COUNTRY: NEW ZEALAND

Annual Report on national involvement in SCAR activities in year: 2009-2010

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1) Delegate	Professor Bryan Storey	Gateway Antarctica, University of Canterbury , Private Bag 4800, Christchurch	+64-3-3642136		bryan.storey@canterbury.ac.nz	
2) Alternate Delegate	Dr Clive Howard-Williams	NIWA, P O Box 8602, Christchurch, New Zealand	+64-3-3437857	+64-3-3485548	c.howard-williams@niwa.co.nz	www.niwa.co.nz
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Other Members	Dr Victoria Metcalf	Cell Biology Group, Agriculture and Life Sciences Division, Lincoln University, PO Box 84, Lincoln 7647, Canterbury			metcalfv@lincoln.ac.nz	www.lincoln.ac.nz
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	Dr Megan Balks	School of Science & Engineering, Earth & Ocean Sciences, University of Waikato, Private Bag 3105, Hamilton 3240			m.balks@waikato.ac.nz	www.waikato.ac.nz/home.shtml
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Other Members	Dr Nancy Bertler	Senior Scientist, Joint Antarctic Research Institute, Victoria University and GNS Science, P O Box 600, Wellington 1142			Nancy.Bertler@vuw.ac.nz	www.victoria.ac.nz/antarctic/people/nancy-bertler/index.aspx http://www.gns.cri.nz/nic/ice/index.htm

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	Associate Professor Gary WIlson	Associate Dean of Research, Division of Sciences, P O Box 56, Dunedin 9054			Gary.wilson@stonebow.otago.ac.nz	www.otago.ac.nz/geology
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AGCS	Dr Nancy Bertler	Senior Scientist, Joint Antarctic Research Institute, Victoria University and GNS Science, P O Box 600, Wellington 1142			Nancy.Bertler@vuw.ac.nz	www.victoria.ac.nz/antarctic/people/nancy-bertler/index.aspx http://www.gns.cri.nz/nic/ice/index.htm
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	Dr Ian Hogg	Department of Biological Sciences, University of Waikato, Private Bag 3105, Hamilton 3240	+64-7-838 4139		i.hogg@waikato.ac.nz	www.waikato.ac.nz/home.shtml
	Dr Vonda Cummings	NIWA Ltd. Private Bag 14901, Wellington. New Zealand	+64-4-386 0300	+64-4-386 0574	v.cummings@niwa.co.nz	www.niwa.co.nz
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ICESTAR	Dr Craig Rodger	Department of Physics, University of Otago, P O Box 56, Dunedin			crodger@physics.otago.ac.nz	www.otago.ac.nz/physics
SALE						
AAA (2010-)						

Activity	Contact Name	Address	Telephone	Fax	Email	other information (e.g.website URL)
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SCAR History Group						
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CPR						
Biological Monitoring						
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ADMAP						
ANTEC						
BIRDS						
SEALS						
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AAA						
ISMASS						
OpMet						

OCEAN	Dr Mike Williams	National Institute of Water and Atmospheric Research, Private Bag 14901, Kilbirnie, Wellington	+64-4-3860389	+64-4-3862153	m.williams@niwa.co.nz	www.niwa.co.nz
DRILL	Dr Nancy Bertler	Senior Scientist, Joint Antarctic Research Institute, Victoria University and GNS Science, P O Box 600, Wellington 1142			Nancy.Bertler@vuw.ac.nz	www.victoria.ac.nz/antarctic/people/nancy-bertler/index.aspx http://www.gns.cri.nz/nic/ice/index.htm

ACTIVITY	Contact Name	Address	Telephone	Fax	Email	other information (e.g.website URL)
STANDING COMMITTEES (SC)						
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	Ms Wendy Shaw	Land Information New Zealand, National Office, Private Box 5501, Wellington			wshaw@linz.govt.nz	www.linz.govt.nz
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SCAGI						

NATIONAL ANTARCTIC DATA CENTRE						
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SCAR DATABASE (insert name of database, if any, for which your country has responsibility)						
A BRIEF SUMMARY OF SCIENTIFIC HIGHLIGHTS						
BIOPROSPECTING						

A Brief Summary of Highlights Supported by Antarctica New Zealand 2009-10

1. Antarctic Physical Environments Research

a. Climate Change

K049: ITASE – Holocene Variability along the Victoria Land Coast. NZ portion of the international project ITASE aimed at collecting and analysing ice cores to determine the spatial climate variability across Antarctica over the last 200 years. This project focuses on coastal cores which have been shown to be very sensitive to climatic variability. (Sir Robin Irvine Doctoral Scholarship).

K056: Dynamics and Change of the Darwin-Hatherton Glacial System. Studying the response of the Antarctic ice sheet to future climate change. Combines glacial, geomorphological and climatological approaches. Contributes to the Latitudinal Gradient Project.

K072: Aims to derive a new terrestrial paleotemperature proxy based on the isotopic composition of carbonate in Antarctic soils to allow us to test hypotheses of climatically influenced changes in hydrology and glacier dynamics, provide corroboration of ice-core based isotopic paleotemperature proxies, and potentially allow reconstruction of past atmospheric CO_2 isotopic composition. (Helicopters New Zealand Doctoral Scholarship).

b. The Cryosphere

K053: The aim of this project is to improve the accuracy of remotely sensed, satellite-derived, snow and ice data by calibrating these data with ground-truth measurements.

K064: The goal of this research is to develop an understanding of the interactions between glaciers and permafrost that will permit models of glaciers to realistically parameterise ice motion, thus improving their ability in predicting glacier response to climate change.

K131: Long-term study on sea ice and Southern Ocean processes. Looking at the physical oceanography of McMurdo Sound, the turbulence that exists under sea ice and its influence on ice formation, circulation in Antarctic fjords, and the physical processes involved in the formation of frazil ice beneath land-fast sea ice. Is a NZ-IPY funded project.

c. The Atmosphere

K055: Dynamics and Ionisation in the Antarctic Middle Atmosphere. Long-term study on the general circulation of the atmosphere, in particular, the behaviour of wave-driven circulation in the middle atmosphere and how this effects the transport of energy and momentum to higher altitudes.

K069: Long-term project monitoring magnetosphere-ionosphere coupling and space weather at high latitudes. Has applications for communications predictions and plasma physics.

K085: Long-term research programme targeted at understanding the drivers of change in the atmosphere, particularly those involved in the formation of the Antarctic ozone hole.

K087: Looking at human-induced long-term trends in trace gases to determine changes in oxidative capacity of the atmosphere.

K089: Collection of a continuous Scott Base climate record from 1957.

2. Southern Ocean Research

a. Oceanography of the Ross Sea

K042: Long-Term monitoring of tides at Cape Roberts and at Scott Base.

b&c. Marine Biodiversity and Ecosystems

K014: Aims to chemically synthesize nonradioactively labeled antifreeze glycoproteins found in Antarctic fish and to use the products to track the route by which secreted antifreeze is able to reach high levels in the circulation, to identify the cell type involved in ice crystal entrapment, and to characterize the likely receptor.

K018: Studying the distribution and abundance of meroplankton (larvae of benthic marine invertebrates and fish) in the water column. Uses morphological and molecular approaches to identify common larval types. Contributes to the Latitudinal Gradient Project.

K043: Studying the productivity of algae that live in and under the sea ice. Determine what the effects of global climate change will have on this productivity (important because sea ice covers a large area). Contributes to the Latitudinal Gradient Project and is a NZ-funded IPY project.

K068: Looking at how increased UV-R radiation damages the DNA of Antarctic invertebrate larvae and embryos and the impacts on how they recover from such damage. Also looking at the effects of ocean acidification on the development the invertebrate's skeleton.

K082: Long-term project aimed at characterising the structure and function of benthic marine communities and determine their relationships to key environmental factors. Important for an improved understanding of Antarctic biodiversity and ecology, and management of the Antarctic coastal zone. Contributes to the Latitudinal Gradient Project and is a NZ-funded IPY project.

3. Antarctic Ecosystems Research

a. Terrestrial Biodiversity

K020: This Terrestrial Biocomplexity project is using an interdisciplinary approach to determine the present status of the biodiversity, and to predict the effects of multiple potential impacts on these ecosystems. The main goal of the research will be a dynamic geographic information system in which the specific observations about patterns and processes of the physical environment, plus observations of the presence of particular organisms and their interactions, will be mapped and linked with computer models that allow prediction into as-yet unsampled locations and scenarios for future change in conditions. Contributes to the LGP and is a NZ-funded IPY project.

K023: Studies microbial speciation, biogeography, and evolution of thermal adaptation at a geographically isolated geothermal site.

b. Ecosystem Functioning

K066: This research aims to understand how terrestrial organisms have adapted to changes in the Antarctic climate during the last 35 million years by conducting

physiological and phylogeographic studies of freezing tolerant and freezing resistant invertebrates. Contributes to the Latitudinal Gradient Project.

K081: Studying various aspects of Antarctic aquatic ecosystems, geochemistry of ponds, photosynthetic and nitrogen fixation rates of microbial mats to assess model predictions against actual observations. Contributes to the Latitudinal Gradient Project and is a NZ-funded IPY project.

K122: Long-term study on the population dynamics of the Adelie penguin population of the Ross Sea as a biological indicator of local, regional and global change. Contributes to the Latitudinal Gradient Project.

c. Human Ecology

K073: Aims to examine the relationships between circannual patterns of psychological and physical activity in Antarctica to generate recommended countermeasures for any decrements in health, safety, and job performance that may arise due to low periods of human activation while on deployment to Antarctica.

d. Management and Conservation

K026: Seeks to quantify the cumulative impacts of human activities on Antarctic soils, identify areas of greater vulnerability, increase our predictive environmental impact assessment abilities, and make way for informed management decisions in the future.

K123: Research to support environmental protection and management of ice-free areas of the Ross Sea region by increasing the fundamental knowledge and understanding of Antarctic soils including soil distribution and climate, and vulnerability to human impact. Contributes to the Latitudinal Gradient Project.

Scientific Activities that may be considered Bioprospecting

Year: 2004/05 and 2005/06
Sites visited: Tramway Ridge, Miers Valley
Microbial Biodiversity and Metgenomics of the Ross Desert, Eastern Antarctica

Department of Biological Sciences, University of Waikato, Private Bag 3105, Hamilton. Professor Craig Cary, Phone: (07) 838 5493, Fax: (07) 838 4324, E-mail: caryc@waikato.ac.nz

This project aims to extend our current research addressing four basic questions relating to the microbiology of the Antarctic mineral type soils 1) What is the true microbial diversity of the terrestrial biotopes? 2) What factors control microbial biomass, activity and diversity? 3) What is the impact of human activities on the introduction of non-indigenous microbial species into Antarctic environments? 4) Can metagenomic methods be applied to the discovery and recovery of valuable genes and gene products in unculturable Antarctic microbiota? Our intent is to survey soils where unprecedented physical/nutrient gradients exist using a suite of molecular genetic approaches. The introduction of molecular genetic tools to the study of microbial ecology has provided a new capability to determine the precise composition and structure of complex microbial communities where most of the members have eluded cultivation. These methods have provided surprising insight into the complexity and diversity of bacterial communities inhabiting a wide range of natural and artificial habitats. To date, these methods have yet to be applied in a comprehensive manner to the study of bacteria inhabiting Antarctic environments.

Year: 2004/05 and 2005/06
Sites visited: Cape Hallett
Biodiversity and Performance of Lichens and Mosses

Department of Biological Sciences, University of Waikato, Private Bag 3105, Hamilton. Professor T G Allan Green, Phone: (07) 838 4225, Fax: (07) 838 4324, E-mail: greentga@waikato.ac.nz

The objective of LGP (Latitudinal Gradient Project) is to increase our understanding of polar ecosystems to the extent that the effects of environmental change can be predicted. This proposal contributes to this objective by determining both the biodiversity of terrestrial vegetation and the effect of environmental parameters on seasonal productivity at Cape Hallett, the first LGP site. Changes in biodiversity are expected to be one signal for environmental change. Biodiversity remains poorly described within the Ross Sea region but application of better collection techniques and better identification including molecular methods, can greatly improve our knowledge. Another signal is likely to be improved production and growth. This will be investigated by determining the active growing season by chlorophyll fluorescence techniques and recording the major environmental parameters (light, plant temperature). The response of net photosynthetic rates to these parameters will also be measured through the season and this will allow total production to be estimated. This data will also allow us to detect acclimation by the mosses and lichens. By changing the response of net photosynthesis to, for example, temperature, acclimation has the potential to confuse any modelling of seasonal production. The data from Cape Hallett will provide a base-line for the remaining LGP sites.

Year: 2004/05
Sites Visited: Darwin Glacier
Terrestrial Biodiversity in Southern Victoria Land

Department of Biological Sciences, University of Waikato, Private Bag 3105, Hamilton. Dr Ian Hogg, Phone: (07) 838 4139, Fax: (07) 838 4324, E-mail: hogg@waikato.ac.nz

In recent decades terrestrial biology studies have been concentrated around Ross Island and the Dry Valleys. During the late 1950s and early 1960s, a considerable number of sites were surveyed in the Ross Sea Region from the Shackleton Glacier at 85o S to Cape Hallett at 72o S. Insects and plants were reported from several of these sites which, in many cases, have not been revisited. Taxonomic and collecting techniques, including modern molecular analyses, have now advanced so much that a repeat visit to these sites can often reveal a far greater biodiversity than presently accepted. In 2003, a visit to Mt Kyffin, 83o 45' S, revealed a total of 26 lichen species, several new to Antarctica, as well as arthropod and other invertebrate taxa (Collembola, Acari, Nematoda). A visit by a terrestrial biology group, focusing on lichens, mosses and invertebrates, is now proposed to the Darwin Glacier region (79o 53' S), which is the next LGP site. Specimens from these isolated sites will increase our present knowledge of biodiversity in these regions and be of great value for molecular phylogeographic research. Furthermore, these data can be used to estimate the date(s) at which these sites became isolated by the Ross Ice Shelf advance.

Year: 2004/05
Sites visited: Cape Bird
Molecular Ecology of Antarctic Fauna

Institute of Molecular BioSciences, Massey University, Albany Campus, Private Bag 102904, North Shore mail centre, Auckland. Professor David M Lambert, Phone: (06) 350 5857 ext 41110, E-mail: D.M.Lambert@massey.ac.nz

A central prediction of the neutral theory of molecular evolution is that the rate of evolution (k) is equal to the rate of mutation (μ). A number of recent studies of human mitochondrial DNA have documented extremely high mutation rates that are significantly higher than evolutionary rates. This lack of concordance between empirical observations and theory has sparked a major controversy. We propose to use two unique biological phenomena we have discovered in Antarctica, to advance our understanding of this central problem in molecular evolution. First, underlying breeding colonies of Adélie penguins (Pygoscelis adeliae) are large numbers of serially preserved sub-fossil remains, dating to 37,000 years BP. We have shown that, entombed in frozen penguin bones, is some of the best-preserved ancient DNA yet discovered. Second, wepropose to examine the remains of Antarctic silverfish of the genus Pleurogramma found in the regurgitations of snow petrels Pagodroma nivea. Using both of these phenomena, we aim to test the central predication of neutral theory by comparing evolutionary and mutation rates.

Year: 2004/05
Sites visited: Cape Hallett
Year: 2006/07
Sites visited: Evans Cape, Gondwana Station, Scott Base
Antarctic Sea Ice, Algal Productivity and Global Climate Change

School of Biological Sciences, Victoria University of Wellington, PO Box 600, Wellington. Dr Ken Ryan, Phone: (04) 472 1000 ext 8107, Fax: (04) 463 5331, E-mail: ken.ryan@vuw.ac.nz

Sea ice exerts a unique and overwhelming influence on marine ecosystems in the Antarctic. Each year, approximately 19 million km2 of Antarctic sea ice melts, creating conditions for a huge influx of algal biomass into the food web of the Southern Ocean. Any reduction in sea ice cover caused by global warming will alter the balance of this productivity and will modify the dynamics and interactions of the whole marine ecosystem. This study will provide ground truth data of total primary productivity and biodiversity in the region, and will be the first to assess the effect of global climate change on primary productivity in Antarctic coastal ecosystems. The relationship between the extent of ice cover and total primary production along an extensive north-south transect of the western coast of the Ross Sea, will be used to predict future scenarios of reduced ice at sites further south. The work will form an integral part of the proposed "Latitudinal Gradient Project" and once completed, will provide a wide range of climatic conditions and a unique opportunity to predict future changes under various climatic models.

Year: 2005/06
Sites visited: Cape Hallett
Year: 2006/07
Sites visited: Gondwana Station, Scott Base
Latitudinal gene drift in organisms from the Ross Sea Region

Department of Biochemistry, University of Otago, PO Box 56, Dunedin. Craig Marshall, Phone: (03) 479 7570, Fax: (03) 479 7866, E-mail: craig.marshall@stonebow.otago.ac.nz

Marine and terrestrial organisms have been exposed to quite different environments after Antarctica separated from the rest of Gondwana and then gradually cooled. Since the development of Antarctica as a frozen continent, there is evidence of significant variation in sea temperature and in the extent of ice shelves. Antarctic marine systems are thought to be potentially well-mixed allowing organisms to move from place to place relatively easily. Notothenioid fish dominate the Antarctic fish fauna and are quite speciose implying that some mechanism must exist to isolate individual populations long enough for new species to arise. It is not clear what mechanisms might be responsible for such isolation and whether ice shelf advance and retreat, or both, may be important in sympatric isolation. In contrast, land organisms such as nematodes; typically inhabit ice-free refugia that comprise only a few percent of the area of the continent. Animals from these areas show much stronger regional variation and a different pattern of speciation to those from marine environments and it is clearer what mechanisms isolate each site. To try and understand the relationship between changes in climate and speciation, we will collect material from both marine and terrestrial animals, determine their phylogenetic histories, and compare these with what is known of changes in climate to determine if any clear associations can be identified.

Year: 2006/07
Sites visited: ASPA 124, Falconer Mt, Nussbaum Riegel, Darwin Glacier, Scott Base
Terrestrial Biodiversity in Southern Victoria Land

Department of Biological Sciences, University of Waikato, Private Bag 3105, Hamilton. Professor T G Allan Green, Phone: (07) 838 4225, Fax: (07) 838 4324, E-mail: greentga@waikato.ac.nz

This research focuses on describing and interpreting biodiversity of terrestrial ecosystems in the Ross Dependency and continues previous research based on a successful mixture of classical and molecular taxonomy. Antarctic terrestrial research is about to go through several paradigm shifts. Rather than a decline in biodiversity at higher latitudes with increasingly extreme environments it seems more likely that we have a contraction to sites with better microclimates with actual species present determined by a colonisation lottery. The organisms present may not all be

recent colonists but, rather, have expanded from refugia; endolithic systems, supposedly thousands of years old, are dated to less than a century. We intend to continue to test these new ideas by extending sampling (invertebrates, lichens and mosses) to the Darwin region (LGP site) and inland from Granite Harbour. We are also introducing an Archiving Change programme to capture existing information for well-researched sites that can be used to monitor and detect change. Our research fits with the New Zealand Science Strategy and LGP (Latitudinal Gradient Programme) and will provide improved capacity for New Zealand to meet its current and future obligations in managing Antarctic terrestrial ecosystems.

Year: 2006/07
Sites visited: Cape Bird, Scott Base
Determining Unique Genetic, Co-Evolutionary, and Metabolic Patterns/Rates that Prevail in Polar Environments

Allan Wilson Centre for Molecular Ecology and Evolution, Massey University, Palmerston North, 06 350 5515 x 7626, E-mail: a.mcgaughran@massey.ac.nz

My PhD is centred around deciphering the unique evolutionary patterns that prevail in polar environments. One aspect of my project will be to test springtail and mite samples for the presence of endosymbiotic bacteria such as Wolbachia, Rickettsia and Spiroplasma, which has not been done before in Antarctic species. If I find evidence for coexistence of these different bacterial types within mite and springtail species, then I will be able to produce a co-phylogeny. Co-evolutionary information will inform my PhD project by determining how long, if present, these bacterial species have been with springtails and mites, and therefore how the evolutionary histories of all the studied species overlap.
Additionally, to adequately interpret evolutionary history, we must understand the evolutionary rates of the organisms of study, particularly in the cold where unique constraints on life evoke distinctive adaptive mechanisms. For example, biotic factors such as life cycle length, organism activity and metabolic rates are thought to potentially affect DNA mutation rates and it is postulated that low environmental temperatures in polar regions tend to lengthen life cycle (due to a short annual growing season). This, in turn, would reduce overall activity and potentially slow rates of molecular evolution (e.g. through a reduced mutation rate). A sound and sensible theory perhaps, however the hypothesis that significant geographic variation in rates of evolution may exist has been examined quite vigorously and there have been many conflicting results. Accordingly, my project allows me to attempt to resolve this issue through investigation of variation in activity (energetic budgets), along a latitudinal gradient, by coupling behavioural observations with measurements of in situ microclimate parameters and respiration/metabolic rates at selected Antarctic sites.

Year: 2006/07
Sites visited: ASPA 124, ASPA 137, Butter Point, Chocolate Cape, Evans Cape,
Gut Micro-organisms of Antarctic Mega-fauna. Is Everything, Everywhere?

Centre for Biodiversity and Ecology Research (CBER), Department of Biological Sciences, Private Bag 3105, University of Waikato, Hamilton. Dr Jonathan Banks, Phone: (07) 838 4139, Fax: (07) 838 4324, E-mail: jbanks@life.uiuc.edu

The constituents of bacterial communities, their diversity and biogeography, are understood poorly and yet microbial ecology drives Earth's ecology [1]. The predominant theory in microbial diversity has been that "everything is everywhere, the environment selects" [2]. However, genetic data from bacteria are revealing that endemism exists within the microbial world and that everything is not everywhere. Although the relatively recent arrival of humans in Antarctica

and the continent's physical separation appears to have limited the introduction of pathogens associated with human activity, there have been disease outbreaks in Antarctic wildlife, possibly due to human activities. There is a lack of knowledge about the route novel micro organisms might take if introduced to naïve Antarctic host populations, in part because the probability of detecting an individual animal with active disease is extremely low. We will overcome the low probability of detecting active disease by using the genetic distances between populations of benign gastrointestinal bacteria to model the pattern of transmission of bacteria around the Ross Sea. This study will also provide insight into the evolution of gut micro-organisms and the information obtained may be significant in ensuring the conservation of the Ross Sea's charismatic and iconic mega-fauna in an environment predicted to change markedly.

Year: 2007/08
Sites visited: Battleship Promontory, Beacon Valley, Miers Valley, Upper Wright Valley
Resolving Environmental Drivers for Microbial Biodiversity in Antarctic Dry Valley Mineral Soils

Department of Biological Sciences, University of Waikato, Private Bag 3105, Hamilton. Professor Craig Cary, Phone: (07) 838 5493, Fax: (07) 838 4324, E-mail: caryc@waikato.ac.nz

This project aims to extend our current research program designed to elucidate the environmental drivers controlling the diversity and genetic function of microbial communities in Antarctic Dry Valley mineral soils. We will address four basic questions: 1) What is the active fraction of the detectable microbial diversity in terrestrial colddesert biotopes? 2) What physicochemical factors control microbial biomass, activity and diversity? 3) How can an assessment of metabolic gene diversity be used to evaluate microbial community structure and interactions. 4) How can metagenomic and classical methods be used to access valuable organisms, genes and gene products in uncultured Antarctic microbiota? Our intent is to continue to investigate unique physical/nutrient gradients (altitudinal, moisture, C/N enrichment, and specialized soil microhabitats) located in the Meirs Valley and other relevant Dry Valley sites. These studies will employ a suite of modern molecular genetic approaches in parallel with micro-environmental monitoring. While these methods are widely validated in studies of microbial molecular ecology, they have, to date, not been applied in any comprehensive study of microbial populations inhabiting Antarctic terrestrial environments.

Year: 2007/08
Sites visited: Battleship Promontory, Seuss Mt, Sperm Bluff, Cape Geology, Smith Valley, Wellman Valley, Gondwana Station
Terrestrial Biodiversity in Southern Victoria Land

Department of Biological Sciences, University of Waikato, Private Bag 3105, Hamilton. Professor T G Allan Green, Phone: (07) 838 4225, Fax: (07) 838 4324, E-mail: greentga@waikato.ac.nz

This research focuses on describing and interpreting biodiversity of terrestrial ecosystems in the Ross Dependency and continues previous research based on a successful mixture of classical and molecular taxonomy. Antarctic terrestrial research is about to go through several paradigm shifts. Rather than a decline in biodiversity at higher latitudes with increasingly extreme environments it seems more likely that we have a contraction to sites with better microclimates with actual species present determined by a colonisation lottery. The organisms present may not all be recent colonists but, rather, have expanded from refugia; endolithic systems, supposedly thousands of years old, are dated to less than a century. We intend to continue to test these new ideas by extending sampling (invertebrates, lichens and mosses) to the Darwin region (LGP site)

and inland from Granite Harbour. Our research contributes to the LGP (Latitudinal Gradient Project).

Year: 2007/08
Sites visited: Cape Bird
Determining Unique Evolutionary Patterns for Terrestrial Invertebrates in Antarctic Environments

Allan Wilson Centre for Molecular Ecology and Evolution, Massey University, Palmerston North. Ms Angela McGaughran, Phone: (06) 350 5515 ext 7626, E-mail: a.mcgaughran@massey.ac.nz

This project aims to decipher the evolutionary history of polar invertebrates by investigating energetic (activity) budgets of the springtail Gomphiocephalus hodgsoni. Specifically, activity will be investigated through measurement of: (1) metabolic rates (via oxygen measurements); (2) pitfall trapping (where presence of organism in trap indicates activity of the organism in the preceding hours); and (3) growth over time. All three measures will be made across a range of spatial scales at Cape Bird, Ross Island, to examine the ways in which activity varies on an hourly, daily and seasonal scale. This project will provide information on the theoretical 'metabolic rate elevation' that has been proposed for polar species, and look at how activity varies across a range of temporal and scales to help determine some of the unique evolutionary patterns that prevail for terrestrial invertebrates in Antarctic environments.

Year: 2007/08
Sites visited: Cape Evans, Gondwana Station, Scott Base
Antarctic Sea Ice and Pelagic Microbial Communities: Latitudinal Influences on Biodiversity and Productivity

School of Biological Sciences, Victoria University of Wellington, Private Bag 600, Wellington. Dr Ken Ryan, Phone: (04) 463 6083, Fax: (04) 463 5331, E-mail: ken.ryan@vuw.ac.nz

Each year, an area of Antarctic sea ice more than twice the size of Australia forms during winter and melts in summer; a process that is perhaps the most dramatic seasonal change on Earth1. This ice provides a unique habitat for growth of the microorganisms that provide the energy base for marine life in ice covered regions. This ice bound microbial community is one of the most diverse forms of life in Antarctica, but we still do not understand how it supports local ecosystems, and as far as the bacterial component is concerned, we do not even know what is there. We will assess the biomass and productivity of the algal component as well as their responses to environmental stresses using PAM fluorometry and oxygen microelectrodes. We will also determine bacterial biodiversity using DNA-identification technologies. We will link productivity and biomass measurements with physical and geographic data into a mathematical model of population dynamics for sites along the western coast of the Ross Sea. The model will describe a baseline for the state of health of the population and will be used to predict future scenarios of reduced ice at sites further south. The work will be an integral part of the "Latitudinal Gradient Project", will build on previous seasons results, and will assess of the effect of global climate change on productivity and biodiversity in Antarctic coastal ecosystems.

Year: 2008/09 and 2009/10
Sites visited: Miers Valley, Garwood Valley and Marshall Valleys
Predicting Biocomplexity in Dry Valley Ecosystems

Department of Biological Sciences, University of Waikato, Private Bag 3105, Hamilton. Professor Craig Cary, Phone: (07) 838 5493, Fax: (07) 838 4324, E-mail: caryc@waikato.ac.nz

This research focuses on describing and interpreting biocomplexity of terrestrial ecosystems in the Ross Sea region delivering a GIS/biodiversity database model linking biodiversity, landscape and environmental factors in a form that is easily understood and taken up by end users. It will provide improved capacity for New Zealand to meet its current and future obligations in managing Antarctic terrestrial ecosystems in an international community. This is a NZ International Polar Year project.

Year: 2008/09
Sites visited: Central Valley, Bartrum Basin, Lake Judith
Terrestrial Biodiversity in Southern Victoria Land

Department of Biological Sciences, University of Waikato, Private Bag 3105, Hamilton. Professor T G Allan Green, Phone: (07) 838 4225, Fax: (07) 838 4324, E-mail: greentga@waikato.ac.nz

This research focuses on describing and interpreting biodiversity of terrestrial ecosystems in the Ross Sea region and continues previous research based on a successful mixture of classical and molecular taxonomy. Antarctic terrestrial research is about to go through several paradigm shifts. Rather than a decline in biodiversity at higher latitudes with increasingly extreme environments it seems more likely that we have a contraction to sites with better microclimates with actual species present determined by a colonisation lottery. The organisms present may not all be recent colonists but, rather, have expanded from refugia; endolithic systems, supposedly thousands of years old, are dated to less than a century. We intend to continue to test these new ideas by sampling (lichens and mosses) in the Darwin region in association with the LGP (Latitudinal Gradient Project).

Year: 2009/10
Sites visited: Hut Point, Granite Harbour
Microbial Biodiversity in Land-Fast Sea Ice in the Ross Sea

School of Biological Sciences, Victoria University of Wellington, Private Bag 600, Wellington. Dr Ken Ryan, Phone: (04) 463 6083, Fax: (04) 463 5331, E-mail: ken.ryan@vuw.ac.nz

Changing patterns of microbial diversity along a latitudinal gradient in the Ross Sea are sensitive indicators of climate change. This research will generate a bio-inventory of the micro-organisms in sea ice using both conventional methods and molecular technology, and will quantify abundances to generate community fingerprints for sea ice biodiversity. Each finge rprint will summarise the biodiversity at one of three sites along the coast of the Ross Sea that will allow temporal and geographical comparisons. This event contributes to the Latitudinal Gradient Project and is a NZ International Polar Year project.

5. List publications or patent applications from your country from the last 5 years that could be classified, under any definition, as the outcome of bioprospecting activities. If none are available to you, for any reason, then simply write 'None available'.'

Antarctica New Zealand has listed a selection of publications by the two researchers who are listed under Question 2 above. Publications by the researchers listed under Question 4 above can be found at:
http://www.antarcticanz.govt.nz/education/1135?PHPSESSID=a0a4e09d6ad962c185738a1fdae32e6f

Selection of publications from Professor Farrell's work in the last 5 years include:

Farrell, R.L. Duncan, S.M. 2005. Uniqueness of Antarctica and potential for commercial success. in Antarctic Bioprospecting. Hemmings A. Rogan-Finnemore M. (eds). Christchurch: University of Canterbury. 2005. pp.10-40. [Gateway Antarctica Special Publication Series, No. 0501]

Wery, N., Gerike, U., Sharman, A., Chaudhuri, J.B., Hough, D.W. and Danson, M.J. 2009. Use of a packed column bioreactor for isolation of diverse protease-producing bacteria from Antarctic soil. Applied and environmental microbiology 69: 1457-1464.

Blanchette, R.A., Held, B.W., Jurgens, J.A., McNew, D.L., Harrington, T.C., Duncan, S.M. And Farrell, R.A. 2004. Wood-destroying soft rot fungi in the historic expedition huts of Antarctica. Applied and Environmental Microbiology 70: 1328-1335.

Held, B.W., Jurgens, J.A., Duncan, S.M., Farrell, R.L. And Blanchette, R.A. 2005. Assessment of fungal diversity and deterioration in a wooden structure at New Harbour, Antarctica. Polar Biology DOI 10.1004/s00300-005-0084-3

Duncan, S.M., Farrell, R.L., Thwaites, J.M., Held, B.W., Arenz, B.E., Jurgens, J.A. And Blanchette, R.A. 2006. Endoglucanase-producing fungi isolated from Cape Evans historic expedition hut on Ross Island, Antarctica. Environmental Microbiology 8:1212-1219

Arenz, B.E., Held, B.W., Jurgens, J.A., Farrell, R.L. And Blanchette, R.A. 2006. Fungal diversity in soils and historic wood from the Ross Sea Region of Antarctica. Soil and Biology and Biochemistry 38: 3057-3064.

Duncan, S.M., Minasaki, R., Farrell, R.A., Thwaites, J.M., Held, B.W., Arena, B.E., Jurgens, J.A. and Blanchette, R.A. 2008. Screening fungi isolated from historic Discovery Hut on Ross Island, Antarctica for cellulose degradation. Antarctic Science DOI: 10.1017/S0954102008001314

Selection of publications from Professor Cary's work in the last 5 years include:

Niederberger T.D.McDonald I.R.Hacker A.L.Soo R.M.Barrett J.E.Wall D.H.Cary C. 2008. Microbial community composition in soils of Northern Victoria Land, Antarctica. Environmental microbiology 10:1713-1624

Adams B.J.Bardgett R.D.Ayres E.Wall D.H.Aislabie J.Bamforth S.Bargagli R.Cary C.Cavacini P.Connell L.Convey P.Fell J.W.Frati F.Hogg I.Newsham K.K.ODonnell A.Russell N.Seppelt R.D.Stevens M.I. 2006. Diversity and distribution of Victoria Land biota. Soil biology and biochemistry 38: 3035-3040

Smith J.J.Ah Tow L.Baker G.Cary C.Cowan D.A. 2006. Bacterial diversity in three different Antarctic cold desert mineral soils. Microbial ecology 51:413-421