char.

Lance Dorsey's PhD project will assess the past, present, & future of Brook Char (*Salvelinus fontinalis*) in New Zealand. Lance plans to study brook char life history and their impact on native fish and invertebrates in headwater streams in Otago.

Trout – Lactose intolerant? Salinity savvy?

Javad Ramezani has completed his year long study of the relationship between dairying, habitat condition and trout life history. A strong and consistent relationship has been found between the percentage of dairying in a catchment and a steady decline in the number of juvenile brown trout over the summer season.

Ramsmus Gabriellson has completed all his field work on patterns of trout migration in the upper Clutha catchment. Trout otoliths collected from trout raised under varying salinity conditions will be analysed in Melbourne in May. The results from this analysis will be used to validate relationships between ambient environmental and otolith concentrations of various trace elements.

Abbey Reith is close to completing her MSc thesis on trout recruitment and migration in the lower Clutha. Abbey has started teacher training in Christchurch and is fitting in the thesis writing around class preparation.

Leonie Kücholl is currently analysing the result of her latest experiment to find out if temporal predictability of food is as important for the behaviour and dominance structure of juvenile brown trout as spatial predictability.

Rachel Paterson completed her PhD investigating the influence of exotic salmonids on native host-parasite dynamics in New Zealand and Argentinean freshwater fish. Using a combination of field surveys, experimental infections and dynamic population modelling this research identified mechanisms through which exotic fish can alter native disease burdens. Rachel is now working as an assistant research fellow at the Otago University Agriculture Research Group on Sustainability (ARGOS) in the Centre for the Study of Farming, Agriculture and the Environment (CSAFE), and is investigating the influence of farm management practices on stream health.

Our remarkable estuaries: a rough road ahead!

Estuaries are probably the most vulnerable ecosystem to global climate change, especially in regard to rising sea levels. In estuaries mysid shrimps are the critical link between benthic and pelagic food webs, and form a large proportion of the faunal biomass. **Sourav Paul** is working on modelling distribution, inter-specific competition and population dynamics of *Tenagomysis* spp in estuaries of New Zealand to predict how they may respond to potential climate change.

Beate Bierschenk is looking at the life history and distribution of estuarine mysids in the Taieri River. Two species, *Gastrosaccus australis* and *Tenagomysis macropsis*, exhibit marked seasonal/ontogenetic change in distribution along the estuary, which seems quite remarkable given that they are primarily pelagic species and are able to maintain position in this highly variable environment. Beate is currently completing a final experiment examining how water turbulence influences mysid orientation and swimming behaviour.

Antje Bierschenk is continuing her work on the influence of catchment land use on rivers and estuaries. In 2010 she conducted an experiment to investigate the impact of catchment land use on organic matter decomposition rates and algal biomass accrual using standardised substrates in ten South Island rivers and estuaries. The percentage pristine area in the catchments and nutrient concentrations proved to have a strong influence on the measured ecosystem functions.

Rocking the snot

Vanessa Hammond has been working on her year's worth of didymo data collected from Otago rivers, with strong relationships between river regulation and nutrients emerging. Vanessa is about to take some time out from thesis writing for the birth of her second child, but is still aiming to complete her PhD by the end of the year.

When keeping the pipes clear isn't the most ideal scenario

For his Master's research, **Michael Greer** is currently heading a project supported through the Ministry of Agriculture's sustainable farming fund. By using faunal surveys and radio telemetry he aims to determine the effect of current drain clearing techniques on the native fish assemblage of Southland drains. His work also includes trialling two alternative techniques in the hope of limiting this impact. The first involves clearing only half the drains in alternating fifty metre sections, so that half the overall habitat remains intact. The second involves placing artificial refuge structures in cleared drains.

Linking agriculture to trematodes

Sabrina Hock's area of research focuses on the indirect effects agricultural run-off has on trematodes in freshwater ecosystems. To be specific, she is looking at the proliferation and transmission of trematodes in the New Zealand mud snail, *Potamopyrgus antipodarum*.

Antibiotics and river biofilms

Cynthia Winkworth recently completed fieldwork investigating antibiotic presence and antibiotic-resistant microbes in river biofilms across the Southland Region as part of her 3-year postdoctoral fellowship, funded by what was previously the Foundation for Research, Science and Technology and is now the Ministry of Science and Innovation. Using molecular techniques she is determining baseline levels for both, as well as how microbial biofilms respond to differing land use throughout the year. She is also working on a project funded by the Maurice and Phyllis Paykel Trust examining antibiotic resistance patterns in biofilms located along a single river (Taieri River, Otago Region) across one year.

Native plants as riparian nutrient buffers

Greg Stanley's been working on a pilot study looking at the effect of agricultural leaching on two native buffer species namely: *Phormium tenax* and *Carex secta*. The study looks at three levels of leachate application associated with different dairy farming intensities and aims to determine how suitable the plants are as buffers of effluent. The project is a good start at demonstrating how plants cope in the buffer strips associated with different farms.

Multiple-Stressors in streams: Hot, Rich, Dirty and Dry!

Jeremy 'Jay' Piggott is busy unravelling the interactive effects of raised water temperature, nutrient enrichment and fine sediment deposition on instream structure, function and measures commonly used to assess stream health from a series of stream-side channel experiments where the three stressors were manipulated simultaneously using full factorial designs.



An experiment under the rainbow – The Kauru stream channel experiment. A complex set-up comprising 128 circular stream channels, 8 water temperatures, 2 nutrient levels and 2 deposited fine sediment levels. Photo: Jeremy 'Jay' Piggott.

Katha Lange just completed a survey of land-use effects and the benthic communities of 43 streams in the Manuherikia catchment and is now processing samples in the lab. Fish and Game is also investigating the fish communities at Katha's sites. Katha will spend the second half of the year on a research visit to the Leibniz-Institute of Freshwater Ecology and Inland Fisheries in Berlin, Germany, to further enhance her skills in modelling stream ecosystems. She will be focusing on the effects of low flows on benthic invertebrate communities.

Annika Wagenhoff submitted her PhD thesis, 'Multiple-stressor effects along gradients of deposited fine

sediment and dissolved nutrients in streams' in March 2011. The first publication from her work entitled 'Subsidy-stress and multiple-stressor effects along gradients of deposited fine sediment and dissolved nutrients in a regional set of streams and rivers' is in press at *Freshwater Biology* and is co-authored by **Colin Townsend**, **Ngairé Phillips** and **Christoph Matthaei**. She presented her work at the recent Symposium for European Freshwater Sciences in Girona, Spain.

Christoph Matthaei has been busy presenting the recent multiple stressors research done by the Stream Team to audiences throughout New Zealand and the world, including the Otago Regional Council, the Ministry of Agriculture and Forestry, two research institutes in Austria and Switzerland and a conference in Spain. He has also analysed data collected by regional councils across the country as a collaborator in a FRST (MSI) Environlink Tools Development research project aimed at establishing nationwide guidelines for monitoring sedimentation in streams. This project is led by **Joanne Clapcott** and **Roger Young** from Cawthron Institute.

Colin Townsend continues to publish papers with colleagues and students on topics related to land-use impacts and multiple stressors in stream ecosystems. In addition, and because of his great age, some earlier work is now finding its way into influential meta-analyses that take large-scale spatial and temporal perspectives. Thus, work in the 1990s on food webs in Taieri tributaries has contributed to an analysis of food webs from marine, stream, lake and terrestrial systems to test the hypothesis that a predator that is higher in the food web will be more similar in size to its prey than a predator at the bottom of the food web, which tend to be proportionally larger than their prey (Riede et al. 2011). And work in the 1970s in the UK has contributed to a four-decade long analysis of invasions and irruptions of top predators in an acid stream whose pH systematically increased as acidifying emissions in Europe declined (Layer et al. in press).

UNIVERSITY OF CANTERBURY

It has been an exceptionally eventful year for the University of Canterbury's Freshwater Ecology Research Group (FERG). There has been a substantial changing of the guard in our group, we moved into our new laboratory space created during Stage I of the Biology renovation, then moved again (between quakes) into temporary offices so that our office space can be renovated during Stage II – and in the midst of this there were two major earthquakes to contend with. Although we hope the world might eventually stop shaking, we are getting on with things and in the end have only suffered relatively minor disruption and loss of time/data. The fact that we are back to a 'new sort of normal' and working at a high level again is testament to the resilience of our people, their commitment to their work, their care and support of each other, and the help we have received in the recovery. We certainly appreciated all the messages of concern and offers of help from the freshwater ecology community around the country and the world. Thank you!

Angus McIntosh, now a full professor, continues to oversee three projects. These include work on enhancing the effectiveness of riparian management (funded by the Mackenzie foundation) research on the influence of spatial compression (e.g., low flows) on stream food webs, and work on native fish ecology associated with flow variability.

Jon Harding is continuing research on the effect of Acid Mine Drainage on stream systems. The most recent focus has been on the tolerance of fish species to acidity. Jon has also started several studies investigating the effect of earthquakes on urban stream health, food webs and restoration.

Mike Winterbourn continues to work on multiple invertebrate-related projects, especially involving the recently established dragonfly *Tramea loewii* in Northland.

Post-doc **Jon O'Brien** is continuing to lead the Mackenzie Foundation project on riparian management in Canterbury streams. Jon is conducting an experiment using organic matter additions to stimulate instream nitrogen retention and denitrification. He is also working on a co-operative project with NIWA examining the role of macrophytes on stream metabolism and nutrient retention. Also part of the Mackenzie project, PhD student **Elizabeth Graham** is continuing her research on the effects of nutrients and eutrophication on stream food web structure and function. This year, she is conducting field experiments on how resource availability and diversity can structure food web function. **Frank Burdon** continues his PhD work investigating the effects of fine sediment pollution on invertebrate communities in agricultural streams. Over the past summer, he has conducted field and laboratory experiments exploring how sediment affects the quality and availability of basal food resources for stream invertebrates. **Teresa Burrell** is in the final stage of her MSc research on factors that control trophic state in freshwater ecosystems. She is currently writing about how riparian planting influences trophic state in Canterbury streams and finishing up lab work from nutrient addition experiments on Lake Forsyth. New MSc student **Karen Renouf** is starting a new project investigating retention of non-point agriculturally-sourced nutrients within riparian buffer zones by specific vegetation type. After a detailed survey of riparian vegetation adjacent to agricultural land in Canterbury waterways, she is now working on quantifying nutrient budgets of native vegetation versus grass buffer zones within high and low intensity land-use areas.



Leaf-pack addition experiment in the Plaskett Drain near Rangiora. Photo: Jon O'Brien.

Kristy Hogsden continues her PhD work on the effects of acid mine drainage on the food webs of West Coast streams. She is conducting lab and field experiments to assess how changes in food web structure alter ecosystem functions such as organic matter processing. Also working on the West Coast, **Kate Schowe** is developing a diatom-based index for streams receiving acid mine drainage. She is currently developing field experiments to investigate how changes in acidity and substrate quality impact diatoms.

PhD student **Simon Howard** has recently completed a survey aimed at determining the habitat preferences of upland longjaw galaxias. This involved fishing over small areas and collecting information on stream velocity and substrate at the immediate capture locations across braided river beds. He started a second survey aimed at measuring growth rate changes in bignose galaxias and upland longjaw galaxias in response to changes in flow. This has involved tagging the galaxiids to make them individually identifiable, and their growth over time will be measured by re-capturing tagged fish in subsequent visits to sites.

Jonathan Bray is into his second year of PhD studies, investigating physicochemical controls on didymo bloom dynamics. Due to the February earthquake an NDS experiment had to be abandoned (it got left on the bench and grew everything but algae). Given this, a hasty change of direction meant the summer was not a complete waste. He is currently investigating how biomass is impacted by sediment and disturbance in relation to lakes. Lab work from a 56-site SI survey is close to completion.

PhD student **Dunladi Umar** is continuing his research on land-use effects on stream communities in highland tropical streams in Nigeria. Over the past year he has reviewed the benthic ecology of tropical streams worldwide and the state of our knowledge on how land use affects this system.

Simon Stewart has been using stable isotopes to examine the sources and fate of nitrogen within streams on the Banks Peninsula and is now working hard to finish off his Master's research on this topic. Setbacks from the recent earthquake have led to opportunities through collaboration with researchers at the USGS in California.

Helen Warburton has begun her PhD research with a mesocosm study to look at the effect of predator and prey body sizes and species identity on interaction strength. She has also presented an award-winning poster at the SIZEMIC conference in Germany, and visited the Universities of York, Sheffield and Queen Mary London.

Mark Galatowitsch started his PhD last year and is studying life-history trade-offs and dispersal of aquatic insect generalists between temporary and permanent ponds in the Canterbury and Marlborough high-countries. He is currently collecting demographics data, continuing a field colonisation experiment and is planning field and lab experiments on generalist traits under drying conditions and responses to different pond predators (e.g. fish and invertebrates).

Kimberley Roberts has just completed her first field season for her Master's thesis, looking at factors that may limit the population recovery of sensitive aquatic insects in streams impacted by agriculture.

Post-doc **Pete McHugh** finished his research on stream size effects on food webs, and has moved on with his wife Katie to take a position with the State of Oregon in the USA. **Phil Jellyman** has successfully finished his PhD and has continued on with the FERG group as a post-doc. He is currently working on a bio-assessment project on the Hurunui River. Other recent graduates include **Hannah Franklin**, who will be starting a PhD at Lincoln University, and **Rebecca Campbell**, who recently completed her PhD on stream community assembly.

Angus McIntosh, Helen Warburton and Melissa Shearer electrofish in the Porter River. Photo: Jane Gosden.



VICTORIA UNIVERSITY OF WELLINGTON

School of Geography, Environment and Earth Sciences

Professor Rewi Newnham and **Dr Aline Holden** are making a reference collection of cuticles from wetland plants for comparison with material from swamp cores. **Martha Trodahl** has completed her work on the effects of hydrological changes on a core from Lake Wairapapa. **Dr Margaret Harper** helpfully identified diatoms for students and from Mana Island for the 2011 Mana Bioblitz.

UNIVERSITY OF WAIKATO

Chris McBride has continued to expand the remote monitoring lake buoy network, which now includes lakes Tūtira and Waikaremoana (Hawke's Bay), Tarawera, Rotoiti and Rotorua (Rotorua lakes), Ngāroto (Waikato), Taihu (China) and Peirce (Singapore).

David Hamilton completed a special issue of *Hydrobiologia* with co-editor Michael Landman on 'Lake restoration: An experimental ecosystem approach for eutrophication control'. In the issue is a detailed case history of the restoration of Lake Ōkaro, one of the Rotorua lakes, as a model for addressing issues of eutrophication with chemical flocculants. Contributing authors from the University of Waikato include **David Hamilton** himself, **Deniz Özkundakci**, **Ian Duggan** and **Nick Ling**.

Deniz Özkundakci has now taken over leading 'Intermediate Outcome 1' (Harmful Algal Blooms) of the Outcome Based Investment (OBI) in Lake Biodiversity. Outcome Based Investments were formerly funded by the Foundation for Research, Science and Technology, which is now part of the Ministry of Science and Innovation. **Adam Daniel** leads 'Intermediate Outcome 2' (Invasive Fish) of the OBI, having returned from USA to take up this position. Several PhD students are well advanced with their studies: **Rebecca Eivers** is examining mitigation options for Waikato peat lakes subject to agricultural runoff, **Jonathan Abell** is quantifying sources and sinks for sediments and nutrients in stream inflows to Lake Rotorua, **Mat Allan** is using remote sensing images for water quality determination, **Michael Pingram** is tracking food webs in the Waikato River, **Jennifer Blair** is looking at smelt production in Lake Rotoiti and **Nina von Westernhagen** has now completed her thesis on Lake Rotoiti and taken up a position with Hawke's Bay Regional Council (HBRC). Masters students include **Bernard Simmonds**, who is examining phytoplankton distributions in Lake Ōkaro, and **Marie Dennis**, based at SCION in Rotorua, who is looking for viruses in two of the Rotorua lakes. Amongst other staff, post-doc **Konrad Gorski** has been examining linkages between fish migrations and distributions and environmental factors in the Rotorua lakes, while **Wendy Paul** pursues her interest in the environmental factors influencing phytoplankton distributions in the Rotorua lakes.

Ian Duggan has recently returned from sabbatical in the UK and Canada, where he was examining botanical gardens as potential vectors for zooplankton invasions. This involved the chore of visiting a number of gardens including Kew, Royal Edinburgh, Oxford University, New York and Missouri. He has also been continuing work on the aquarium trade, and other microfaunal related topics. He has one current MSc student, **Yvonne Taura**, investigating the effects of willow and willow control on microfauna in the South Taupō wetland.

Kevin Collier has been continuing work on large rivers (<http://www.lernz.co.nz/largerivers.html>), primarily on the Waikato River which is currently the focus of restoration initiatives. Two MSc theses have recently been completed, one by **Melany Ginders** examining the role of natural and constructed side-arms in water quality and plankton dynamics, and another by **Toni Johnston** who examined the effects of riprap and willows on littoral invertebrate and fish communities in the river through Hamilton. Kevin has also been working with **Michael Pingram** who is studying energy transfer through food webs in the lower river, and **Konrad Gorski** who has been making the most of recent floods to investigate the use of inundated floodplains by fish and gathering water quality data to support a predictive model of the lower river. Kevin, Konrad and Michael recently attended the International Conference on the Future and Status of the World's Large Rivers in Vienna.

MASSEY UNIVERSITY

Russell Death has been continuing his research on New Zealand and global patterns of invertebrate β -diversity. **Anna Astorga** (on a grant from Finland) spent the summer analysing and writing up the data from our New Zealand latitudinal study. She has secured postdoctoral funding to return later in the year to continue this research and analyse some of the data collected this summer in Chile (her home country). Russell and **Josh Markham** and Russell Death spent three weeks in Northern Patagonia, Chile helping Anna sample the invertebrate faunas of 48 streams (currently unaffected by didymo or hydrodams) in the Rio Cisne and Rio Aysén basins. The plan was to sample the fish as well but conductivities were on average around 10 μ S and, not surprisingly, the electric fishing machine did not work. Research is also continuing on a Bayesian Belief Network of the mauri of the Manawatū River in association with the project on Integrated Freshwater Solutions (<http://www.ifs.org.nz/>), funded by the former Foundation for Research, Science and Technology. Russell has also attended mediated modelling sessions to act as an observer as part of this project; these sessions have helped a number of interested parties work together to formulate an action plan to clean up the Manawatū River.

Mike Joy has been working with **Bruno David** on the fish survey protocols Envirolink project. The work so far has included a questionnaire and trialling the efficiency of different techniques in lowland streams. **Christy Creed** has been doing most of the fieldwork with **Josh Markham** lending a hand as required. A survey of eel distribution in Māori customary fishing sites in the upper Whanganui River was completed in April by Christy and **Sharon Togher** and is being written up now. Apart from that, Mike continues his advocacy work – letters, articles and talks trying to force some action from apathetic, ignorant and self-serving politicians around the sad and worsening state of New Zealand's environment.

Ian Henderson's interest in lakes is growing with the resumption of regular class field trips to Lake Namunamu. An unusual event happened in this small, deep, eutrophic lake last November during which it appeared to de-stratify and lose all its oxygen. In March it was stratified as usual but there is a very dense concentration of something containing Bacteriochlorophyll d at the thermocline. Apart from this lake, Ian has been seduced by the dark side (marine) and extended his interest in Trichoptera to the marine caddis. **Alex Boast** at Victoria University has just completed an MSc on the phylogeography and phylogenetics of the endemic family of marine caddisflies, uncovering some startling results that will be published soon. Ian also published modelling work on the recreational fishery for blue cod in the Marlborough Sounds, somewhat to the chagrin of MFish.



Rio Cisne, Chile. Photo taken from Puente el Diablo (Bridge of the Devil)

Stella McQueen is researching the use of gabion baskets as habitat by native fish for her MSc. Her book, *The New Zealand Native Freshwater Aquarium*, is selling well and she is working on several public aquarium projects to raise public awareness of the plight of native fish.

Amanda Death (although she is not following in her father's footsteps) was lured into freshwater ecology over summer as a way to earn money. (If only she could see the great financial rewards of freshwater ecology ...) She investigated the effect of gravel extraction from the dry on the invertebrate fauna of the Pohangina River. Surprisingly, she found that gravel extraction on dry river banks may in fact be more detrimental to instream life than extraction from the wetted channel. This is clearly an area that needs further study.



Josh Markham busy with field work sampling stones in Patagonia.

Josh Markham has completed all the field work for his MSc on the effects of river engineering on life supporting capacity and 'just' needs to process the samples and write it up. As a reward his supervisor provided funding allowing him to assist with some stream sampling in Patagonia. To show his appreciation Josh took a nice photo of a police station on the Chilean—Argentine border that nearly had both him and his supervisor shot and/or imprisoned. Fortunately, his four-wheel driving skills in the foot hills of the Andes probably made up for his lack of etiquette with the officials. The truck did not end up like many others the intrepid researchers saw, including the police truck with its caved-in roof from rolling down a cliff, and the two vehicles at the University field station which seemed to be in a similar state.

DEPARTMENT OF CONSERVATION

Amy Macdonald continues to enjoy working on a diverse range of freshwater conservation projects. Annual mudfish monitoring continues in key Northland wetlands during August. With significant fires burning transect lines in two Northland mudfish monitoring sites in recent years, as well as drought conditions in the past two summers, this data has taken on new value. To date, data indicates that mudfish populations are reasonably resilient to the immediate impacts of fire, however longer term effects resulting from vegetation changes and the interaction of fire and drought are yet to be understood. Moving into the advocacy side of things ...the Far North opened their



Pukeko created by Parua Bay School stand proudly beside Lake Ngatu to celebrate World Wetlands Day 2011. Photo: Ngāi Takoto-a-Iwi Research Unit.

celebrations for World Wetlands Day with over 120 people attending a dawn ceremony at Lake Ngatu to honour the significant restoration progress that has been achieved at the lake. The event was organised by the local community in partnership with DOC. A number of students in school holiday programmes around the North Island also contributed to the celebration by creating artistic wetland animals that were displayed on the day.

Inanga Spawning in Nelson-Malborough Conservancy

Fewer office-based tasks than usual this autumn allowed **Martin Rutledge** to extract himself from the computer and get his feet wet doing some pest fish and inanga spawning survey work. A highlight



A cloud of milt drifts out of inanga spawning on the margins of Poormans Valley Stream. Photo: Martin Rutledge

was finding significant inanga spawning in Poormans Valley Stream which enters the Waimea Inlet near Nelson City. Some hungry eels were seen mooching around taking their share of eggs and fish. Protecting the Inlet and its tributaries is a focus of the Waimea Inlet Strategy.

Our native fish up close & personal

New Zealanders can now meet the native fish of New Zealand face to face with the opening of the Genesis Energy Freshwater Aquarium at the Tongariro National Trout Centre in Tūrangi. It is a window to the underwater world of our native fish that are often not easily found in the wild, and whose stories will now be known and shared.

The aquarium is a dream come true for Department of Conservation fish expert **Glenn**

Maclean and architect **Herwi Sheltus**. Visitors start on a journey from a central, bubbling, busy brook favoured by the bullies, to quiet tanks that showcase the fish who prefer calm, still waters such as kōkopu and eels/tuna. Pest fish are displayed behind jail bars, and aquatic weeds are contrasted with native freshwater plants to help the public learn to identify the threats to our freshwater ecosystems.

The aquarium has been an adventure in the making. The tanks are made of thick acrylic, rather than glass, as it acts as an effective thermal buffering between water and weather. This specialised acrylic came all the way from Germany, and the tanks were built in Napier by Classique Plastics. The theme were developed by Thornburn Consultants, an Auckland company that also helped create Kelly Tarltons. Knowledge in raising and show-casing native fish in captivity has come from the Mahurangi Technical Institute, the National Aquarium of New Zealand in Napier & **Stella McQueen**.

Overnight, Department of Conservation rangers have gone from caring for the grounds of the Tongariro National



The tuna are a popular tank. Photo: Dave Conley



The kōkopu meet up with Ranger Nathaniel for lunch. Photo: Kim Turia.

Trout Centre to becoming experts in the care of the aquarium. They have already been dubbed ‘fish whisperers’, as they are singing to the fish to calm them, and using food to train the fish to come out during the day, seeing as many of the species are nocturnal.

The ‘naughty tank’ holds many interesting tales, as the rangers learn about ‘who eats who’ in the native fish world. It turns out the giant bully is not only a bully by name, but also by nature. The learning curve is flattening out as the fish settle down in their new home. The aquarium is free for children and \$10 for adults.

Fantastic Whio

Mike Nicholson has been working on Fantastic Whio, a new programme offered to New Zealand primary school children through the already popular Taupō For Tomorrow education programme, which runs from the Tongariro Trout Centre. Hastings Intermediate was the first school to take up the new programme, and all left excited at having seen whio in the wild.

An education resource has been written as background in support for teachers. The material stresses the importance of whio as an indicator species for clean freshwater, as they require clean, fast flowing rivers for survival. Students also net invertebrates in the Tongariro River, and work to a point system to determine the quality of the water from the invertebrates that they find.



Mike and students studying Tongariro River invertebrates. Photo: Mike Nicholson

Fish on the move

Callum Bourke has been undertaking a range of freshwater fish survey work since moving to the Auckland Area from the Taupō Fishery Area. Black mudfish, dwarf inanga and shortjaw kōkopu are some of the species that have been surveyed recently and it has been great to work closely with representatives of NIWA and Auckland Council (AC). Callum has been spending a lot of time on Motutapu Island in the Hauraki Gulf undertaking freshwater fish surveys, water quality testing, wetland and stream fencing proposals, and improving fish passage. He is currently looking

at the feasibility of translocating a freshwater fish species to the island.



One of three land-locked shortjaw kōkopu caught in the Hunua Ranges. Photo: Callum Bourke

Getting to know the Waikato Conservancy

Jane Goodman took over the role of Freshwater Technical Support Officer in the Waikato Conservancy from Michael Lake in November 2010. Jane has been trying to get out and about in the field to gain a better understanding of the freshwater ecosystems and issues in the Waikato. With the assistance of Area staff, Jane has carried out some fish monitoring and surveys. A large proportion of her time has been taken up working with planners on RMA consents.

FENZ, old friends, and the rotenone application at Zealandia

David West continues to fill an unashamedly fish-centric role in the freshwater section at DOC. Working with John Leathwick & other DOC staff, the Freshwater Ecosystems of New Zealand (FENZ) GIS database was recently released to local and central government and is now publically available via requests to FENZ@doc.govt.nz. FENZ training workshops have been run, with more to come soon. Dave has especially enjoyed engaging with new users of FENZ as opportunities arise.

A large collaborative effort with DOC Area, Conservancy and Research and Development staff, Zealandia (a.k.a Karori Wildlife Sanctuary) staff, the University of Waikato, the University of Otago and public volunteers brought several years of effort to fruition with an application of rotenone to the Karori Upper Reservoir and its tributaries. This was the first attempt in New Zealand to use rotenone slurry within a flowing system. Thus far we are 'quietly confident' of having returned the upper Karori catchment to a native fish only status. Use of environmental DNA in collaboration with University of Waikato, The Nature Conservancy (Lindsay Chadderton) and the University of Notre Dame supports densities and presence of brown trout prior to the operation, and sampling is about to commence to collect post-operation eDNA levels. Work with central government, CRIs and universities continues to increase and the new collaborative style is appreciated even if it does mean more meetings.

Using FENZ to guide national priorities

Dave Kelly continues to work on a range of conservation-focused freshwater initiatives. He has been utilising the FENZ GIS database to identify a set of lake catchments to be prioritised by the Department for their biodiversity conservation values, and is assisting the National Monitoring team in designing monitoring programmes for those ecosystems. This has resulted in a recent review being published for assessing the ecological integrity of freshwaters of rivers and lakes (<http://www.doc.govt.nz/upload/documents/science-and-technical/sfc307entire.pdf>). He is also continuing some work on braided river ecosystems on the South Island, looking at flow-invertebrate productivity relationships around large-scale flow diversions, as well as braided river bird habitat use. Dave has had to temporarily relocate to the Buller Area Office in Westport due to the Christchurch earthquakes, and is spending some time locally on the Mokihinui River in relation to Meridian's Mokihinui River power scheme proposal.

Setting the standards for aquatic transfers

Before taking parental leave in June this year, **Natasha Grainger** could be found providing fabulous freshwater advice to DOC staff around the country. A large part of her time in the last year was spent reviewing the Department's Standard Operating Procedure on Aquatic Life Transfers, which has not been reviewed for several years. She did, however, manage to get out into the field to participate in the rotenone in flowing waters trial at Zealandia (see above). Natasha is expected back in May 2012.

Permits, RMA, rotenone and pest fish

Milena Palka was appointed as Technical Support Officer (Freshwater) for the Wellington/Hawke's Bay Conservancy in November 2010. She has been getting up to speed with the inner workings of DOC and gaining an appreciation for the challenges facing freshwater ecosystems within the Conservancy's boundaries. The majority of her time is spent processing aquatic



Kōaro in the Whakatīkei River. Photo: Corina Jordan, Fish and Game



One of New Zealand's rarest fish – the lowland longjaw galaxias.

transfer permits and dealing with RMA issues but she has managed to get out in the field and help out with several native fish surveys. These include the Waiparere wetlands in Wairoa which are considered a habitat type of scarcity in the East Coast and Hawke's Bay region, and ongoing Fish and Game surveys of the Hutt River catchment.

Milena also provided assistance during the massive operation to eradicate brown trout from the upper reservoir and tributaries of Zealandia. Amongst other things the work included helping Otago MSc student **Lan Pham** to tag, measure and relocate banded kōkopu into refuges during

the treatment, and then back into their homes post-operation. A massive 28.4 cm long banded was discovered during the recovery and was nicknamed 'Granddaddy Bob' in memory of the grandfather of galaxiid work, Robert McDowall. With some difficulty in keeping bandeds where they were supposed to be, Milena can now testify they are indeed very crafty fish and incredibly capable escape artists.

Most recently, Milena has been helping coordinate the pest fish work for the region, working with contractor (Tom Williams) to achieve a regionally-combined and up-to-date pest fish database in preparation for next season's work.

Protection for one of our rarest fish

Dean Nelson and Twizel staff with lots of help from the Coastal Otago freshwater team (particularly **Pete Ravenscroft**) and Canterbury Conservancy staff have been working on protecting a site for the nationally critical lowland longjaw galaxias (Waitaki River) or *Galaxias aff. cobitinis* 'Waitaki' and the local endemic bignose galaxias (*Galaxias macronasus*) by installing a weir as a trout barrier. Initial results have been spectacular, with monitoring showing big increases in populations of both species once all trout were removed. We have also just received funding from the Canterbury Water Management Strategy Upper Waitaki Zone Committee to fence this small spring-fed stream, the bulk of which is on private land.

The weir technique to exclude trout is also going to be applied to another lowland longjaw galaxias stream in the Hakataramea Valley. This site is due to become part of the DOC estate through the Tenure Review process and we have the permission of the landowner to go ahead with weir installation. Once again we have just received two thirds of the funding from the CWMS Lower



Nadine Bott (DOC) returning 'Granddaddy Bob' the banded kōkopu safely back into his home post-rotenone. Photo: David Moss (DOC)

Waitaki Zone Committee to protect our key population of this species which is only known from seven other sites in the Mackenzie Basin.

Nadine Bott has been dividing her time between supervising 6 staff and freshwater work. She has been involved in the Karori Sanctuary cube root powder in flowing water trial, extensive RMA work including several large wastewater treatment plant applications and the Transmission Gully EPA hearing, as well as coordinating the pest fish programme for the Conservancy. Our greatest gains are made through inputting into RMA consent applications and this work never seems to subside.

Southland Conservancy

Andy Hicks has been filling in for Emily Funnell, a.k.a. 'Mumma', in the Southland Conservancy. Babies seem to be a fashionable accessory item at the moment. Andy is continuing to try to incorporate larval giant kōkopu requirements into the management of Waituna Lagoon, which has become the centre of a media storm as a variety of stakeholders try to stop the lagoon 'flipping' from a clear-water, sea-grass haven into a nutrient-thick pea soup. Andy is also supporting a University of Otago project, being carried out by Masters student **Michael Greer**, looking at more ecologically sensitive ways to manage farm drains (a.k.a. 'creeks').

Saving fish while the ground shakes

Nicholas Dunn temporarily took on the Canterbury Conservancy Freshwater Technical Support role in December allowing Sjaan Bowie (née Charteris) to head off on maternity leave for a second time. Since his move back to DOC, he has been involved in a number of projects including work with Canterbury mudfish (*Neochanna burrowsius*), upland longjaw galaxias (*Galaxias prognathus*), and assessing the effectiveness of irrigation intake fish screens. Time has also been spent assessing various RMA-related projects and providing advice to the Canterbury Water Management Strategy Water Zone Committees.

Mining, hydro, and aquatic invertebrates on the West Coast

Darin Sutherland has been doing a lot of Access Arrangement/Concession and RMA work, largely around proposed mining and hydro schemes on the West Coast, particularly on the Stockton/Denniston plateaus. Earlier this year he went out with staff from DOC, Fish and Game and the West Coast Regional Council to examine the aquatic pest weed *Lagarosiphon major* infestation recently discovered in Lake Paringa and to check nearby lakes to see if the weed had spread to them as well.

He has also been working on freshwater invertebrates. He is chairing the panel re-ranking the threat status of New Zealand's freshwater invertebrates and was also involved in DOC's species optimisation project for freshwater invertebrates.

Rosemary Miller has returned to the Department of Conservation working as the freshwater Technical Support Officer (TSO) for the Tongariro-Whanganui-



Waimangaroa River up in the Denniston Plateau. Photo: Darin Sutherland.

Taranaki Conservancy after working for a few years with the Taranaki Regional Council and a short contract with MfE (working on water quality and quantity limits). Her focus is on providing technical support to the Department's appeal on the Horizons' One Plan which covers a number of interesting water quality and quantity issues. After a short stint as Acting TSO Freshwater before Rosemary arrived, **Hannah Rainforth** has taken up a biodiversity ranger role. Luckily this still incorporates some freshwater work, including managing the pest fish programme and the native fish survey work. It also includes whio work, which means some fun rafting down the stunning but somewhat rough Manganui-o-te-Ao River. Hannah worked with contractors **Natasha Petrove** and **Ursula Brandes** on this year's fish surveys, finding some wee gems in the local streams.

In the deep south, **Murray Neilson** has been busy with a number of RMA matters including: appeals (now settled) over changes to Otago Regional Council's Regional Plan: Water, minimum flow setting and wetland proposals; and an appeal against a consent granted to take water from a threatened galaxiid habitat – also now settled. Together with Pete Ravenscroft and the Coastal Otago Freshwater fish team, he trialled the first use of the MesoHABSIM method in NZ, in the Kauru River. He has also been heavily involved with DOC's National Office Policy team in commenting on the New Start for Freshwater programme, the Freshwater Fisheries Jurisdictional Review and the NES on Forestry. Pete Ravenscroft and team have been completing their annual non-migratory galaxiid monitoring programme (47 sites on 14 streams), and have been heavily involved in assisting Contact Energy Ltd with the company's native fish programme on the Clutha River (a requirement of new consents to operate the hydro scheme).

Arawai Kākāriki Wetland Restoration Programme

Hugh Robertson has been compiling the 2007-2010 national report for the Arawai Kakariki Wetland Restoration Programme, which highlights achievements across the broad range of monitoring, research and on-ground freshwater management projects at the three Arawai Kakariki sites (Whangamarino, Ō Tū Wharekai (Ashburton Lakes/upper Rangitata River), and Awarua-Waituna). Research on the restoration of wetland vegetation post willow control and on the resilience of macrophytes in Waituna Lagoon also continues. More recently, Hugh and Karen Denyer coordinated a workshop to develop guidelines for identifying wetlands of international significance (Ramsar sites) in New Zealand.

FISH AND GAME

At the National level, Fish and Game has been heavily involved in the Land and Water Forum process, with both **Bryce Johnson** and **Neil Deans** being involved in the Small Group and intercessional 'working' groups seeking to recommend policy through collaborative processes. Now that Government is seeking the Forum's view on how its 58 recommendations are implemented, it is likely that Fish and Game, along with the more than 60 other organisations represented on the Forum, will be involved at various levels in working through recommendations on implementation to Government.

In addition, Fish and Game is involved in various activities in water management throughout the country, given the extraordinary pressure now being placed on the freshwater resource. **Neil Deans** is involved with the Dairy Environment Leadership Group in: scoping the next incarnation of a Dairy and Clean Streams Accord; various processes seeking to address the vexed question of

addressing the effects of land use on water quality in Canterbury; advice on the development of a National Environmental Standard for Plantation Forestry; the development of the River Values Assessment System (RiVAS); and various projects looking at market mechanisms for addressing water quality and quantity issues and integrated catchment management.

Around the regions, in Northland a major fishery is the Kai Iwi lakes, which **Rudi Hoetjes** found to have turned a corner for trout fishing. Fish at the July 2011 Kai Iwi Lakes Fishing Competition weighed in as the biggest recorded since the early nineties. The winning trout weighed in at a solid 2.6 kg, showing clearly how the fishery has improved. The complete removal of the pine tree plantations surrounding the lakes is implicated in this turn around. The roots from the pines have drawn down a lot of groundwater over the years and limited natural runoff into the lakes. This has compromised the lake levels during low rainfall years in particular. With the pine trees gone and native vegetation species doing better, the lakes are healthier. There is now more food present in the form of native species like inanga and kōura, and the vegetation along the shoreline is providing a wide and varied diet of insects for the trout to feed on.

The native dwarf inanga are thriving at Kai Iwi. Trout feed on dwarf inanga in the same way as they do smelt in Lake Taupō and the Rotorua lakes. Anglers with fish finders on board their boats are commenting on seeing enormous shoals of small fish swirling like large balls in the water column. Increases in number are likely due to higher lake levels in the reeds where they breed. Kōura are being seen at night in their many hundreds if not thousands. Work by **Dave Rowe** from NIWA has shown that trout predation reduces numbers of gambusia and that native fish do better in the presence of trout where gambusia are present.

Fish and Game had traditionally stocked the fishery with 3000 trout fingerlings but in 2001 this was reduced to 2000 fingerlings due to a decline in the overall trout average weight and condition factor. The reduced stocking saw average fish weights start to improve in 2003. But since the removal of the pine trees, there has been a marked increase of 200 grams per fish in the average weight of catches in the annual fishing contest. This may result in an increase in annual trout liberations into the Kai Iwi Lakes, to provide greater angler opportunity and harvest. Kaipara District Council's decision to remove the pine trees and replace these with more natives to be planted in their place has been vindicated.

Northland trout fisheries rely on stocking in those limited areas which support trout. In May of 2011 Fish and Game Northland released trout into the following waters: Wilsons Dam 600 brown trout, Whau Valley Dam 250 rainbow trout, Lake Manuwai 600 rainbow trout, Lake Taharoa (Kai Iwi Lakes) 2000 rainbow trout, Lake Waikere (Kai Iwi Lakes) 350 rainbow trout and Waitangi River 250 rainbow trout.

In the Auckland/Waikato region, Fish and Game have continued their programme of wetland restoration with large projects on their Eastern Whangamarino property and the margins of Lake Waikere. The 354 hectare Eastern Whangamarino property, a Ramsar wetland site, was purchased in 1964 and the restoration project includes the removal of willow, creation of open water, and a new bund system to protect the remnant peat bog. The project will provide recreational gamebird hunting opportunities as well as protecting and enhancing native vegetation and wildlife. The Lake Waikere project involves wetland restoration/creation around the lake margins on public conservation land that had previously been drained and grazed. Both projects are funded by the Waikato Ecological Enhancement Trust.

Eastern Region Fish and Game have continued to be involved with angler creel surveys within the Rotorua Lakes. The decline in lakes water quality has been a hot topic for a number of years now (and remains so) and potential rehabilitation projects include engineering and chemical

interventions. Fish and Game are monitoring the fisheries to assess any potential changes resulting from these actions. We have long term data sets from fish traps and angler creel surveys to undertake this. Opening Day surveys have been collected for over 30 years on some lakes.

Other projects that Eastern Region Fish and Game are currently involved with are:

- 'ZZ' tagging trial. We are undertaking research into the timing of trout liberations to Rotorua lakes in order to better tailor our releases to assess trout growth and angler return. We released 500 tagged trout each month throughout 2010 into Lake Tarawera. Growth will be monitored through our existing tagged trout program and this project will run for 4-5 years.
- Fish and Game have been assisting the University of Waikato with provision of trout samples (gut and otolith) from Lake Rotorua and Rotoiti to determine trout growth, movement, and to contribute to Doctorate work on trout bioenergetics.
- Fish and Game have been involved with the installation and maintenance of the Waikaremoana monitoring buoy. The data received is being used to look at lake generated effects on the trout fishery.
- We are going to be looking at habitat composition and trout recruitment within spawning streams around the Rotorua lakes. The project is designed to identify areas that rehabilitation work can be done to better improve wild spawning success.

Freshwater wetlands are also of significant interest to Fish and Game as they are critical habitats for game birds; consequently Fish and Game offer free wetland restoration advice and assistance. We have had a good response from landowners along the Waiotapu Stream resulting in 23 ha of remnant oxbows being restored. The 24 ha Ohaaki Wetland has been created as a result of geothermal abstraction resulting in subsidence. Both projects required in excess of \$1 million funding and both projects are contributing to the improvement in water quality within the Waikato River.

Other freshwater wetland work has concentrated on waterfowl survival and distribution studies through a joint radio tracking study being undertaken between Eastern Region and Auckland/ Waikato Fish and Game. In January 2011, 46 transmitters were mounted to mallard ducks captured in the Bay of Plenty wetlands. These birds were released and have been monitored up to and during the game bird hunting season.

The releases were followed with a number of telemetry surveys of wetlands and drains around the release area including two aerial surveys. Of the juvenile females fitted with transmitters we know that at least 10 made it through until opening weekend and 1 died (~9% mortality).

Over in the Hawke's Bay, there are a number of development proposals being undertaken at present affecting water and Fish and Game interests, requiring considerable staff input. These include the following:

Storage dams

Hawke's Bay Regional Council is in the process of carrying out a feasibility study for an irrigation storage/hydro dam on the Mākaroro River which is a tributary of the Waipawa and Tukituki system. If built, this dam would hold 75 million cubic meters of water to irrigate 22,500 ha of currently un-irrigated land in the Central Hawke's Bay region.

Two sites have been identified on tributaries of the Ngaruroro River as potential sites for irrigation dams holding 30 million cubic metres to irrigate a further 6,300 ha. These may have effects on water and habitat quality in the Tukituki River and its trout fishery downstream.

Power generation

Trust power is in the process of exercising consents gained in 2002 and 2003 for a small dam and two hydro electric turbines sites on the upper Esk River which will produce approximately 3.5 kW.

Effluent

Central Hawke's Bay Council and HBRC are under way with a project to remove a third of the effluent currently entering the Waipawa and Tukituki River from the oxidation ponds of the Waipawa and Waipukurau townships. The effluent will be sprayed under tress until the soil is saturated, then diverted to storage ponds and finally released to the river when it is three times the median flow during winter.

Taharua River water quality

HBRC have released a Draft Discussion paper on the future management of the Taharua and Upper Mōhaka River which has degraded water quality due to dairy operations within this catchment despite the existence of a Water Conservation Order.

Resource consents in our top wetlands

Development and renewal of water take consents affecting our top three regionally significant wetlands Whakakī, Poukawa and Pekapeka wetlands are also under way.

Phil Teal leads the team at Wellington Fish and Game, with input into wetland enhancement projects around the region, and overseeing some research projects including standardising protocols for monitoring waterfowl numbers.

Corina Jordan is undertaking studies into integrated catchment management for maintaining riverine brown trout fisheries. She will be trying to quantify relationships between environmental variables (land use, water quality, hydrology, instream and riparian habitat, and sedimentation), and the health of brown trout fisheries. This will also include defining relationships between environmental variables and trout spawning/recruitment habitats. It is anticipated that a Habitat Quality Index for recreational trout fisheries will be developed.

Steve Pilkington continues to lead the drift dive programme which has seen a consolidation of information on Wellington Region's trout fisheries. This work is supplemented with spawning surveys, co-ordinated by **Nic Cudby**, and electric fishing surveys post spawning to investigate recruitment in key recreational rivers such as Hutt River in Wellington. Steve is also co-ordinating a project to establish the microchemistry of juvenile trout otoliths to investigate the importance of natal sites for trout in the upper Rangitikei River. **Nic Cudby** is also looking at water level management in the eastern wetlands surrounding Lake Wairarapa.

Wellington Fish and Game are also overseeing a project undertaken by Massey University to look at the impact of deposited sediment. Sediment can affect trout in two main ways: reduction of oxygen supply to eggs in redds, and alteration of invertebrate food resources. Research will focus on sedimentation thresholds and rate of recovery linked to sediment flushing. This will focus on some Wairarapa rivers such as the Ruamāhanga River and other Manawatū sites.

In the Nelson Marlborough region, **Rhys Barrier** is continuing his work providing advice on freshwater biodiversity and habitat protection to landowners throughout the region, and assisting in the provision of public access to water bodies. Rhys and **Vaughan Lynn** are heavily involved with the development of the Fish and Game administered 120 ha Para Swamp beside SH 1 at Tuamarina between Picton and Blenheim. Most of the willows in the wetland have now been helicopter sprayed and successfully killed with more planting being undertaken in cleared areas. High water levels this season have restricted the ability to enter the swamp to undertake earthworks to maintain water level compartments, but this is planned for when water levels are suitable. **Lawson Davey** continues to support the Cawthron Institute work into the effects of flows on juvenile trout rearing and all staff

are working with **Iain Maxwell** of Cawthron on a new database looking at changes over time in salmonid habitat throughout the region and the country.

In the planning area, **Neil Deans** has: presented submissions to Tasman Resource Management Plan Part IV on activities in the beds of lakes and rivers; is working with Tasman District Council, Lincoln University and Cawthron staff on applying the River Value Assessment System to Tasman District rivers; and provided advice to Marlborough District Council on its revised Regional Policy Statement. He continues his involvement with the Waimea Water Augmentation Committee who are seeking to develop water storage to increase river flows in the Waimea River near Richmond. Neil has also visited colleagues in British Columbia and presented several papers on water, fisheries and wildlife management, and also Scotland where he co-presented a paper on integrated catchment management in the Motueka River to a workshop with colleagues from Scotland, England and Canada.

The West Coast team have been performing annual salmon and trout spawning counts. They have helped the West Coast Regional Council and DoC with pest weed surveillance in lakes, trout spawning counts, drift dive surveys and a backcountry perceptions survey. This coming summer they are performing a netting survey of Lake Brunner and initiating a long term monitoring programme on the Māwheraiti river to look at factors affecting fluctuations in sportfish numbers. We will also be contributing to Cawthron's aquatic stressors project in the Inchbonnie catchment and be involved in a riparian planting and rehabilitation scheme in the area. Of course we are involved in the statutory planning process and advocacy on behalf of water quality, specifically in the Lake Brunner catchment.

Earthquakes have seriously affected capability of most institutions in central Canterbury, including Fish and Game. Many activities continue regardless, however, including salmon management and the push towards more sustainable water management, which is stretching Fish and Game resources to contribute to various Environment Canterbury requirements including a new regional policy statement involving **Tony Hawker**, specialist groups looking at land use effects on water quality (**Neil Deans**), and Zone Committees involving **Tony Hawker** and other Fish and Game staff or councillors.

Mark Webb has been involved with monitoring of the success of the Rangitata Diversion Race Bio-acoustic Fish Fence as a means of excluding juvenile salmon from a 30 cumec diversion from the Rangitata River. He has produced resource consent applications to rehabilitate and enhance a 3 km length of springfed tributary to the lower Rangitata. This is a salmon spawning stream and works will replace the degraded streambed with screened shingle and boulder to create salmon spawning and rearing habitat and include larger silt interception ponds to be developed as waterfowl habitat. Mark has also put his hand to designing a 3 km salmon spawning race as part of a large irrigation development in the lower Rangitata River.

Hamish Stevens has completed reading several hundred salmon scales from rivers of the Region to assess life history patterns and incidence of hatchery fish in adult salmon returns. He has also assisted with management of two trout spawning stream enhancement programmes at Lake Alexandrina. These projects have been funded by a local angler/hutholder group and have involved replacement of the original streambed with clean shingles to produce spawning, rearing, and adult trout holding habitats. The local angling community are also involved in monitoring the success of their habitat improvement by tagging spawning trout and running an extensive multi-season angler diary scheme.

Graeme Hughes has continued to assist with didymo research at the Otiake site on the lower Waitaki River. This is a further investigation into the properties of spring water that may

inhibit didymo growth using artificial substrates. Graeme continues to be the 'go to' source for information on the status of sockeye salmon on the upper Waitaki. This species has sustained a huge recovery in the last six years from obscurity over the previous 15 years. Recent spawning counts indicate up to 20,000 adult salmon spawning annually in tributaries to Lake Benmore. Graeme believes the resurgence could be linked to small increases in nutrient levels in Lake Benmore providing increased food supplies for the filter feeding sockeye.

Otago Fish and Game staff are gearing up for a batch of Water Plan changes which will set minimum flows on the Pōmāhaka and Waiwera Rivers in South and West Otago and the Lindis, Manuherikia and Cardrona Rivers in Central Otago. There are marked differences in circumstances between rivers with the Central Otago waters being heavily over allocated. In the case of the Lindis the river is completely diverted for irrigation during summer, stranding fish and leaving kilometers of dry river bed. The Pōmāhaka and Waiwera Rivers are not overallocated at present and there is an opportunity to set minimum flows that provide adequately for aquatic ecosystems. However, competition for water is intensifying.

Water quality in areas of intensive agriculture – South and West Otago and the Maniototo – remains poor despite increased resourcing of compliance monitoring and a new Rural Water Quality Strategy being rolled out by Otago Regional Council (ORC). Fish and Game is undertaking complementary monitoring in affected catchments in conjunction with ORC and the University of Otago who are undertaking work on identification of ecosystem stressors.

Otago Fish and Game's application to amend the Kawarau Water Conservation Order to completely prohibit damming on the Nevis River is now before the Environment Court with hearings expected late this year or early next. As well as sustaining an outstanding backcountry trout fishery, the river is home to a population of Gollum galaxias now considered to be a separate species. The river is the only unmodified river in Central Otago District that still flows in its natural state and is highly important for a range of historic, indigenous flora and fauna and recreational values.

There is continuing work with Contact Energy on mitigation of the sports fishery impacts of their Clutha hydro scheme, which is part of their consent requirement. A primary focus of that work is enhancement of the salmon fishery, with a target of 5000 returning adult fish. The current run is under a thousand fish.

Papers were presented at international conferences in the last year by **Rasmus Gabrielson** (Dynamics of Inland Fisheries Conference in the Czech Republic) and **Niall Watson** (The Conservation and Management of Rivers Conference in the UK). Lastly from Otago, **Donald Scott** reports that, "No I'm not dead yet, just a little slower." He recently retired as Councillor, but continues as a scientific adviser on fisheries.

The drift diving programme to assess populations of large trout in the middle and upper reaches of Southland's rivers continued last summer with counts made on the Oreti, Mararoa, Mataura, Waiau and Aparima rivers. Surveys have found that in the Mararoa River brown and rainbow trout have declined from 10-30 per km to only 5-10 per km since the establishment of didymo. In the lower Waiau the numbers of trout over 20 cm trout have declined from between 150-250 per km from 1996 to 2002 to 50-110 per km from 2006-2011 when didymo has been present. Similarly in the Upper Waiau trout abundance has declined from 320-420 per km to about 150 per km since didymo has become established.

Long term monitoring of trout spawning abundance in the Waituna stream showed a slight decrease in the average number of redds this winter. Spawning counts in ten other rivers show relatively consistent counts from year to year, suggesting that trout numbers in the middle reaches of the region's major rivers are not declining.

Stuart Sutherland, Bill Jarvie and Cathy Kilroy (NIWA) have been collecting and analysing data on didymo biomass in the Mararoa and Waiau rivers in relation to the flow regime. Meridian Energy have voluntarily released flushing flows to manage the didymo biomass in the Waiau. The monitoring suggests that flows of at least 10 times the median are needed to reduce didymo biomass to levels that meet the periphyton guidelines for trout habitat and fishing. Flows of about 20 times the median are needed to reduce biomass to low levels, especially on cobble/boulder substrates. **Maurice Rodway** presented a poster, put together by Cathy, on this subject to the American Fisheries Society conference in Seattle in September 2011.

Assistance from a commercial eel fisherman has provided data on trout abundance in lowland rivers where other survey methods are not possible due to river size and turbidity issues. Eel fishermen use fyke nets to catch eels but they regularly catch trout as well. Prior to releasing these, the eel fisherman recorded the sizes and numbers of trout he caught over the summer. 1314 trout were processed. The largest fish were from the Aparima but most (550) came from the Mataura. We plan to expand this programme next summer and into the future using our own nets and fishing in a wider range of waters. We expect we will be able to monitor relative abundance over time and from river to river by using CPUE. We will also measure trout length to monitor the health of trout populations in these lowland waters.

FRESHWATER SOLUTIONS

Richard Montgomerie has been busy, since establishing Freshwater Solutions in late 2009, on a wide range of resource consent related work including resource consent compliance monitoring for Pike River Coal Ltd and Francis Mining Ltd on the Westcoast and Alliance Group Ltd in the Wairarapa. Richard has also recently prepared AEE's for Fonterra, Envirowaste Ltd and Environment Waikato. Although now based in Tauranga Richard remains involved in the Canterbury water resources scene and has recently worked with URS and Aecom on water management zone assessments of the Waiau/Hurunui River catchments and the Ashley River catchment. Richard is enjoying the challenge of operating his own business and the flexibility and opportunity to work with a wide range of water resource managers, researchers, planners, engineers and environmental professionals.



Richard Montgomerie undertaking surber sampling.
Photo: Mark Newman.

LANDCARE RESEARCH

Stephen Moore is part of the Sustainability & Society team based at the Tamaki (Auckland) office of Landcare Research. In practice, he is based at home where he spends most of each year stuck behind a microscope. This year Stephen has continued with his main areas of work: analysing freshwater invertebrate samples sent by clients from all over NZ; assisting with AEEs and consent-related biological monitoring programmes; and overseas freshwater biological contracts (recent projects in Fiji, Brunei, Papua New Guinea and Singapore).

Stephen continues his interest in photography of freshwater invertebrates and fish – every taxon he finds in his NZ or overseas projects is added to the photo collection, which now contains several thousand images. Example images from the NZ, Brunei and PNG invertebrate work can be seen on the Landcare Research web site:

http://www.landcareresearch.co.nz/research/biosystematics/invertebrates/freshwater_invertsCD/.

A summary presentation of some of Stephen's urban development case studies can be seen on: http://www.landcareresearch.co.nz/publications/researchpubs/Moore_NZFSS_2008.pdf.

ECOLOGICAL ECONOMICS RESEARCH NEW ZEALAND

Integrated Freshwater Solution Project

*Ecological Economics Research New Zealand (EERNZ) is a research group based at Massey University. For one of their projects, entitled Integrated Freshwater Solutions, EERNZ collaborated with NZFSS member **Russell Death**. Russell reports below on the project.*

The Integrated Freshwater Solutions (IFS) project combines stakeholders' perspectives with current science to generate an action plan to protect and enhance the Manawatū Catchment. Research from multiple disciplines (natural, social and economic) undertaken by Ecological Economics Research New Zealand, Horizons Regional Council, iwi and other stakeholders are brought together by this project. The project runs from October 2010 to September 2013. The project addresses management issues such as: how the river responds to different contaminants, the environmental, cultural, economic and social consequences of good or poor water quality and how different actions potentially impact on river water quality, cultural values, economic growth and social factors.

The \$1.05m IFS programme has six parallel research streams, mediated modelling led by Ecological Economics Research New Zealand, Bayesian belief modelling led by the Institute of Natural Resources, monitoring of the Ōroua-Manawatū confluence water quality led by Taiao Raukawa Trust, co-management of the Manawatū River led by Tānenuiārangi Manawatū Inc, and community-based monitoring of shellfish led by Muaūpoko Tribal Authority. A newly developed applied ecological economics paper is offered for the first time in semester 3, 2011, within the context of the IFS research programme. Students will learn from on-going research efforts and work towards finding innovative solutions to complex challenges facing the Manawatū River.

In August 2010, the members of the Manawatū River Leaders' Forum signed an Accord to take action to improve the state of the Manawatū River. The Accord includes a focus, vision, and goals for the river. The leaders agreed to champion and give life to the Accord and made a series of commitments. One of the commitments was to establish a collaboratively owned and implemented

Action Plan by March 2011 ready for implementation by 1 July 2011. This Action Plan has been developed during a series of 6 workshops as a collaboration between the IFS team, Horizons Regional Council and the Forum's chairman. The workshops were open to the public, with stakeholders representing iwi and hapū, environmental interests, farming and industry, district and city councils and Horizons Regional Council. These workshops resulted in the Action Plan having been completed and presented to the Manawatū River Leaders' Forum.

Whereas the resulting Action Plan primarily supports the annual planning cycle of local and regional authorities, the next iteration of the workshops under the IFS project aims to support the 10-year planning cycle and foster adaptive capacity.

TARANAKI REGIONAL COUNCIL

Freshwater Contact Recreational Programme

The Taranaki Regional Council (TRC) summer bathing/recreational programme ended in April and, yes, there were still people recreating that late in the season in waters of relatively low temperatures, although the Taranaki wind and rain soon put a stop to that! There were relatively few instances that *E. coli* exceeded action levels at the 14 freshwater sites monitored from November 2010 to April 2011. Lake Rotokare is a problem area for Taranaki and this year was no exception when

cyanobacteria exceeded health standards, as has been the case for the last couple of years. It's a scenic lake with incredible native biodiversity, however with little inflow or outflow cyanobacteria levels can get quite high.



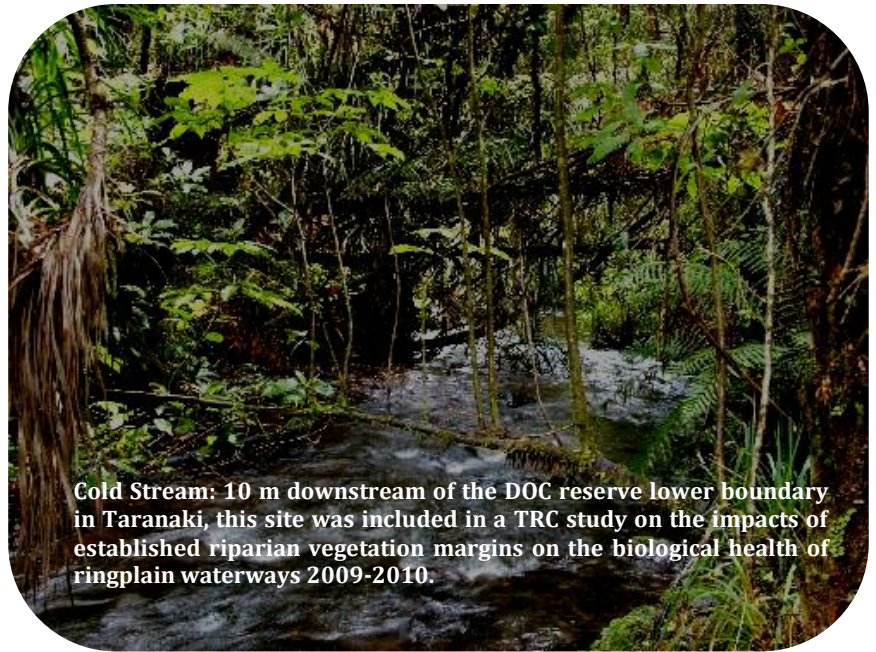
A Taranaki Regional Council scientific officer sampling the Kaupokonui River beach domain site for the Taranaki Regional Council's Freshwater contact recreational programme.

Resource Investigation into Community Irrigation Fund

MAF's Community Irrigation Fund, Taranaki's three District Councils and the Regional Council have commenced a study on the practicality and feasibility of various water storage and rural irrigation options in Taranaki. They hope to consider the potential of rural irrigation schemes and the possibilities of working them with existing schemes and infrastructure to explore the variety of communities which can benefit.

Macroinvertebrate Riparian Assessment

Taranaki Regional Council has one of the largest databases for monitoring of macroinvertebrate communities within its waterways and has recently undertaken an assessment of the impacts of established patches of riparian margins on the biological health of waterways. The areas assessed were the upper reaches of Cold Stream which is in the relatively undisturbed reaches of a DOC reserve as well as in close proximity to the National Park.



Cold Stream: 10 m downstream of the DOC reserve lower boundary in Taranaki, this site was included in a TRC study on the impacts of established riparian vegetation margins on the biological health of ringplain waterways 2009-2010.

This showed marked improvements within the riparian reach and a short distance downstream within open farmland. In the mid reaches of Dunns Creek, where there is a much shorter reach of riparian pine vegetation, there was little impact on the 'poor' quality health of the stream which drains an intensively farmed catchment. This is probably due to a lack of connectivity with any colonizing stretches upstream. More extensive bush cover provided by the Huatoki Domain in the lower, urbanised reaches of the Huatoki Stream was coincident with physical habitat improvement, reduction in periphyton streambed cover, and some improvement in macroinvertebrate stream 'health' which extended downstream beyond the Domain where riparian tree cover remained despite urbanisation of these reaches of the catchment. Stream macroinvertebrate 'health' improvement was due mainly to a reduction in 'tolerant' taxa numbers rather than recruitment of more 'sensitive' taxa within the communities of the Huatoki Stream.



A Taranaki Regional Council freshwater biologist undertaking a kick sampling survey for macroinvertebrate monitoring

Regional Freshwater Plan

Taranaki Regional Council's Freshwater Plan and Regional Soil Plan are to be reviewed later this year. This involves work on the production of discussion papers and technical investigations covering a variety of topics. A few key areas concerned are diffuse source contamination, including the riparian programme, freshwater biodiversity, including wetland protection and dual treatment systems for point source agricultural discharges, and of course limit setting as required by the NPS.

TRC Freshwater Staff

TRC has had three staff changes since last year. **Keith Brodie** is now Monitoring Manager and is responsible for the behaviour and performance of the Scientific Officers and staff. Policy Analyst **Angela Lenz** will be involved in the review of the freshwater plan. **Alex Connolly**, who recently emigrated from the UK, now fills the role of Scientific Officer for State of the Environment. The rest of the team remains unchanged, but just

to refresh your memories: Scientific Officer Water Resources **Chris Fowles** leads various State of the Environment Monitoring (SEM) projects and performs biological macroinvertebrate and other consent monitoring. **Bart Jansma**, Scientific Officer Freshwater Biology, juggles fish pass investigations with hydroelectric power scheme consent monitoring, investigations into effects of riparian restoration and periphyton SEM. **Ray Harris**, Technical Officer, gathers the samples for several SEM programmes, along with **Amy Cameron** who works between departments. **Fiona Jansma**, Scientific Officer Hydrology, leads the hydro team and has returned to work after maternity leave on a part time basis.

HORIZONS REGIONAL COUNCIL

The freshwater team expand their horizons

Scientists working on water-related projects at Horizons continue to be kept busy monitoring and studying the water quality and aquatic ecology of the Region's freshwater and coasts. Currently our State of the Environment (SoE) programme monitors water quality at 66 sites in addition to sites upstream and downstream of 39 significant discharges to water. Estuarine water quality monitoring began this year and the number of coastal monitoring sites was also increased.

A project to study Lake Horowhenua is currently underway to identify options for addressing poor water quality in the Region's largest lake. Annual aquatic macroinvertebrate monitoring continued at 48 river sites region-wide with monthly periphyton cover and biomass assessments continuing for a third year. Freshwater fish monitoring was also increased this year with 54 sites surveyed so far.

Cyanobacteria were monitored weekly in a new programme throughout the summer season. The aim of this monitoring was to determine the spatial and temporal distribution of toxic blooms in the region's rivers. The data was used for a project investigating the causes of bloom toxicity, undertaken in collaboration with the Cawthron Institute. Didymo surveillance continued at a number of sites across the region with the North Island remaining Didymo-free.

Results from these monitoring programmes supported the development of the Manawatū River Accord. Efforts remain focussed on identifying further opportunities to 'clean-up' this degraded waterbody.

Water metering continued, with 84% of the total allocated volume for the region telemetered to Horizons databases in real-time and displayed publicly through the WaterMatters web site. Compliance continues to be automatically assessed using these tools and enforcement activities have been actioned as a result.

Horizons were audited (along with 3 other Regional Councils) by the Office of the Auditor General in early March, with the focus of the audit being the management of water quality by regional councils. The results of the audit are expected to be published in the coming months.

Following appeals on the One Plan decisions, we have begun Environment Court mediation on a number of aspects of the Plan with appeal parties. The outcomes of mediation will determine what appeals are continued to hearings before the Environment Court later in the year or early next year.

NIWA

Bob Wilcock continues his research on the influence of dairy farming on water quality and on the efficacy of mitigation measures. Bob has also been working with **John Quinn**, **Kit Rutherford** and **Roger Young** on nutrient-periphyton relationships and nutrient spiralling in rivers. Summer field work was carried out in the Tukituki River, Hawke's Bay.

Rob Davies-Colley has been leading the preparation of a major report for the Ministry for the Environment on 'dependable monitoring' of freshwaters by regional councils to support national SoE reporting. This is the companion to another major report by **Neale Hudson** and others on indicators and indexes for reporting on New Zealand's freshwaters. Rob continues to lead a large research project on sediment quality for which the main test bed is the Kaipara Harbour, which is subject to impacts from fine sediment (on visual clarity and light penetration) and other contaminants (nutrients, microbes) from rivers in its catchment. Rob also leads research on monitoring and reporting of water quality and aquatic ecological health as a subcontractor to Landcare Research in their 'Values, monitoring and outcomes' programme, and is scientific spokesperson for the National Rivers Water Quality Network (NRWQN) operated by NIWA. He was the co-chair of the International Water Association (IWA) conference (sponsored by NIWA) on 'Diffuse water pollution and eutrophication' (DIPCON2011).

Aslan Wright-Stow has continued working on the long-term impacts of exotic forestry harvesting on streams in the Coromandel with **John Quinn**. John and Aslan are also well underway on a project on the East Cape to determine whether upstream harvest impacts can be detected on downstream unharvested streams in Torere Forest.

After up to 10 years of monitoring the impacts of calcium magnesium acetate (CMA) for highway de-icing applied to the Desert Road, and roads in the South West Central Plateau and Hawke's Bay regions, this project has finally wrapped up. No significant ecological impacts were detected on any of the streams studied over this period. Aslan has also been involved in a collaborative project between NIWA and Cawthron (with **Dean Olsen**) looking at the function of wood on the hyporheic zone of anthropogenically impacted streams. He has also continued to work on a range of marine and lakes projects in his capacity as a scientific diver.

John Quinn contributed to two interdisciplinary catchment projects examining the links between land and water



Bob Wilcock
hanging out in the lab



The Waikato River and the Tukituki Nutrient attenuation research team hard at work (top, photo: John Quinn) and two recirculating chambers (one shaded) being used to measure factors influencing nutrient processing (right).



management and aquatic values: the Waikato River Scoping Study <http://www.mfe.govt.nz/publications/treaty/waikato-river-scoping-study/index.html> and the Hurunui/Culverden Basin Land Use and Catchment Values Project (with ECan, led by **Liz Wedderburn**, AgResearch). John is involved in EnviroLink Tools projects to develop a new decision making framework and nutrient guidelines for instream periphyton and plants (with **Fleur Matheson** and **Chris Hickey**) and to develop Deposited Sediment Guidelines (led by **Joanne Clapcott**), and was pleased to see the restoration indicator toolkit (led by **Steph Parkyn**) published http://www.niwa.co.nz/_data/assets/pdf_file/0004/107059/Restoration-Indicators-4-WEB.pdf. John leads the new Aquatic Rehabilitation MSI programme and research on instream nutrient attenuation in the Cumulative Effects programme. The nutrient work has focused on the Tukituki River, where substantial removal of dissolved inorganic N and P from the water column occurs between inputs around his home town of Waipukurau and the coast under summer low-flow conditions. He has continued involvement in forestry/stream studies on the Coromandel Peninsula and published a paper on factors influencing the magnitude of logging impact and recovery rates of macroinvertebrates (with **David Reid**). This year John enjoyed a 3 month sabbatical in Canada visiting the Canadian Rivers Institute (New Brunswick), INRS-ETE (Quebec), Universities of Waterloo, Guelph and British Columbia.

Richard Storey has been overseeing the 'Habitat Bottlenecks for Invertebrates' objective of **John Quinn's** Aquatic Rehabilitation programme this year. Within this programme he has been involved in two projects to better understand recolonisation dynamics in restored streams. The first project investigates upstream movement (rates and ranges) of larval and adult insects to determine the potential for recolonisation from downstream source populations. The second project explores the effects of connectivity to upstream source populations on invertebrate recolonisation of restored streams in Taranaki. Richard is also involved with the MSI-funded Values, Monitoring and Outcomes programme (led by **Rob Davies-Colley**), in which he is exploring better ways to monitor and report nationally on the biological condition of New Zealand's rivers. In a similar vein, Richard wrote a chapter on river biomonitoring for a recent Ministry for the Environment project on dependable monitoring and single indicators of freshwater quality. In the coming year, he is looking forward to investigating the invertebrate communities of some little-studied high alpine streams, a TFBIS-funded effort to help validate the new FENZ (Freshwater Ecosystems of NZ) classification system.

Graham McBride has been busy with microbial modelling projects, including a large-scale study of pathogens and indicators and associated human health risks in a number of USA water courses (with a team from AMEC and UC Davis – see Bambic et al. 2011). He has continued work with Steve Chapra (Tufts) on *Campylobacter* contamination in agricultural waters (McBride & Chapra 2011) and the utility of kinematic wave theory in explaining the observed patterns of pathogens and indicators during flood events (McBride 2011). On a different (statistical) tack, he (with **Peter Johnstone**, AgResearch) has promoted the use of Bayesian credible intervals for calculating the probability of absence of rare or invasive species, given that a sampling effort has failed to detect any (McBride & Johnstone 2011).

This year saw **Ngairé Phillips** completing her NZ Health Research Council-funded project on contaminants in traditional food sources, which focused on species in the Rotorua lakes, as well as in Temuka and Whakatane. Some very interesting results have come out of this and she is currently in discussion with MAF, Fish and Game, BOPRC and health authorities as to how best to present this information to the public. Her MSI-funded project on the ecology of customary fisheries in the Rotorua (Te Arawa) lakes gained another year of funding, with the focus this year being on benthic algal mats and their contributions to lake productivity. She is currently writing up the results of the

in-lake manipulative macrophyte experiment, which examined the impacts of macrophytes on kōura and kākahi (with **Mary de Winton**). An interesting result from the previous year's work (with **Mary de Winton** and **Susie Wood**) was the finding of the toxin nodularin in Lake Tikitapu. Ngaire's interest in invertebrate species traits continues through collaboration, with several new publications. A recently completed project funded jointly by Waikato Regional Council (**Kevin Collier**) and Auckland Council (**Martin Neale**) has highlighted the potential value of the approach in regional council monitoring programmes. Ngaire also continues to manage the trials and tribulations of NIWA Hamilton's Freshwater Ecology Group. Our group has diminished somewhat, with **David Reid**, **Kristel van Houte-Howes** and **Kathryn Julian** all resigning. We're feeling kinda small!

In Christchurch, **Ton Snelder** has been appointed leader of the NIWA Science Programme 'Consequences of Water Use' (formerly the 'Environmental Flows' programme), which incorporates core funding as well as all associated commercial work. He has been busy setting up projects with objective leaders and ensuring that these significantly contribute to science on water use as well as meeting stakeholders needs.

Doug Booker has been undertaking research on eco-hydraulics and environmental flow setting, specifically in relation to generalisation of habitat-flow and biota-flow relationships. Doug is leader of the River Ecosystem Modelling and Environmental Flows Strategic Assessment Platform projects and the Consequences of Water Use programme.

Scott Larned is starting a new groundwater research initiative this year within the Consequences of Water Use programme, with a focus on groundwater ecosystem responses to river flows (with **Laura Drummond** and **Nelson Boustead**). Other new, continuing, and prospective projects include hyporheic ecology experiments with colleagues from Cemagref, France, macrophyte-flow and periphyton-flow relationships across Canterbury rivers, water-quality monitoring network design, and field experiments with the invasive didymo (with **Cathy Kilroy**).

Within the Consequences of Water Use programme, **Don Jellyman**, **Shannon Crow**, and **Marty Bonnett** have been working on understanding of the roles that flow regimes play in structuring native fish communities, with the goal of being able to quantify likely responses of fish communities to hydrological alteration. **Don Jellyman** also continues research on eels and, with **Shannon Crow**, has commenced a study of eel population estimation techniques in a small local lake. He is also involved in studies of lampreys (juvenile habitats, tracking of adults). Much of his time has been involved in studying the impacts of potential hydro schemes on fish stocks, and a considerable



An algal mat from Lake Tikitapu (Rotorua), featuring Mary de Winton's hand. In collaboration with Susie Wood (Cawthron), the team have identified the cyanotoxin nodularin. To their knowledge this is the first detection of nodularin in freshwater periphyton in the absence of Nodularia. They currently have a paper in review on this work. And doesn't it look just like a meat patty? Photo: Aleki Taumopeau.

amount of work has been undertaken in Lake Manapōuri tracking movements of acoustically-tagged migrating longfin eels to determine whether there are opportunities to intercept those eels that are attracted to the power station intake.

Cathy Kilroy has continued to work with **Prof. Max Bothwell**, Environment Canada, with experiments investigating the factors that control didymo presence and blooms. The main outcome of the research has been that didymo blooms seem to be driven by excessive stalk production in phosphorus-limited conditions. Two papers are published or in press on this topic, and a third is well advanced. The reasons for didymo presence in some rivers and absence in others remain elusive. This work has been funded by NIWA Capability funds, Department of Conservation, Fish and Game NZ, and Meridian Energy. Other work on didymo has included an ongoing programme on the Waiau River, Southland, looking at management of blooms using flow releases (funded by Meridian Energy, in collaboration with **Maurice Rodway**, **Stu Sutherland** and **Bill Jarvie** from Southland Fish and Game). On the wetland front, Cathy is working on the biodiversity of stream algae in Ō Tū Wharekai (Ashburton Lakes) with **Rosemary Clucas** from DoC, and on using diatoms as condition indicators in wetlands (in the Restoring Wetlands programme funded by the former Foundation for Research, Science and Technology). **Cathy Kilroy**, **Doug Booker**, **Laura Drummond** and **Janine Wech** have started working on periphyton biomass—flow—nutrient relationships in the Consequences of Water Use programme.

Alastair Suren spent a large portion of the summer on the Kapiti Coast investigating the effects of discharging groundwater into the Waikanae River. This is being done for the Kapiti Coast District Council to potentially abstract more water from the Waikanae River, and augment flows below the treatment plant with groundwater, to ensure minimum flows remain in the river. This work was done in conjunction with **Janine Wech**, **Jenni Gadd** and **Braden Croker**. He is also working with **Earl Shaver** (Aqua Terra Ltd) investigating the effects of stormwater inputs from state highways on aquatic invertebrate communities. Alastair and **Cathy Kilroy** have also been rafting down the Mōkihinui River as part of preparing evidence for an upcoming Environment Court hearing on behalf of Meridian Energy. He has also started working on an Animal Health Board funded study with **MS Srinivasan** and **Janine Wech** conducting detailed field studies to better understand the fate of 1080 when it leaches from baits and enters the soil. Finally, he was successful in a recent DoC application to the Terrestrial and Freshwater Biodiversity Information System (TFBIS) fund where he has been granted funds to improve the Freshwater Biodata Information System (FBIS) database. This work will involve migrating all of NIWA's freshwater biological data into the FBIS system, improving the end-user interface, and developing web-portals to allow other datasets to link with FBIS, creating a confederated database structure.

In the past year **JoAnna Lessard** has continued working with **David Plew** on lowland stream macrophyte-hydraulic relationships in Canterbury. This year they collaborated with **Angus McIntosh** and **Jon O'Brien** at the University of Canterbury to research the effects of macrophytes on stream metabolism as well as solute transport and storage. She continues work with **Ned Norton** assessing streams associated with the Hunter-Downs Irrigation scheme and the North Bank Tunnel Hydro Project. She is also about to submit a paper on the importance of flood flows in water management, using the Opuha dam as a case study. Recent months have been focused on helping to set up this year's study objectives for the newly funded Consequences of Water Use programme. Joanna's primary responsibility will be studying the role of water flow to control primary producers, in particular aquatic macrophytes.

Michelle Greenwood is in her second year of a 2-year post-doc funded by the Rutherford Foundation (Royal Society of New Zealand). She has spent the winter in the lab processing samples

after a busy summer field season collecting aquatic and terrestrial invertebrates (pitfall, emergence, and sticky traps) from different aged floodplain habitats in the upper Waimakariri River floodplain. The results will help quantify how braided river flow regimes maintain diverse terrestrial floodplain communities, through both the creation of a range of aged terrestrial habitats (bare gravel to vegetated terraces) and through subsidies from the river channels of aquatic insect prey and water to terrestrial organisms.

ENVIRONMENT SOUTHLAND

One place is dominating the Environmental Information (and all other divisions) work streams at Environment Southland – **WAITUNA LAGOON**. We ‘discovered’ how at risk Waituna Lagoon is to ‘flipping’ to an algal-dominated state through the State of the Environment Freshwater Reporting project, where we combined multiple monitoring programmes conducted by Environment Southland and the Department of Conservation (DOC) and assessed the overall health of the lagoon (Hamill 2011, Robertson and Stevens 2009, Stevens and Robertson 2010). As part of our response to this alarming news we convened an expert panel (the **Lagoon Technical Group** or LTG) to:

- help define the problem and explain it to the Waituna community;
- recommend lagoon management options; and to
- recommend further monitoring requirements and further research.

The LTG comprises of **Barry Robertson** and **Leigh Stevens** (Wriggle Coastal Management), **Marc Schallenberg** (University of Otago), **Keith Hamill** (Opus International Consultants), **Andy Hicks** and **Hugh Robertson** (DOC), **Shirley Hayward** (DairyNZ), **Dean Whaanga** (Te Ao Marama Inc) and supported by Environment Southland scientists – **Jane Kitson**, **Greg Larkin**, **Kirsten Meijer** and **Chris Jenkins**. Interim recommendations to reduce the risk of the Waituna Lagoon flipping have been produced (LTG, 2011), and are available on the Environment Southland website (www.es.govt.nz). These recommendations were peer reviewed by **David Hamilton**.

The Environment Southland team have been doing round the clock high flow water quality sampling and gauging to determine nutrient and sediment loads exported to the lagoon during floods in the catchment. Monitoring has been ramped up in the lagoon to include bottom water quality sampling, characterisation of phytoplankton assemblages, sediment quality and dive transects to assess macroalgae abundance. Engineering advice has been sought on opening and/or closing of the lagoon to manage nutrient and sediment in the short term.

Jane Kitson has been working with Te Ao Mārama Inc to develop *Water 2010: Report on the State of Southland's Freshwater Environment*. This publication comprises four reports: *Our Health* (water in relation to the health of people), *Our Ecosystems*, *Our Uses*, and *Our Threats* (freshwater natural hazards and climate change/variability). The *Our Health* report was launched in August 2010, and the three others will be out later in the calendar year, and will feed into Environment Southland's Long Term Plan.

Steven Ledington has been busy setting minimum flows for a spring fed stream – the Meadow Burn. Cawthron are currently preparing a flow recommendation report for the mid to lower reaches of the Meadow Burn for the critical species brown trout, while in the upper reaches work has been undertaken to look at flow requirements for the critical species, Gollum galaxiids. A recent Environment Court decision upheld Environment Southland's decision to decline an irrigation take from the surrounding aquifer on the basis of cumulative stream depletion effects on the Meadow Burn.

Roger Hodson and the Living Streams team have been continuing to work with landowners, managers and drainage management contractors to minimise the effects of drainage management on freshwater quality and to ensure that conflicts between riparian management and drainage management are understood and taken into consideration during design and management of both. Financial assistance toward riparian management continues to be offered to landowners in the Waihopai and Waituna (Moffat Creek) catchments.

Greg Larkin has started a faecal source tracking investigation in the Waikawa Catchment. This is being conducted with Te Ao Marama Inc and the rūnanga in Awarua. **Kirsten Meijer** has been working in the Waituna Lagoon, collecting and analysing data. Our annual biomonitoring is finally complete after a rather wet summer down south delaying monitoring. Stormwater consents are progressing slowly for the Invercargill City and Southland District Councils, hindered by a lack of monitoring information and detailed AEEs submitted by applicants.

The groundwater team (**Karen Wilson** and **Dianne Elliotte**) have been very busy! The Maitara Strategic Water Demand report is out soon and community projects relating to groundwater quality in Balfour and Edendale are in full swing. They are also working on a proposed Water Plan variation to amend the management of confined and fractured rock aquifers in the region. Recent technical reports for groundwater are on the Environment Southland website and include a technical comment on groundwater in Waituna and the groundwater quantity State of the Environment technical report (Wilson 2011). **Clinton Rissman** joined the groundwater team in June, and the Surface water team has recently welcomed **Jane Kitson** as the new Senior Scientist – Surface water/Coasts. Jane is also the Māori representative on the NZFSS executive.

GREATER WELLINGTON REGIONAL COUNCIL

State of the Environment (SoE) river and stream monitoring

The summer SoE fieldwork (macroinvertebrate and periphyton sampling at 55 sites, as well as biofilm sampling at a selection of these sites) was finally completed in mid April, overseen by **Alton Perrie**. Regular rainfall had hampered attempts to sample our small urban stream sites in Wellington City and Porirua.

Continuous monitoring of dissolved oxygen concentrations and water temperature has been carried out at selected stream SoE sites thought to experience significant thermal stress during summer months. Work also has been undertaken in the lower reaches of Porirua Stream – a major tributary of Porirua Harbour – to establish a permanent continuous water quality monitoring site in close proximity to our existing stream flow recorder. Turbidity will be measured at this site, allowing us to keep a gauge on potential sediment runoff from earthworks and other development further up the catchment.

We are currently preparing our 5-yearly SoE state and trend reports covering all resource areas, including river and stream water quality and ecology, lake health, and soil, groundwater and recreational water quality. These reports are due for release at the end of 2011. Due to concerns over data integrity – principally as a result of analytical laboratory changes during the reporting period – NIWA has been contracted to assist with investigating the data quality and to carry out the trend analyses for our river and stream water quality data.

Recreational water quality monitoring and toxic cyanobacteria

Dislodged cyanobacteria mats were present along the edge of the Waipoua River in Masterton from late February until mid March, and in the lower reaches of the Waikanae and Hutt rivers from late March. Warning signs advising river users to avoid contact with the river were posted at public access points in these areas. No cyanobacteria-related dog deaths or human health incidents were reported. There have been a number of issues regarding communication of toxic algae risk to the public and a meeting was held in late January with Territorial Authorities and Regional Public Health to address these. It was agreed that actions will be taken to improve toxic cyanobacteria warning signage and communication for implementation during the 2011/12 bathing season. Greater Wellington, together with several other regional councils, is helping fund **Mark Heath's** PhD benthic cyanobacteria research.

Water quality and ecological investigations/projects

The Mangatarere Stream catchment water quality investigation completed in July 2010, coordinated by **Juliet Milne**, has led to the development of a 'catchment pilot project' to be run alongside the review of the regional plans. The focus of the project will be to engage with Carterton District Council, landowners, iwi and key industry and community stakeholders with the objective of improving water quality in the catchment as well as to explore approaches that could be applied in other catchments.

Greater Wellington, together with Porirua City Council and Wellington City Council, will soon be releasing a draft Porirua Harbour and Catchment Strategy for public comment. The strategy has as its vision 'A healthy harbour and waterways' and is focussed on addressing key issues around sedimentation, pollution (both stormwater inputs and eutrophication) and habitat restoration.

In March, **NIWA** undertook LakeSPI assessments in three of the region's lakes – Kōhangaterā, Kōhangapiripiri and Pounui. This was a first for these lakes and the results were exciting: despite discovering the presence of an introduced weed (*Elodea canadensis*) in Lake Kōhangaterā, this lake is considered 'a nationally outstanding example of a lowland lagoon system' and was ranked 10th best nationally out of a total of 206 New Zealand lakes assessed to date. Lakes Kōhangapiripiri and Pounui fell in the 'high' group for lake condition.

Lake Kōhangaterā, Wellington. Photo: Juliet Milne



Lake Wairarapa investigations

Work continues to improve our understanding of aspects of the water quality and hydrology of Lake Wairarapa. Two concurrent flow gauging runs have been completed to help characterise summer surface water inflows and six new shallow groundwater and open water level monitoring points have recently been established at the north-eastern end of the lake. The data gathered will hopefully help us understand the interaction between the hydrology of the lake, the Tauherenikau River and marginal wetlands, and therefore, the potential implications of water level alteration (by abstraction, lake level manipulation and drainage).



Matt Rowland measuring flow in a tributary of Lake Wairarapa.
Photo: Mike Thompson

Water quality standards

Summer Warr and **Alton Perrie** have been continuing to work towards defining recommended river ecology, water quality and habitat quality limits for the second-generation Regional Freshwater Plan. Identification of limits for fish, macroinvertebrate and periphyton indicators to protect aquatic ecosystem values of rivers in our region is being undertaken internally while **Olivier Ausseil** (Aquanet Consulting) is assisting with the identification of water quality limits across a range of values (e.g., aquatic ecosystems and trout spawning). The first step in this water quality work has been the preparation of a report on patterns in nutrient concentrations measured at our routine river and stream monitoring sites to provide background information for formulation of nutrient limits.

Also associated with the regional plan review, **Juliet Milne** convened an expert panel toxicants workshop on 2 May to discuss how we should approach developing coastal and fresh water receiving environment limits for stormwater-derived toxicants such as zinc and copper. The experts attending the workshop were **Bruce Williamson** (Diffuse Sources Ltd), **Chris Hickey** (NIWA), **Olivier Ausseil** (Aquanet Consulting Ltd), **Paul Barter** (Cawthron), **Paul Kennedy** (Golder Associates) and **Shane Kelly** (Coast & Catchment Ltd). **Graham Sevicke-Jones** (HBRC) and **Amanda Hunt** (MfE) also attended.

Instream flow assessment

Led by **Mike Thompson**, work has continued over the summer to review minimum flows for rivers and streams for the second-generation Regional Freshwater Plan. The current focus is on summarising the findings of individual investigations that have already been completed as well as establishing the baseline criteria for the next phase of work: reviewing core and supplementary allocations across the region. We are also due to receive a report from **Caleb Royal** on flow-related values held by iwi for several Wairarapa waterways; this report will further inform policy and plan decisions on minimum flow setting.

Wetland hydrology

In February we received the first draft of a report from consultant **Keith Thompson** documenting assessments of the condition of 10 wetlands in the region thought to be vulnerable to water abstraction. The assessments have looked at wetland hydrology, vegetation condition and water quality, with the report noting both threats to these and recommendations for improved management and monitoring. This information will be useful for developing a planning framework for wetlands.

Staff changes

Mike Thompson has been permanently appointed as Senior Environmental Scientist (Hydrology) following Laura Keenan's resignation in December after 12 months' parental leave. Laura remains on-staff on a casual basis. In March, **Dr Megan Oliver** started in our newly created part-time position of Environmental Scientist, Coastal Water Quality and Ecology. Megan's role will include overseeing our estuary monitoring programme. The position previously held by Doug McAlister (Senior Environmental Scientist – Groundwater) has been filled by **Dr Doug Mzila**. **Sheree Tidswell** has resigned to undertake her OE.



Staff changes

There have been large scale staff changes, in terms of roles, responsibilities and personnel, as a result of the Council re-organisation. The main freshwater contacts at Council are **Dr Martin Neale** and **Graham Surrey** who both work in the newly created Research, Investigations and Monitoring Unit (check out our websites at <http://www.knowledgeauckland.org.nz/> and <http://monitorauckland.arc.govt.nz/>).

Finding out what's in the new Local Board areas

Freshwater report cards have been produced summarising the extent and condition of the river resources in the new Local Board areas. See <http://www.knowledgeauckland.org.nz/>. In March 2011, and in conjunction with NIWA, Auckland Council carried out a four-day survey for shortjaw kōkopu in the Mangatāwhiri River, upstream of the water supply reservoir in the Hunua Ranges. Two fish are currently having their otoliths analysed to determine whether they came from a lacustrine population, which, if confirmed, would be the first time that this life history characteristic has been described for this species.

A Council record of 83 sites were sampled as part of the River Ecology Monitoring programme (REMP) during the summer of 2011. The extra sites have been added to the programme primarily to provide a more comprehensive evidence base for the Local Board freshwater report cards. Provisional data indicates the highest scoring site is on the Milne Stream in the Hunua Ranges (MCI = 147), and the lowest scoring site is on the Edgar Stream (MCI = 43) in Central Auckland.

Eye Spy on the lakes

The latest LakeSPI survey of Lake Wainamu, near Bethells Beach on Auckland's West Coast, has shown that Egeria cover has been reduced to near zero density after the introduction of grass carp in 2009. Full eradication of this weed from the lake appears imminent and native charophytes are already showing signs of re-establishment.

Getting it down on paper

'Auckland Unleashed', a discussion document to stimulate interest and participation in the production of The Auckland Plan, was released at a mayoral summit in March. Further details are available from www.theaucklandplan.govt.nz. A paper was published in the NZJMFR based on research work undertaken by NIWA and ARC. The paper is entitled 'Biodiversity values of small headwater streams in contrasting land uses in the Auckland Region'.

A better map, and a better SEV

A GIS-based modelling project to accurately describe the extent and location of river channels in the Auckland Region is underway. Previous investigations indicated that existing assessments of river channels in Auckland substantially under-represented the resource. Being able to manage our resources effectively relies in part on knowing how much we have and where they are; this project aims to fill these information gaps.

A review of the Stream Ecological Valuation (SEV) has been undertaken this year. Using the extensive datasets and experience of using the stream assessment technique that have been generated since its publication in 2006, most of the original authors, along with **Martin Neale** (AC) and **Richard Storey** (NIWA), have reviewed the method and made a series of changes. The review has focussed on removing redundancy and duplication and resolving some of the variables or functions that were not performing as expected. The overall result is a SEV that is simpler to understand and more efficient to carry out, whilst minimizing the loss of any important information. Field testing of the new method has just been completed, and if all goes well we envisage publication and release early in the new financial year.

The Bacterial Community Index

The BCI project continues to progress. This is a multi-council project in conjunction with the University of Auckland, and has seen a series of sites sampled in summer 2011 to further support the development of an indicator of stream health based on the bacterial component of stream biofilms.

ENVIRONMENT WAIKATO

Bruno David has initiated several fish projects in the Waikato Region aimed at improving understanding the state of the region's fish fauna, enhancing habitat in urban streams and testing an approach to trap koi carp.

Fish condominiums

A project to enhance cover within urban streams to increase their capacity to support native fish species is currently underway. Pre-data have been collected from a treatment and control site in Gibbons Creek, central Hamilton. Next year the plan is to deploy a series of fish 'condominiums' within stream banks; monitoring of any changes in relative abundance and size class structure will take place in upcoming years. It is hoped that, if successful, this tool could be used as a mitigation option in other localities where instream channel habitat is removed as part of flood protection activities.

Carp cage and auto finger trap carp counter

A project to undertake automated point source control of koi carp is underway after a successful finger trap test last year bottle necked nearly 2 tonnes of carp in 2

days in the Lake Waikare fishway. An automated carp finger trap 'counter' and cage is planned for deployment next financial year. Negotiations are currently underway to convert accumulated biomass of carp flesh captured by the trap into high grade potting mix for use as a medium to propagate native tree species. The intention is to store the energy removed and contained within carp flesh within tree growth as a long term solution.



Koi carp spawning run trapped in Lake Waikare outlet stream prior to removal. Photo: Mark Hamer

Reference and future SOE monitoring programme

Starting in December 2009, **Bruno David** initiated a reference site monitoring programme across the region recording standardised information for various ecological and physical components at a 150 m reach scale in wadeable streams. The purpose is to include ecological and physical system components to more accurately reflect the true state of waterbodies and to create a more accurate and defensible benchmark. Environment Waikato's monitoring has recently been extended to include freshwater fish. This important addition provides information relating to the connectivity of river systems, particularly where diadromous species should be expected to occur. Components currently being measured in this project include: water chemistry, fish (including size class and density), aquatic invertebrates, instream and bankside habitat (incl. depth, velocity, riparian shade), stream gradient, periphyton, submerged and emergent vegetation. These data will be summarised this winter and most components/indicators (excluding water quality) will be averaged on the same numeric scale to provide a single average ecological score for each reference reach. Next year the aim will be to expand the network and to compare reference site scores with scores obtained from random sites to provide more accurate information regarding the state of the environment within our region.

The 2011 SOE monitoring of macroinvertebrates, aquatic plant and habitat in wadeable streams was successfully completed by **Mark Hamer**. This is the third year of a rotating panel design involving 60 randomly selected sites to provide an unbiased estimate of regional stream condition, coupled with a selection of reference sites and long-term monitoring sites. These data will be analysed and written up over the next year. In association with **Ngairé Phillips** (NIWA), **Kevin Collier** and **Martin Neale** (Auckland Council) are investigating the use of macroinvertebrate traits as a tool to diagnose stressors using their SOE macroinvertebrate datasets.



A randomly selected Regional Ecological Monitoring of Streams (REMS) site that Mark Hamer is excited to be about to sample. Photo: John Hughey.

Tracie Dean-Speirs has recently started at Waikato Regional Council as a Lakes Management Officer in the River & Catchment Services Group – with a focus on shallow lake management. Her current projects involve working with other agencies through accords and other management agreements to co-ordinate work on shallow lakes, establishing minimum lake/bed levels for peat lakes and wetlands, and developing a management plan for the Council’s future work on shallow lakes.

Non-wadeable/large river studies

Kevin Collier and **Mark Hamer** have been evaluating the use of cotton strip breakdown, ecosystem metabolism and littoral macroinvertebrate communities as measures of non-wadeable river health. This work has involved sampling around 30 randomly selected sites accessed by kayak or boat. Kevin has also been writing up a study looking at the effectiveness of various indicators for detecting enrichment impacts on the Waikato River, and is currently assessing the effectiveness of macroinvertebrates as indicators of thermal changes.

STARK ENVIRONMENTAL LIMITED

In the last year, **John** and **Yvonne Stark** and their staff from Stark Environmental have processed nearly 600 macroinvertebrate samples for 20 different clients from Auckland to Christchurch and have prepared 15 client reports and two briefs of evidence. They have undertaken field work in Southland, South Canterbury, Buller, Golden Bay, Manawatū, and Taranaki.

EOS ECOLOGY

Team EOS has had another productive year, with a range of freshwater and estuary projects to keep us occupied. Recent and ongoing work includes:

- yearly monitoring of estuary environments and shellfish populations
- long-term city-wide invertebrate and habitat monitoring programmes
- investigating the treatment efficiency of stormwater treatment wetlands
- stream restoration (design and implementation) for protecting crayfish populations
- assessing the success of stream restoration projects
- invertebrate identification for State of the Environment work and an array of research projects
- numerous resource consent projects including consent auditing and infrastructure projects.

Our two major projects this year have been our expedition to Campbell Island and the Christchurch earthquake environmental response work, (see below).



Campbell Island: Past, Present and Future

Some may not consider a sub-Antarctic island the best summer holiday destination, but for **Shelley McMurtrie** and **Alex James** this was the perfect combination of research and intrepid exploration. After months of EOS coordinating the multidisciplinary nine week expedition to Campbell Island it was a relief to board the HMNZS Wellington in December 2010 and head into the wild southern ocean. Shelley was responsible for leading the three-person freshwater team that included Alex from EOS and Krystyna Saunders from Bern University (Switzerland). Goals of the freshwater research programme were to characterise the many freshwater stream environments on the island, unravel the

overarching factors affecting community composition, and discern the importance of marine nutrient subsidies in driving stream food webs. Through studying the biological and geo-chemical properties of the numerous tarns, the programme also aimed to reconstruct past environmental conditions and deduce long-term environmental and climatic change. The wider expedition team included botanists, historians, archaeologists, and terrestrial ecologists – this diverse team had the combined aim of uncovering the island’s human history, ecosystem processes and ecology, and biota recovery after decades of grazing and the world’s largest island rat eradication programme. We had a comprehensive field programme that was only partly hindered by the challenging environment, with access around the island often involving crawling through dwarf *Dracophyllum* forests and avoiding overzealous sea lions. The environment and wildlife were true highlights of the trip, as was the world’s first video recording of the call of the rare Campbell Island Snipe that Shelley captured one evening when returning to base camp. We returned to Christchurch 11 days before the February earthquake and were very lucky that our precious cargo of invertebrate, water, sediment and core samples all survived the earthquake.

Find out more about our journey at www.campbellisland.org.nz

Top to bottom: A flowerbed of *Pleurophyllum speciosum* overlooks Northwest Bay; Shelley sampling Southeast Stream under cover of a dwarf *Dracophyllum* forest; Shelley and Alex sampling Camp Stream on an unusually warm and sunny day; Alex and Shelley having lunch and enjoying the view towards Courrejolles Point; a deep pool in Camp Stream. Photos: Shelley McMurtrie and EOS Ecology

The Earthquakes

Like much of Christchurch, EOS Ecology was affected by the great perturbation of February 22nd. Our offices were messed up, with furniture falling over, freezers spilling their contents, and miscellaneous items jumping around. Luckily our building remained structurally sound and apart from cracking in the plaster walls and a few doors that don't quite fit the frames properly anymore we suffered little actual damage. Fortunately none of our staff suffered any serious damage to themselves or their homes. After a few days of cleanup and a few weeks waiting for the resumption of power, water, and sewage services, EOS Ecology was ready to face the challenges of the disaster zone that was Christchurch. While the June 13 earthquake did hit us again we were much more prepared for it, and with power and water staying on it was only a few days before we were back on track again.



The Avon River choked with silt the evening of February 22nd. Photo: Alex James

Christchurch's waterways have been subjected to a major disturbance incorporating multiple stressors including bed uplift, bank slumping, massive fine sediment inputs, and the ongoing discharge of raw wastewater from broken sewer pipes. After the initial emergency phase was over, a team of aquatic scientists with representatives from Environment

Canterbury, Christchurch City Council, NIWA, and EOS Ecology (Shelley McMurtrie) was assembled to establish an investigation to aid earthquake response management decisions relating to the Avon and Heathcote Rivers. EOS Ecology is leading a number of the investigations:

- Invertebrate surveys – to determine the impact of silt and sewage inputs on macroinvertebrate communities in the wadeable part of the Avon River, EOS Ecology has resampled nine urban waterway sites that we have previous data for. To differentiate the effects of silt and sewage, three sites were selected that had only silt inputs, three sites that were predominantly affected by sewage inputs, and three sites upstream of any earthquake-related silt or sewage inputs.
- Fish survey – the effect of the earthquake on fish communities of the Avon River in the wadeable section was assessed by resampling fish at six previously fished sites along an

Cockle monitoring in the Avon-Heathcote Estuary after the earthquake requires some additional personal protection (bottom left). Amber and Nick check hopefully to see if they have enough cockles as the smell in the estuary is overpowering (bottom right). Photos: Shelley McMurtrie





Post-earthquake electrofishing in the Avon River through the central city cordon. Photos: Shelley McMurtrie



upstream-downstream gradient from no earthquake-related inputs, to possible silt inputs, to known silt and sewage inputs.

- Invertebrate bioassays – because the lower portions of the Avon and Heathcote Rivers are unwadeable, they have received little attention with respect to invertebrate sampling over the years. It is also these portions that are receiving the bulk of the sewage inputs. To determine the impact of sewage (specifically lowered dissolved oxygen and elevated ammonia) on the invertebrate fauna of these lower unwadeable reaches EOS Ecology designed a bioassay cage experiment. Three common species (*Potamopyrgus antipodarum*, *Paracalliope fluviatilis*, and *Paratya curvirostris*) were obtained from local waterways not receiving sewage inputs and held in cages upstream and downstream of the sewage discharges into the Avon and Heathcote Rivers.

- River dredging – there is the potential that dredging of the lower Avon and Heathcote Rivers (and possibly Styx River) will be required to restore flood capacity that was compromised by the earthquake. With a dearth of information on the fauna of the lower non-wadeable sections of these rivers, EOS Ecology will lead a project to determine the current state of the fish and invertebrate faunas and what potential effects river dredging will have on them.

RYDER CONSULTING

After escaping the February earthquake relatively unscathed, the June shake saw our Christchurch office placed in the 'Orange Zone' and so a good degree of uncertainty now exists regarding its future. **Ruth Goldsmith** also briefly experienced her own braided river in the backyard. Ruth has enjoyed frequent field trips out of the city over the summer, including to the Wairarapa for fieldwork associated with a proposed wind farm, and the West Coast for re-consenting of the McKays Creek/Kanieri Forks Hydroelectric Power Scheme near Hokitika.

Ruth has also been investigating ways of providing safe downstream passage for eels at dams. Model eels, matching the physical characteristics of downstream migrating adult eels, were constructed and acceleration sensors implanted in their 'belly'. The eels were released over the dam and the forces they encountered in their journey down the spillway and into the tailrace recorded by the sensors. The eels were then retrieved from the tailrace, with the recovered data providing an indication of how live eels may respond to the same journey.

Ben Ludgate has spent a busy past 12 months surveying streams and rivers throughout the



Urethane rubber model eels used in the spillway trial. Small eel dimensions: 1 m long, maximum diameter 100 mm, weight approximately 4.5 kg.



Ben carrying a trout from the helicopter monsoon bucket to be released in the Branch River.

country as well as managing the sample processing laboratory in our new Dunedin office. He and Ruth, along with the assistance of Fish and Game staff, recently completed a three-year trout transfer project to the Branch River in Marlborough. Approximately 800 large trout have been transferred, with the final transfer involving a 500 km journey by tanker and helicopter. The trout have been implanted with passive integrated transponder tags to monitor their movements through a fish pass at the Branch Hydroelectric Power Scheme weir. Fish and Game Nelson/Marlborough recently reported an excellent late fishing season for anglers in the Branch/Leatham rivers.

Jarred Arthur joined Ryder Consulting this year. He recently completed a Master’s degree at University of

Canterbury investigating aquatic communities in forest and pasture streams in Canterbury and Taranaki. Despite Otago’s inclement weather over the past five months, Jarred has managed to survey benthic communities in a number of streams throughout the region and is looking forward to venturing further afield over the coming months.

Greg Ryder has had a heavy resource consent hearing and environment court workload over the past few years. Recently, he has been working alongside Fish and Game Otago and the Department of Conservation in developing native fish and salmonid enhancement initiatives in the lower Clutha River catchment. He has also been assisting Environment Southland to identify ‘sensitive environments’ within its region, which are catchments and/or sub-catchments that have water quality issues or are at risk of developing them. Greg continues to enjoy examining relationships between flow patterns, water quality and benthic communities.



Who said rampant periphyton growth can’t be beautiful? An example of a cyanobacteria and filamentous green algae community in a West Coast river.

AQUANET CONSULTING LTD

Over the past 12 months, Aquanet Consulting has been involved in a wide range of projects, involving field studies, technical reporting, peer reviewing, project management, and appearances as an expert witness. Over the summer months, we were commissioned to undertake a number of field studies, including periphyton surveys and stormwater monitoring for the Palmerston North City Council, and a baseline water quality and aquatic ecology survey in Māhia for Wairoa District Council. We also assisted Hawke’s Bay Regional Council staff to undertake a catchment water quality and aquatic ecology investigation in the Whangawehi Stream catchment, Māhia Peninsula.

Olivier Ausseil has been busy with a number of technical reports, including a regional state of knowledge on the effects of stormwater report for Hawke's Bay regional Council and a regional nutrient status report for Greater Wellington Regional Council. The series of technical reports on recommended water quality limits to support Greater Wellington's proposed Freshwater Plan is well underway. We also contributed to Environment Southland's State of the Environment reports, both as a technical contributor and in a peer-review/mentoring capacity.

With regards to RMA processes, Aquanet was involved in a number of resource consent applications and compliance cases, in particular in Council Hearings and Environment Court Direct Referrals and Appeals on behalf of consenting authorities, applicants and submitters. We are also working for the Department of Conservation on matters related to the One Plan Appeal.

Project management and facilitation is a fast growing area for Aquanet Consulting. Olivier has been appointed as the Facilitator of the Palmerston North Wastewater Monitoring Group, and continues to act as the regional councils' Champion in the 'Sedimentation and in-stream values' Envirolink Tools project. In the large project department, Olivier has recently been appointed in the Science Lead role for the Ruataniwha Plains Water Augmentation Scheme, a large water storage project undertaken by the Hawke's Bay Regional Council. The job involves the project management, coordination and peer-review of a series of water quantity, water quality and ecology studies over the next 12-15 months.



Small stream gauging using a portable V-notch weir as part of the Te Māhia Beach Wastewater Scheme baseline water quality and aquatic ecology survey. Photo: Olivier Ausseil.

OPUS INTERNATIONAL CONSULTANTS

The Opus team has completed some interesting collaborative projects in the last 12 months along with the more usual monitoring and AEE work. **Keith Hamill** (Opus) and **Richard Montgomery** (Freshwater Solutions) prepared an AEE for drainage and catchment management activities by the River and Catchment Services team of Environment Waikato. We made use of the conservation value ranking (Leathwick and Julian 2009) to help identify ecologically sensitive areas, which proved to be a valuable approach for risk assessment and prioritising mitigation measures.

Keith Hamill led a joint project with **Piet Verburg**, **Martin Unwin** (NIWA) and **Jonathan Abell** (University of Waikato) to assess the state, trends and monitoring of lake water quality in New Zealand. This resulted in three reports reviewing the current state of monitoring (Hamill and Verberg 2010), nationwide state and trends (Verberg et al. 2010) and a comparison with international practice (Redeker et al 2010).

Roger MacGibbon, **Keith Hamill** and **James Turner** (AgResearch) assessed the feasibility of using wetlands to remove nitrogen and phosphorus from rivers and seeps entering Lake Rotorua.

We found them to be a reasonably cost-effective option, but their widespread use may not be realised without the right policy framework.

Keith Hamill also wrote a lakes and lagoon technical report for 'Southland Water 2010: Our Ecosystems'. This identified that Waituna Lagoon was at high risk of 'flipping' into a dirty state and Environment Southland is now leading efforts identifying how to restore and clean up the lagoon.

CAWTHRON

And the group is growing and growing ...

The Cawthron Freshwater Research group is constantly growing with **Craig Allen** and **Louis Tremblay** as the latest team members. After finishing his MSc in Physical Geography looking at wetland hydrology, Craig started working for Cawthron as an eco-hydraulics scientist in September 2010. Since then he has been busy with a range of projects, including minimum flow analysis, invertebrate habitat modelling and water quality monitoring. Louis joined the team last December after 12 years with Landcare Research. Louis' role is to build an ecotoxicology capability platform to complement the Coastal and Freshwater team expertise.

How much water is enough?

On the research front, **John Hayes** has been working with **Robin Holmes** on a PIT tag tracking study aimed at understanding the effects of natural flow variation on the timing and magnitude of juvenile brown trout emigration from the Rainy River, a spawning-nursery tributary of the Motueka River. This work complements a long term (10 year) study of juvenile trout population dynamics – also aimed at understanding the effects of flow variation (see NZJMF 44:247-270). Floods rather than low flows appear to be dominating the population dynamics and emigration, and the population thins in winter rather than summer – the opposite to what we expected going into the study. Another stimulating research project has been a collaborative venture with **Dean Olsen** and **Doug Booker** (NIWA), developing BITHabSim (Benthic Invertebrate Time series Habitat Simulation). This is a model that simulates benthic invertebrate habitat and relative abundance time series for hydrographs. It takes account of disturbance by floods, wetting and drying of the channel, and accrual rates of invertebrate populations. We have developed the model in response to a need for greater precision in assessing the effects of water allocation scenarios on benthic productivity, upon which fish and birds, the main instream values fought over in resource consent hearings, depend. The above projects are funded under NIWA's Environmental Flows Programme. Robin and John have also developed a trout habitat survey protocol for streams. The protocol aims to assess the condition of habitat at the catchment scale in order to underpin limiting factor analysis and scoping of rehabilitation options. This work is funded under NIWA's Aquatic Rehabilitation Programme.

John has contributed to several environmental consulting projects over the last year, including Genesis' re-consenting of the Huntly Thermal Power Scheme, Meridian's interest in including hydropower generation in water allocation planning in the Waiau River in North Canterbury, DOC and Fish and Game's interests in the effects of Trustpower's Lake Coleridge storage variation for hydro power and irrigation, and Fish and Game's interest in varying consent conditions to mitigate the effects of Central Plains Water Irrigation Scheme on salmon angling.

Between bugs and hockey

Karen Shearer has been involved in a variety of research and commercial work this past year, which has made for a very interesting work-life sprinkled with a good dose of fieldwork. She is

currently working with the Department of Conservation investigating the effects of dairy farming in the Molesworth Station on invertebrates in the Acheron River. Karen and **Roger Young** have recently had a paper accepted for the NZJMFR looking at the influences of land use and geology on invertebrates in the Motueka River. Karen continues to work with **John Hayes** and **Dean Olsen** on FST-funded research seeking to better define how changes in water flow affect the availability of habitat for trout and invertebrates. Karen continues to enjoy playing hockey and has (again) been selected in the NZ Master's team for her age group.



The Acheron River in the Molesworth Station backcountry. Photo: Karen Shearer.

Deep underneath the ground

Dean Olsen has been working on a project looking at the effect of wood on the hyporheic zone with **John Quinn** and **Paul Franklin** (both of NIWA) as part of the Rehabilitation programme. He is also involved in a number of commercial projects including a review of temperature criteria for native biota for Environment Waikato, Auckland Council and Hawke's Bay Regional Council.

Mr Busy

Iain Maxwell has been working on setting up a fishery attribute database and working with Fish and Game to compile data into it. The database will be used to rank rivers that have some recreational fishing from those under a high degree of change to those relatively unmodified. This work will then feed into later MSI research into cumulative effects and tipping points. He has also been working with Hawke's Bay Regional Council and Tonkin and Taylor to review potential effects of water storage proposals on the instream values of the Tukituki River catchment. Together with HBRC he reviewed the potential effects of a proposed upgrade of the Waipukurau/Waipawa waste water treatment system on the Tukituki river fisheries. Other projects he has been working on include a review for Meridian Energy of the potential effects of a proposed scheme on the Waiau River together with **John Hayes, Kati Doehring, Craig Allan, Dean Olsen** and many others. Iain has also been involved in setting up a project to chase floods in the Mokihinui River using DIDSON with **Don Jellyman**. The intention is to try to film eel migration around flood events to assist Don's work with Meridian Energy Limited. One of the



The DIDSON set up in the Mokihinui to monitor eel migration during flooding. Photo: A. Quarterman

biggest challenges for Iain, however, was the temporary management of the Cawthron Coastal-Freshwater group while **Rowan Strickland** was taking a well earned break in the US.

During most of the last year, **Roger Young** was involved with finishing off the Integrated Catchment Management (ICM) research programme and has subsequently been busy editing a special issue of the New Zealand Journal of Marine and Freshwater Research that summarises the last ten years of ICM research in the Motueka Catchment. Other than that, Roger has been busy getting the Cawthron components of the MSI-funded Aquatic Rehabilitation and Cumulative Effects Programmes up and running. He particularly enjoyed a stint of field work with **John Quinn** and other NIWA staff on the Tukituki River in February examining ecosystem metabolism and nutrient uptake along the river. He's also been working with **Joanne Clapcott**, and the rest of the Streambed Sedimentation project team, on an Envirolink-funded report outlining a series of protocols and guidelines for the measurement and interpretation of deposited sediment on river beds. The report will be completed in October. Roger has also been working with **Joe Hay** and **Steve Ledington** on the effects of low flow on dissolved oxygen in a Southland spring-fed stream and approaches that could be used to set minimum flows in these types of systems. Roger has also been helping **Bob Wilcock**, **Graham McBride** and **Max Gibbs** prepare a guide for Horizons Regional Council on continuous measurement and interpretation of dissolved oxygen in rivers, and working with **Kati Doehring** and **Trevor James** on a review of Tasman District Council's surface water quality.

A big part of last and this year, **Kati Doehring** spent on finishing off a 199 page long Tasman District Council Surface Water Quality SOE Report. In March, Kati spent three weeks in the Waikato area to conduct some coarse particulate organic matter (CPOM) retention experiments as part of the MSI Aquatic Rehabilitation programme to identify the difference in retention magnitude of varying riparian vegetation stages after replanting. After she drove 5000 km between the Coromandel and

Floating wooden dowels (left) to compare coarse particulate organic matter (CPOM) retention between impacted and restored agricultural streams and (right) Kati Doehring scanning for sediment-buried waratahs in a Waikato stream. Photos: K. Doehring and K. Costley.



Taupō, crossing almost every dairy farm existing in the Waikato (and there are lots!), she now knows how to speak cow. She has also been working with **Iain Maxwell** and others on a review of potential effects of the proposed Waiau River irrigation scheme for Meridian Energy and helping out other Cawthroners with her GIS skills.

How warm is too hot?

Other than small scale bio-monitoring for regional councils and consultants, **Robin Holmes** has been working on a review of the effects of temperature on New Zealand's native freshwater fauna for Environment Waikato together with John Hayes and Louis Tremblay. He also assists **John Hayes** with the current MSI Aquatic Rehabilitation project in the Whakakahi, developing a small-scale instream habitat assessment protocol.

The Didymo goddess

Susie Wood's research group recently successfully established laboratory cultures of didymo. She is now working with **Cathy Kilroy** (NIWA) and **Craig Cary** (Waikato University) and **Philippe Gerbeaux** (DOC) to explore didymo distribution patterns and stalk production using these cultures. Susie continues to work on a number of cyanobacterial related projects. Research with **Craig Cary** and **David Hamilton** (Waikato University) demonstrated for the first time that cyanobacteria do not continuously produce toxins. Collectively they have identified environmental variables that trigger the 'switching' on and off of toxin production. Working with **Ngairé Philips** and **Mary De Winton** (both of NIWA), Susie has recently characterized the benthic algal communities of a range of lakes of differing trophic status in the Rotorua region. Susie and **Roger Young** are supervising Mark Heath's PhD (Victoria University). This project aims to gain knowledge on the drivers of benthic cyanobacterial proliferation and toxin production in rivers nationwide. Susie is also working with **Francine Smith** and **Sally Gaw** (both of Canterbury University) on several projects investigating benthic cyanobacteria in the Canterbury region.

Layer after layer

Joanne Clapcott has been investigating the idea of reference condition in our rivers and streams. A spatial review has highlighted gaps in our SOE network at a national level and examined ways in which we could fill these gaps, from targeted monitoring through to modelling reference state. The project in the NIWA-led Aquatic Rehabilitation programme aims to develop robust estimations of reference state for a number of river indicators and links closely to another project Joanne is working on, identifying land use thresholds in the NIWA-led Cumulative Effects programme. An early output from these projects has been the development of a spatial layer predicting fine sediment cover in streams. The layer can be used to estimate sediment cover or identify where soft-bottomed streams may once have been cobbles. Uncannily, this work links to the ENVIROLINK tools project on Sedimentation and Instream Values. Joanne and **Roger Young** are project leaders and together with a multi-institutional research team plan to deliver recommended protocols and guidelines for assessing fine sediment in streams in October. Joanne has also begun working with Jon Harding (University of Canterbury) on a 2-year project to develop a national spatial layer of mining impacts on stream integrity.

Environmental Monitoring Strategy for Auckland Council

Morphum Environmental scientists **Justine Coup** and **Taryn Pearce** have been carrying out field surveys to support the monitoring programme for streams in the Auckland Isthmus. Twelve sites have been identified for the initial phase of the study, targeting waterways influenced by a number of large stormwater and infrastructure projects.

Stream Ecological Valuations have been conducted at each site and sites were selected to support wider ecological and water quality monitoring for streams in urban Auckland. This information will be used as a base against which to measure change in these highly developed catchments.

While out and about the team had a visit from an eel hoping to be a movie star – check out the video footage on the Morphum website here:

<http://www.morphum.com/news.asp?pageID=2145880545&RefID=2141740621>

Watercourse Management Plans

In order to support catchment and stream managements in Central Auckland, Morphum was commissioned to undertake surveys and produce four Watercourse Management Plans (WMPs) for Metrowater (under the previous Auckland City Council). **Justine Coup** and **Damian Young** have written the WMPs, which are comprehensive ‘stream walk reports’ that identify management zones and restoration opportunities to guide maintenance contractors, council planners and community groups. Restoration in the Lower Meola Creek is being undertaken by Wai Care Auckland Central and is based around the location of the Restoration Opportunities identified.

<http://morphum.com/index.asp?pageID=2145886544>

Meola Wet Weather Water Quality Monitoring

As part of a wider project, Morphum have been doing water quality monitoring in the Meola Creek catchment over summer and autumn 2011 for the Auckland Council. This has involved baseline and synoptic wet weather monitoring of the creek, harbour and selected network discharge points.

Mobilising a team of 12 to undertake wet weather monitoring at short notice has been a bit of a struggle, with one of the two wet weather events falling on a Friday evening before a long weekend, and the other falling on a Saturday! However, the use of humans instead of auto samplers has meant that a larger range of parameters can be assessed as the volume of the sample collected is not limited by machinery.

The results obtained are very interesting and will inform development of critical infrastructure within Auckland. The next step is to take a closer look at the assimilative capacity of the stream during winter months to assess the influence of aquifer inputs on keeping the stream healthy.



Lower reaches of Meola Creek, Point Chevalier, Auckland. Photo: J. Coup.

Te Uku Wind Farm Monitoring

Morphum have been undertaking water and ecological monitoring of the Meridian Energy Ltd Te Uku Windfarm project for over 18 months. The wind farm is now operational so the construction monitoring is complete, but Morphum are carrying out post-construction monitoring to test whether longer term effects can be determined.

In addition to the monitoring, Morphum carried out a post-construction assessment of road culverts for fish passage. The Te Uku Windfarm was awarded the Environment Waikato's earthworks 'Site of the Year' award in 2010 as a result of their commitment to high environmental standards on site.

Wai Care Programme

Morphum provides the resources to support the Auckland Central Wai Care Co-ordinator roles. **Justine Coup** and **Taryn Pearce** are the Co-ordinators for Wai Care Auckland Central and are finding that this year more schools and communities are putting their hands up to monitor and take action to improve urban waterways. The big project this year is the Lower Meola Restoration Project, where several community groups and schools are working together to improve riparian integrity. The Wai Care Expo was held on May 28th and **Professor Jenny Webster Brown** (Director, Waterways Centre for Freshwater Management) was one of the guest speakers, sharing her knowledge around water chemistry with a workshop on 'What water chemistry is telling us about our stream'. The work Wai Care does highlights the need to ensure clear communication between scientists and the communities who are undertaking practical, hands-on action in our streams.

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S.I.L. 1987 Trust Fund Awards

The Society administers grants for overseas travel by young scientists and visits by overseas scientists through the SIL 1987 Trust Fund. The two grants are:

S.I.L. 1987 Trust Fund Travel Award *and* S.I.L. 1987 Trust Fund Guest Lecturer Award

S.I.L. 1987 TRUST FUND TRAVEL AWARD

Objective: To enable outstanding young scientists to attend overseas conferences, seminars or workshops, or to visit institutions to learn techniques, develop expertise, use equipment, collections or library facilities not available in New Zealand.

Eligibility: Applicants shall be New Zealand based members of the New Zealand Freshwater Sciences Society. Preference will be given to candidates less than 35 years of age, or who graduated in the previous 10 year period.

Previous awards: No person shall be ineligible for an award because of a previous award.

Applications: Applications shall be made on the electronic form available either on the website (<http://freshwater.science.org.nz/>) or from the Secretary of the New Zealand Freshwater Sciences Society (brian.sorrell@biology.au.dk) by the date shown below.

Applicants will need to state their aims and objectives, submit a draft itinerary, supporting letters from relevant institutions, overseas contacts, a curriculum vitae, a list of publications, a draft budget showing other sources of financial support obtained or being sought, and name two referees.

Criteria: Applicants will be judged on the benefits that are likely to accrue to the candidate and limnological research in New Zealand as a result of the trip.

Reporting: The successful candidate will submit a trip report for publication in the Society's newsletter. Where appropriate, the successful candidate will also describe the work done during the trip at the next annual meeting of the Society.

Award: The award will cover the costs of travel (up to 100% for the grantee only) together with a contribution towards accommodation and living expenses up to \$2000.00 or such higher sum that may be determined by the Trustees.

Tenure: Such period/periods as the Committee thinks fit.

Frequency: The award may be made annually provided there are suitable candidates. The Committee may decide not to make an award in any particular year.

Closing date: Applications must be submitted to the Secretary/Treasurer by **30 November 2011** for travel in 2012. All material (including letters of support from referees) must be submitted electronically to the Secretary/Treasurer. Applications should be a **single Word or pdf (preferred!) file**, plus pdfs of letters of support. Please note that material received as hard copy cannot be considered.

S.I.L. 1987 TRUST FUND GUEST LECTURER AWARD

Objective: To provide financial support for visits to and/or within New Zealand by eminent overseas limnologists, whose visits will benefit New Zealand's limnological research community as a whole.

Eligibility: Candidates should be eminent in some field of limnological research and have the ability to make a contribution to limnological research in New Zealand.

Previous awards: No person shall be ineligible for an award because of a previous award.

Applications: Applications shall be made on the electronic form available either on the website (<http://freshwater.science.org.nz/>) or from the Secretary of the New Zealand Freshwater Sciences Society (brian.sorrell@biology.au.dk) by the date shown below.

Nominations: Candidates must be nominated by a financial member of the NZFSS who will submit on their behalf a letter outlining the aims and objectives of the trip, a curriculum vitae, a list of publications, a draft itinerary, a draft budget showing other sources of finance if any, and the names of two referees.

Criteria: The candidates shall be judged on their eminence in the field of limnological research and their ability to make a contribution to New Zealand's limnological research community. Visitors will be expected to address the annual meeting of the NZFSS and to visit several New Zealand research institutions including universities.

Reporting: The successful candidate will submit a trip report for publication in the Society's newsletter.

Award: The award will cover the costs of travel (up to 100% for the grantee only) together with a contribution towards accommodation and living expenses up to \$2000.00 or such higher sum that may be determined by the Trustees. In determining the value of the award the Committee shall take into account the fact that overseas scientists are often better able to receive financial assistance than New Zealanders.

Tenure: Such period/periods as the Committee thinks fit.

Frequency: The award may be made annually provided there are suitable candidates. The Committee may decide not to make an award in any particular year.

Closing date: Applications must be submitted to the Secretary/Treasurer by **30 November 2011** for Guest Lecturers proposed for the 2012 Dunedin conference. All material (including letters of support from referees) must be submitted electronically to the Secretary/Treasurer. Applications should be a **single Word or pdf (preferred!) file**, plus pdfs of letters of support. Please note that material received as hard copy cannot be considered.

Beyond the Blue Pacific – stories from S.I.L recipients who ventured abroad

This year there were three recipients of the S.I.L Awards – Tina Bayer, Jennifer Blair and Helen Warburton. The three intrepid journeyers recount their stories and tell us about their adventures below.

FROM THE MOUNTAINS OF NEW ZEALAND TO THE MESOCOSMS OF FRANCE

By Tina Bayer, University of Otago

Thanks to the support of an S.I.L Trust Travel Award, I was able to attend the 7th European Freshwater Symposium (SEFS) in Girona, Spain, from 27th of June to 1st of July 2011. This conference is a meeting and exchange platform for freshwater scientists from all over Europe, but was also well attended by delegates from overseas, with a total 500 delegates from Europe, Australia, New Zealand, and America. It was the largest turnout at a SEFS meeting to date, showing perhaps the growing importance of this conference. This year's theme was 'Freshwater ecosystems – Challenges between conservation and management under global change'.

A wide variety of topics were covered at this conference, with plenty of interesting sessions and talks on offer. For me, of special interest were the sessions on microbial ecology, impact of global change on freshwaters, and trophic food webs. Ruben Sommagura made me aware of the role of anoxygenic phototrophic bacteria in mountain lakes, and Martin Kainz and Thomas Larson presented exciting developments in using fatty acids and stable isotope fingerprinting in aquatic food web studies. Working on impacts of climatic changes on sub-alpine lakes myself, I was also captured by Manuel Villar-Argaiz presentation on global stressor propagation through food webs leading to decoupled trophic relationships in mountain lakes, and David Livingstone's plenary on climate as a forcing variable to lakes.

I gave a presentation entitled 'Impact of climate change on large, oligotrophic lakes in New Zealand'; it was well received with some very helpful feedback. It was a great opportunity to contribute a New Zealand perspective to the session, and present my research to an international audience.

From the sessions, plenary talks, feedback for my own talk, and discussions with peers, I believe I have come away from the conference not only richer in knowledge and contacts, but also inspiration and ideas. I also immensely enjoyed the opportunity to catch up with old European contacts and with recent developments in European Freshwater science and management, particularly successes and problems with the European Water Framework Directive, on which I completed my honours project in Germany in 2004. I feel lessons learnt here are applicable to freshwater management world-wide.

As part of my trip to Europe, I also spent four weeks in Southern France working on a mesocosm experiment looking at top-down vs. bottom-up effects in estuary food webs. It was a great experience being part of team of more than 15 international collaborators and a large, well organised experiment.

I am very grateful for the S.I.L Trust Travel Award that enabled me to attend this conference and feel that it has been an important stepping stone in my career and a worthwhile experience.

THE DIFFICULTIES OF NAVIGATION IN AUSTRALIA

By Jennifer Blair

In July I attended the Australian Society for Fish Biology Conference and the 5th Australian Technical Workshop on Fishways in Townsville with support from the S.I.L Trust Travel Award. The conference encompassed a wide range of themes including the effects of climate change on coral reef fishes, management and enumeration of fish stocks, and tracking movement using telemetry. Highlights included keynote addresses by Chris Lowe about the different tools available for tracking marine fish using telemetry, and by Geoffery Jones about the connectivity of reef fish populations and export from marine reserves. We were also lucky enough to visit the Townsville aquarium for one of the conference functions. I was pretty jealous of all the local students who had to go diving on the Great Barrier Reef as part of their field work – of course, they thought the water was cold during winter at only 20 °C!

At the fishways workshop, it was interesting to see the challenges faced with fish passage from other countries' perspectives; it seems that Australians have an even tougher job than we do. On the one hand, there is such a wide range of fish sizes to accommodate in the fish passes, from small fish such as gudgeons and smelt, through to the large Murray cod. On the other hand, many Australian species are weak swimmers, meaning that fishways need to be carefully engineered to reduce water velocity and turbulence, and several modelling approaches can be used to do this. A general theme in the workshop was that rock ramp or "natural" fishways can be effective, but careful design and installation is needed; things can often go wrong in the installation stage! Prefabricated vertical slot fishways are emerging as another option in Australia as they can be designed for certain specifications. Of course, once the fishway is installed, it's vital to monitor passage of fish through the structure. Keynote speaker Dave Marvin presented probably the most impressive fish passage system of the conference; the Columbia Basin PTAGIS programme in Oregon, USA, which tags over 2 million fish per year.

Overall the conference was a fantastic experience; I learnt a lot and met a lot of very knowledgeable people. I'm very grateful to NZFSS and the S.I.L Trust for giving me this award. Thanks very much!

A SIZEMIC TRIP AROUND THE WORLD

By Helen Warburton, University of Canterbury

In April this year I was lucky enough to be selected to attend SIZEMIC's 4th, and final, International Workshop in Hamburg, Germany. SIZEMIC (www.sizemic.org) is a European research network dedicated to synthesising size- and species-based research carried out in different branches of applied and theoretical ecology, fostering integrated advances in size-based research with the aim of providing collaboration across existing research boundaries and training for young scientists.

The workshop theme was 'Changing climate, physiological adaptation, ecosystem resilience and body size constraints' and was run over three days. Each day comprised of a number of plenary

and discussion sessions led by invited presenters who are at the forefront of their research fields. The sessions were aimed at understanding how physiological constraints of organisms in a community and the structure of whole communities influences the ability of ecosystems to cope and adapt to global environmental change. My PhD research is focused on understanding how body size distribution patterns in a community influence predator-prey interactions, how these change with increasing water temperatures, and ultimately how this affects food web stability in stream ecosystems. Therefore, the SIZEMIC workshop sessions were all very relevant to my PhD research. It was great to be at such a focused workshop where there were so many relevant talks in both the empirical and theoretical fields of ecology.

Attending the workshop was an amazing and extremely beneficial experience. The workshop registrations were limited to a relatively small number of participants (80-90). Therefore, it was easy to meet and network with leading researchers from Europe and the United States who are working in areas similar to that of my PhD. I presented a poster entitled '*Body mass-abundance relationships in streams: the importance of habitat size*'. This allowed me to discuss my ideas and results to date and receive feedback from an experienced international audience. As a result I have been able to generate a number of new ideas for my work and have also been offered a number of collaborative opportunities which would allow me to work on datasets that have been collected by other research groups. To top off a great conference I was also awarded the 'Best Poster' award.

Following the SIZEMIC workshop I spent three weeks at the University of York where I was hosted by Professor Richard Law in the Theoretical Ecology Research Group. While I was there I gave a presentation on my research to a mostly mathematical/theoretical ecology audience. It was interesting to get this group's perspective and feedback on my primarily empirical-based research. While in York I spent time discussing the best methods to use when modelling food web dynamics and what type of empirical data I would need to collect to parameterise these models. To be able to talk to Richard and other members of the group who have a great understanding of food web stability from both a mathematical modelling approach and an empirical understanding of the biology was incredibly valuable.

While in the UK I was also invited to spend a day with members of Phil Warren and Andrew Beckerman's lab in the Evolution and Community Ecology Department at Sheffield University. While there I gave another presentation on my research and spent time discussing it with different members of their group. After visiting Sheffield University I spent a few days at Queen Mary University in London with members of Guy Woodward's Lab and a day in the field visiting a number of streams in the Ashdown Forest. I obtained useful information on sampling techniques and laboratory protocols which I will put into practice in New Zealand.

On the way home from the UK, I attended the North American Benthological Society meeting in Providence, USA. This conference was a great forum for learning about freshwater research across a wide range of topics and systems, and provided an ideal opportunity to present my research. My talk was well received, generating a lot of questions, and I was able to get further helpful feedback.

My trip overseas was an amazing and inspiring experience, and hugely beneficial to my PhD studies. I have made many useful contacts and received an amazing amount of positive and helpful feedback. I am extremely grateful for having received an S.I.L. 1987 Trust Fund Travel Award to help subsidise this fantastic trip!

V.H. Jolly Student Travel Awards

NZFSS encourages student attendance at its conferences by supporting student travel through the V.H. Jolly Awards. The Awards are named in honour of the late Violet Hilary Jolly, a founder member of the Society and one of New Zealand's foremost pioneering limnologists, who was instrumental in encouraging and supporting student involvement in New Zealand limnology.

The criteria for the Awards are as follows:

1. The Awards are solely for the purpose of supporting the travel expenses of students attending the annual conference of NZFSS.
2. The Awards are restricted to full-time students who are financial members of the NZFSS, as defined in the Society constitution.
3. Only those students who present either an oral paper or a poster paper at the conference for which an Award is sought are eligible.
4. Students who are residents of the town where the conference is being held are not eligible.
5. Students who are in receipt of other forms of travel support to attend the conference are not eligible.
6. Students may apply for an Award in person by identifying themselves to the Secretary/Treasurer during the conference.

The sum awarded shall be up to \$100.00 per student, and the funds available for Awards shall be half of the interest earned in the previous financial year on the Society's bank accounts.

In the event of the number of applications exceeding the available funds, the Secretary/Treasurer shall distribute the available Awards

NZ Freshwater Sciences Society Medal and Honorary Membership

Rules

1. *The New Zealand Freshwater Sciences Society Medal is for an outstanding contribution to our understanding and management of freshwaters by a member of the Society, with criteria for consideration of nominations as set out below.*
2. *Nominations for Medals are considered by the Awards Committee (currently comprising the President, Secretary-Treasurer, a SIL Trustee and two members elected at an AGM).*
3. *Honorary membership of the Society can be voted at a General Meeting of the Society, for those members who have performed significant service to the Society usually over a long period, on the recommendation of the Executive Committee as set out in the Society rules.*

Criteria for the Medal:

Matters for consideration by the Awards Committee (not all need apply in any particular case and not in priority order):

- National or international recognition of research or management output
- Leadership in particular fresh or brackish water science field
- Quantum and quality of research or management output
- Contribution to education or public knowledge of freshwater science
- Contribution towards sustainable management of freshwater environments
- Contribution towards the conservation of one or more species, habitats or freshwater ecosystems

There would be an expectation that any members nominated and considered worthy of this elevated status would be recognised in an appropriate fashion, such as in an award ceremony at the annual conference, to which the person awarded would be invited at the Society's cost and expected to provide a presentation. Nominations would include relevant biographic information, a statement of the nominated person's specific outstanding contributions to freshwater science in New Zealand and letters of support from at least two additional members of the Society at least one of whom is not employed by the same organisation. Closing dates for nominations are 30 June of each year. There would be no expectation that any Award need be presented in any given year. It is recommended that nominations are made without prior knowledge of the nominee.

Criteria for Honorary Membership of the Society:

As is set out in the Constitution, persons considered eligible for honorary membership are recommended to a General Meeting of the Society by the Executive Committee. Criteria for the award would usually involve significant service to freshwater science and/or to the Society, usually over a lengthy period. It is recommended that any nominations for honorary membership

Budget for the year ended 30 June 2010

Schedule 1

NZ Limnological Society (Inc.) t/a NZ Freshwater Sciences Society

Financial Performance Schedule for the year ended 30 June 2010

	<i>This Year</i>	<i>Last Year</i>
	\$	\$
Cash Expenses		
Awards		
DoC Prizes	150	500
VH Jolly Memorial Fund	1,000	600
SIL Trust Prize	800	650
Fish & Game Prize	250	-
	<u>2,200</u>	<u>1,750</u>
Bank Charges	560	509
Conference 2010 - Seeding Fund	5,000	2,500
Conference Expenses	975	7,517
Emblems	-	21
Oral History Project	-	4,603
Postage	458	41
Printing Costs		
Newsletter	2,656	142
Subscriptions	631	631
Website Design	578	2,831
	<u>13,058</u>	<u>20,545</u>
Interest Received		
Bank of New Zealand Ltd	<u>2,427</u>	<u>2,998</u>
Sundry Income		
Subscriptions	4,392	8,004
Conference Income	4,110	11,727
Donations Received	553	563
SIL Trust Donations	86	182
Grants	-	4,170
Entomological Society Bulletin	-	403
	<u>9,141</u>	<u>25,049</u>

NZ Limnological Society (Inc.) t/a NZ Freshwater Sciences Society

**Statement of Financial Performance
for the year ended 30 June 2010**

	<i>Sch</i>	<i>This Year</i> \$	<i>Last Year</i> \$
Income			
Book Sales		657	2,942
Cost of Sales			
Opening Stock		1,964	3,674
Closing Stock		<u>950</u>	<u>1,964</u>
		1,014	1,710
Gross Profit/ (Loss)			
		<u>(357)</u>	1,232
Interest Received	1	2,427	2,998
Sundry Income	1	<u>9,141</u>	<u>25,049</u>
		11,211	29,279
Expenses			
Cash Expenses	1	13,058	20,545
Net Income /Loss for Year			
		<u>(1,847)</u>	<u>8,734</u>
Income Reserved			
		(1,847)	8,734
		<u>(1,847)</u>	<u>8,734</u>

NZ Limnological Society (Inc.) t/a NZ Freshwater Sciences Society

**Statement of Movements in Members Funds
for the year ended 30 June 2010**

	<i>This Year</i>	<i>Last Year</i>
	\$	\$
Credits for Year:		
Surplus of Income over Expenses for Year	-	8,734
Debits for Year:		
Deficit of Income over Expenses for Year	1,847	-
Adjustment for 2009 Income Overstated	<u>3,672</u>	-
	5,519	-
Debit for Year	<u>(5,519)</u>	8,734
Opening Credit Balance	88,709	79,975
Closing Credit Balance	<u><u>83,189</u></u>	<u><u>88,709</u></u>

NZ Limnological Society (Inc.) t/a NZ Freshwater Sciences Society

**Statement of Financial Position
as at 30 June 2010**

	<i>This Year</i>	<i>Last Year</i>
	\$	\$
ASSETS		
Current Assets		
Bank of New Zealand Ltd	9,600	28,967
GST Refund	339	-
Accounts Receivable	-	11,157
Interest Accrued	1,399	1,365
Stock on Hand	950	1,964
	<u>12,288</u>	<u>43,453</u>
Investments		
Bank of New Zealand Ltd		
Term Deposit due 30/07/10 @ 4.80%	70,913	48,595
	<u>83,201</u>	<u>92,048</u>
Total Assets		
LIABILITIES		
Current Liabilities		
GST Due	-	2,400
Accounts Payable	11	939
	<u>11</u>	<u>3,339</u>
Total Liabilities		
EXCESS ASSETS OVER LIABILITIES	<u>83,190</u>	<u>88,709</u>
EQUITY		
Members Funds	83,190	88,709
	<u>83,190</u>	<u>88,709</u>

Minutes of the 43rd Annual General Meeting of the New Zealand Limnological Society Inc.

(Trading as NZ Freshwater Sciences Society)

The AGM was held at the Chateau-on-the-Park, Christchurch. The meeting opened at 12.00 pm, Wednesday 24th November 2010.

Present: Kevin Collier, President; Brian Sorrell, Secretary-Treasurer; and 53 members.

1. Apologies: Vivienne Cassie-Cooper.

2. Minutes of the 42nd AGM:

Matters arising from minutes: Dealt with under general business.

Motion: That minutes be accepted as a true and correct record of the 41st AGM (*Angus McIntosh/Kristy Hogsden carried*).

3. President's Report:

This year we saw the passing of one of our honorary life members Don Forsyth. Don was a long standing member of the DSIR Taupo lab where he worked on lake ecology, geothermal waters and chironomid taxonomy. He was a mentor to many members in the Society today and his legacy lives on through their work. The legacy of another of our founding members, Ann Chapman, is nearing completion with drafts of several chapters of the Crustacea book now with Trevor Crosby of Manaaki Whenua Press for layout. Huge thanks are due to Maureen Lewis for her efforts under difficult circumstances and to Mike Winterbourn for his relentless efforts to see this book through to its fruition. We hope to see it published before too long.

It is pleasing to see increasing student participation in the Society with the inaugural presentation of the best student published paper award. Thanks to Kristy Hogsden for leading this and we look forward to having student representatives from each university in the future helping us develop other ways that the Society can foster and encourage development of our next generation of leaders. Several other members have also helped the Society out this year. Alton Perrie attended the Constituents Society meeting on behalf of the Society. This meeting sounded a lot like the previous one I went to with general discontent with the communication and level of service provided by the Royal Society. In addition, Jon Harding has been appointed to the Royal Society Biological Sciences Advisory Panel.

This year is election time for the society, and several elected and non-elected committee members are standing down. It has been my privilege to serve as President for the last four years. Wendy Paul, who has done a great job keeping the website alive and up to date, is moving on to spend time in other areas. Jay Piggot of Otago University has kindly agreed to take over the webmaster position. Marc Schallenberg, Neil Deans, Chris Arbuckle and Dave Speirs are also moving on from their elected positions, and I wish to acknowledge their input and support over the last few years. Thanks also to Brian Sorrell and Janine Wech for efficiently handling the Secretary-Treasurer responsibilities, and Hannah Rainforth for her efforts as newsletter editor. The Exec recently proposed some new positions to get members more involved in the Society, and it is pleasing to see some volunteers come forward. Jon Harding, Angus McIntosh, Kristy Hogsden, Adrian Meredith, Shirley Hayward, Dave West, Michele Stevenson, Shelley McMurtrie and Doug Booker, who along

with Lea Bodea have done a fantastic job organising this conference in the face of considerable adversity.

This year there have been several developments related to freshwater management. NZFSS made a submission of the stocktake of Schedule 4 land. Thanks to all those who participated in the forum discussion and shared their expertise with this submission. The Freshwater NPS is still being debated and has come under scrutiny with the Land and Water Forum report which recognises the urgent need for such an instrument. On behalf of the Executive Committee I wrote to Minister Nick Smith and Alistair Bisley endorsing the revised NPS, and received a response from the Minister advising that he was delaying any decision until the Land and Water Forum reported back. Consultation meetings are now underway and it is to be hoped that forceful decisions will follow underpinned by sound science. To quote the Land and Water Forum report: *'Effective water management can only be achieved with quality science and knowledge'*. Today your work and our Society are more relevant than ever and we need a strong voice to keep this message to the fore.

I move from the Chair that this report be accepted. *(Kevin Collier/Carried)*.

4. Secretary Treasurer's Report:

Total membership at 11 November 2010 was 418.

Table 1. Financial status of membership.

	2010	2009	2008	2007	2006
Members current:					
Paid	148	172	89†	252	178
Unpaid	240	163	202	44	76
Members in arrears:					
1 yr	-	36	37	37	48
2 yr	-	39	36	2	28
3 yr	-	-	2	-	11
Other:					
Honorary	11	11	11	11	11
Life	4	3	3	3	3
Legal req.*	1	1	1	1	1
Societies	5	5	5	5	5
Libraries	9	9	9	9	9
Total	418	439	395	364	370

* Not a member

† Not comparable with other years due to Visa processing problems in 2007/08.

Table 2. Type of membership

	2010	2009	2008	2007	2006
Ordinary	288	294	263	235	244
Corporate	15	28	31	32	30
Honorary	11	11	11	11	11
Life	4	3	3	3	3
Unwaged/student	95	98	82	78	77
Other (Societies)	5	5	5	5	5

Finances:

The accounts were audited by Stephen Dine of Brown Web Richardson, Hastings. The Society continues in sound financial condition and is in a good position to continue supporting its aims. Our total assets (including equity in stock of unsold Bulletin and Freshwaters books) at 30 June 2010 were \$83,189. Income was exceeded by expenditure by \$1847 in 2009/10.

Income: Our subscriptions income was \$4392, which was our greatest single income item this year. Interest was \$2427. The conference turnover continues to dominate our finances. Our conference activities maintained a sound excess of income over expenditure (\$3135 c.f. \$1710 in the previous year). The actual profit of the Whangarei conference (NZFSS 50% share) was \$4624. Due to the timing of payments of deposits, profits and penalties from different conferences, income and expenditure from individual conferences continue to appear in different financial years, making direct comparisons difficult. The main expenditure item in 2009/10 has been the printing costs of the newsletter (\$2656). We have one term deposit, the combined Jolly Fund, with \$59,993 at 1 Nov 2010. The Current Account at 1 Nov 2010 was at \$15,258.

I request that the Secretary-Treasurer's report be accepted.

Motion: That the Society accounts for 2009/10 be accepted (*Brian Sorrell/John Harding-carried*).

Motion: That the Auditor for the next financial year be Brown Webb Richardson Ltd., Hastings. (*Brian Sorrell/Marc Schallenberg - carried*).

5. S.I.L 1987 Trust Fund

Kit Rutherford tabled the 2009/10 financial statement, and that the loss on investments is a paper loss only. Nevertheless, it was agreed that the Trust does need other income to achieve its aims. The possibilities of canvassing donations or running an appeal were discussed. Members were reminded that donations can be made with subscriptions.

Motion: That the Society transfer \$10,000 of Society assets to the S.I.L. 1987 Trust. (*Roger Young/Philippe Gerbeaux- carried*).

6. Publications:

Webmaster's Report: Wendy Paul reported that the forum is still underused and encouraged more use of it. Jay Piggott has offered to take over the role from Wendy, who is stepping down.

Newsletter: Hannah Rainforth highlighted the recent newsletter and encouraged members to respond quickly to future requests for information as the newsletter is now a large job. Kati Doehring has offered to take on the role of Assistant Editor to help Hannah.

Posters: Numbers are decreasing and reprints may need to be considered. Offers for writing new posters will be welcomed.

Crustacean book: Kevin Collier reported that publication is imminent and that profits will be shared with Manaaki Whenua Press.

Freshwaters of NZ: Jon Harding raised the possibility of a second edition being prepared in 2 or 3 years' time as the first printing is nearly sold out.

7. Future Conferences:

The 2011 conference in Australia with ASL will be held from 26-30 September in Brisbane in conjunction with the Rivers Symposium. ASL President Fran Sheldon reports that costs are not yet

finalized. Philippe Gerbeaux raised the idea of the 40th Anniversary of the Ramsar Convention being celebrated at the conference.

Motion: That the Society allocate \$10000 to assist student travel to the Brisbane conference. (Dave West/Jo Clapcott – carried).

The 2012 conference will be held in 2012; Gerry Closs and Marc Schallenberg have kindly offered to chair the organising committee. The suggestion for 2013 is Hamilton, jointly with Marine Sciences and the Australasian Society for Fish Biology.

8. Election of Society Officers:

The following officers were nominated and duly elected:

- *President:* Nominations David Hamilton (Angus McIntosh /Jon Harding).
Motion: Nominations close (Carolyn Burns/Neil Deans carried)
David Hamilton elected President unopposed.
- *Secretary/Treasurer:* Nominations Brian Sorrell (Neil Deans/Ngaire Phillips).
Motion: Nominations close (David Hamilton/Gerry Closs carried)
Brian Sorrell elected Secretary/Treasurer unopposed.
- *Committee Officers:* Nominations Susie Woods (Roger Young/Kate McArthur); Deniz Özkundakci (Michael Pingram/David Hamilton)
Motion: Nominations close (Bruno David/Kati Doehring carried)
Susie Woods and Deniz Özkundakci elected Committee Officers unopposed.
- *Newsletter editor:* Hannah Rainforth (Dave West/Natasha Grainger).
Motion: Nominations close (Roger Young/Gerry Closs carried)
Hannah Rainforth elected Newsletter Editor unopposed.
- *S.I.L. Trust Fund Awards Committee:* Nominations Mary de Winton (Ngaire Phillips/Marc Schallenberg); Natasha Grainger (Kevin Collier/David Hamilton)
Motion: Nominations close (Ngaire Phillips/David Hamilton carried)
Mary de Winton and Natasha Grainger elected S.I.L. Trust Fund Awards Committee unopposed.

Several members have kindly offered their time to assist as co-opted Executive Members for specific tasks:

- Janine Wech as Assistant Secretary-Treasurer;
- Jay Piggott as Website Manager;
- Kristy Hogsden as Student Representative;
- Kati Doehring as Assistant Newsletter Editor;
- Mike Patrick as Media Monitor;
- Justine Coup for Community Outreach;
- Jane Kitson as Maori Representative.

9. General Business:

Professional Code of Ethics: The option of a code of ethics for freshwater scientists was raised at the 2009 AGM. Jon Harding reported on the discussion of this matter that occurred on the forum, and the codes adopted by other Societies. Supporters on the forum cite the need to provide credibility for freshwater scientists, opponents raised concerns of enforcement issues and who would get to make decisions about enforcing such a code. 37 members returned the questionnaire on the forum with votes at 60% in favour and 35% against. The Ecological Society of America was given as an example of a Society with such a code, with recommendations and guidelines although it is not enforced. Carolyn Burns reported that we are eligible to use the RSNZ code and process for enforcement – but noted that some of these in the past have resulted in legal actions at great cost. It was uncertain whether a RSNZ ruling would be binding. It was also noted that the Environment Court Code of Conduct would always supersede any code the Society adopts.

Motion: The Executive should consider the matter and report back at the next AGM. *(David LeCren/Jon Harding – carried).*

Māori Representation on Executive Committee: Ian Kusabs reported on the increase in numbers of Maori scientists, students and iwi involvement in freshwater issues, and the benefits to the Society of better interacting with the Maori community, getting community advice from a Maori perspective, involvement of Maori members in conferences, and providing a support network for Maori students and scientists. He also noted that Jane Kitson's role as Maori Rep on the Executive was based on a mandate from the Society's Maori members. The meeting welcomed Jane to her new role and thanked Ian Kusabs for facilitating the matter.

Press Statement from NZFSS on Land-Water Forum and the National Policy Statement: Carolyn Burns and Kit Rutherford presented their draft recommendations that included support for the LWF and changes to the wording, especially using the phrase '*refine and adopt*'. Jon Harding noted the urgency in adopting a version of the NPS. The meeting supported the Society finalising the matter. Kevin Collier suggested that wording emphasise the need for recommendations for quality science and knowledge to underpin management.

Motion: The reworded press release be adopted as a press release and sent to the minister. *(Carolyn Burns/Kit Rutherford – carried).*

Further Matters: David Hamilton thanked Kristy Hogsden for organising the student mentor programme and encouraged its expansion, and reminded members of benefits of being S.I.L. members, including receiving the new journal 'Inland Waters'.

Appreciation to outgoing President:

Motion: That Kevin Collier be thanked for his successful period as President. *(Neil Deans - carried).*

The meeting closed at 2.00 p.m.

New Zealand Freshwater Sciences Society Constitution

- 1 The name of the Society shall be the New Zealand Limnological Society Incorporated.
- 2 Objectives: To establish effective liaison between all persons interested in any aspect of fresh and brackish water research in New Zealand, and to encourage and promote these interests.
- 3 Means of Attaining Objectives:
 - (a) The establishment and maintenance of a register of all persons working in the appropriate fields in New Zealand, giving details of their current interests.
 - (b) The holding of meetings and conferences to deliver scientific papers, and to discuss scientific topics.
 - (c) Co-operation and affiliation with other scientific bodies when appropriate.
 - (d) The production of a newsletter including information about the current interests of freshwater workers, and listing relevant new publications and other items of interest.
 - (e) The distribution of the Newsletter to appropriate organisations in New Zealand and overseas.
- 4 Membership:
 - (a) The members of the Society shall be:
 - 1 Ordinary members who shall be persons admitted to membership by the committee, and whose annual subscription as fixed from time to time shall be accepted by the Committee.
 - 2 Unwaged Members who shall be any full-time student of a secondary or tertiary educational institution, and who shall pay such annual subscription as shall be fixed from time to time.
 - 3 Honorary Members who may be elected at a general meeting on the recommendation of the Committee.
 - 4 Life Members who shall be persons admitted to membership by the committee, and whose lifetime subscription shall be paid in advance as a single fee as fixed from time to time.
 - (b) Newly elected members shall be notified by the Secretary of their election and sent a copy of the constitution.
 - (c) Any member may resign by giving notice in writing to the Secretary, and paying all subscriptions due.
 - (d) Any member shall notify the Secretary in writing of a change of address.
 - (e) The Committee shall have the power to cancel membership in the case of conduct considered prejudicial to the Society.
 - (f) All members are entitled to receive the Society's Newsletter free of charge.

5 Executive and Meetings:

- (a) There shall be an Executive Committee consisting of the President, the immediate Past President (ex officio), the Secretary-Treasurer, the Editor,

and two (2) other members,
- (b) The Committee shall implement the Society's general business, and a simple majority shall decide all questions at Committee Meetings. If voting is equal, a motion is lost. A quorum at a Committee Meeting shall be three (3).
- (c) The officers shall be elected every two years, either at a General Meeting or by postal ballot as the existing Committee determine. The postal ballot shall be held before the end of the financial year, and if a General Meeting is not held, the committee shall have the power to scrutinize and count the votes, and declare the results.
- (d) The newly elected officers shall take office 1 month after their election.
- (e) Candidates for positions as officers shall be nominated at the General Meeting, or in writing signed by two other members, received by the Secretary before the time of such meetings, or by the 31st of August if a meeting is not held. Every candidate shall signify personally, or in writing his or her acceptance of nomination. The Committee shall have the power to co-opt members of the Society to fill any casual vacancies on the Committee.
- (f) The Executive Committee may summon a General Meeting or a General Meeting shall be summoned on receipt of a request signed by no fewer than ten (10) members entitled to vote. General Meetings shall be summoned by notice in writing, specifying the business to be considered, and notices shall be posted not less than fourteen (14) days prior to the proposed date.
- (g) At all General Meetings, ten (10) members entitled to vote shall constitute a quorum, and a simple majority shall carry a motion. Voting shall be on the voices, or by show of hands or by ballot at the discretion of the chairman, provided that, if any member so demand, voting shall be by ballot. The Chairman shall have a deliberative and a casting vote.
- (h) Votes of members. Each Member shall have one vote at a General Meeting, and each Affiliated Body shall have the right to appoint a delegate who shall have one vote at a General Meeting.

6 Finance:

- (a) Annual Subscription: shall be due on the 1st of July in each year and the amount shall be fixed at a General Meeting. Members whose subscriptions are not paid by the succeeding 30th of June shall be unfinancial and shall be liable to forfeit all benefits of membership. The financial year shall conclude on the 30th of June.
- (b) The funds of the Society shall be controlled by the Executive Committee and shall be banked in the name of the Society. Cheques and bills shall be signed by any one of the President or Secretary-Treasurer, and must be approved in writing by other members of the Executive Committee. The Society shall not have the power to borrow money.
- (c) Any income, benefit or advantage shall be applied to the charitable purposes of the Society as described in Sections 2 and 3 above.
- (d) No member of the Society, or any person associated with a member, shall participate in or materially influence any decision made by the Society in respect of the payment to or on behalf of that member or associated person of any income, benefit or advantage whatsoever.
- (e) Any such income paid shall be reasonable and relative to that which would be paid in an arm's length transaction (being the open market value).

- (f) The provisions and effect of clauses 6(c), 6(d) and 6(e) shall not be removed from this document and shall be included and implied into any document replacing this document.
- (g) Payment of accounts must first be approved by the Executive Committee. This may be done at a meeting or by mail, and items may be approved in advance for one financial year.
- (h) An Annual Report and Financial Statement shall be prepared and posted to members. The Financial Statement shall be audited by a person appointed at the previous General Meeting.

7

Organisation:

- (a) The Secretary-Treasurer shall keep (i) a Minute Book containing full minutes of all meetings, and (ii) a Register with the names, addresses, professional interests and date of joining of all members.
- (b) Affiliated Bodies. Incorporated or unincorporated bodies, and other organisations approved by the Committee, may become affiliated with the Society on acceptance by the Committee, and on payment of such annual subscription as may be fixed from time to time.
- (c) Changes in the Constitution may be made only on a two-thirds majority of the votes polled, and this vote shall be conducted by letter.
- (d) No addition to or alteration or recession of the rules shall be approved if it affects the charitable objects, the personal benefit clauses, or the winding up clause, except as specified under clause 7(g) below.
- (e) The Common Seal of the Society shall be in the custody of the Secretary, who shall in pursuance of a resolution of the Committee to that effect, affix the same to all instruments requiring the same.
- (f) The Society shall not be wound up except on a two-thirds majority of a postal vote, but shall be dissolved in the event of the membership being fewer than five (5) persons. In the event of dissolution of the Society, its assets shall become the property of the Royal Society of New Zealand which shall dispose of the assets in accordance with the aims of the Society.
- (g) The provisions and effects of this clause 7(f) shall not be removed from this document and shall be included and implied into any document replacing this document, except that another organisation, which must be an Inland Revenue Department approved charitable organisation, may be named in place of the Royal Society of New Zealand.

Membership application

How do I join?

Print out the following details, fill in the boxes and mail to NZFSS Assistant Secretary/Treasurer, Janine Wech, c/- NIWA, PO Box 8602, Riccarton, Christchurch 8440 or email j.wech@niwa.co.nz

Title:.....Surname:..... Initials:..... First Name:.....
Address:
Telephone: (main)..... (other).....
Fax:..... Email:.....
Membership type (Waged, student, unwaged):

Please fill out the following permissions:

I agree to the NZ Freshwater Sciences Society publishing my membership details.

Choose one: Yes No Please sign: _____

I give permission for my email address to be added to the NZFSS email mailing group.

Choose one: Yes No Please sign: _____

My preferred format for receiving the NZFSS newsletters is as a:

Choose one: Electronic pdf Hard copy

Brief List of Your Professional Interests:

.....

Payment:

Waged/Corporate \$40 Student \$10 Unwaged \$10
Donation to S.I.L. 1987 Trust Awards* (optional) \$4
TOTAL AMOUNT \$ Make cheques payable to 'NZ Freshwater Sciences Society'

Payment by Credit Card:

Visa Mastercard (circle one) Name on card:
Card no:..... Expiry date:.....
Signature:.....

Send to:

NZFSS Assistant Secretary/Treasurer, Janine Wech, c/- NIWA, PO Box 8602, Riccarton, Christchurch 8440 or email j.wech@niwa.co.nz

*The SIL 1987 Trust supports overseas travel awards for beginning NZ scientists and guest lecturer visits to NZ by eminent international freshwater scientists.