MEMBER COUNTRY: **New Zealand**

National Report to SCAR for year: 2013-14

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3)	Associate Professor Mary Sewell	The School of Biological Sciences, The University of Auckland Private Bag 92019, Auckland Mail Centre, Auckland 1142	+64 9 3737599 ext 83758		m.sewell@auckland.ac.nz	http://www.bioscienceresearch.co.nz/staff/mary-sewell/
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Activity	Contact Name	Address	Telephone	Fax	Email	Website
Scientific Research Program						
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2)						
3)						
AntEco						
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Other Groups (optional)						
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An optional report summarising scientific highlights of the past year may be included below.

Event K020 - 1314	**Protection of Antarctic Terrestrial Ecosystems**
Jan. 2014	Professor Craig Cary, Phone: (07) 838 5493, E-mail: caryc@waikato.ac.nz Department of Biological Sciences, University of Waikato, Private Bag 3105, Hamilton.
Miers Valley, McKelvey Valley, Victoria Valley, Alatna Valley and Taylor Valley	This research will deliver a bio geographical characterisation for the entire Ross Sea region, together with a predictive model for the effects of climate change. We will achieve this by greatly extending and upgrading our existing model that links the biodiversity with landscape and environmental features. We plan to extend its coverage to include biota in all ice-free regions of the Ross Sea region and increase its prediction capability by importing detailed analyses of the physical, chemical and biological drivers responsible for the biodiversity combined with a sensitivity analysis of the model using detailed survey and ecophysiological studies of biodiversity hotspots. This will allow us to test various climate change scenarios and to determine the impacts and risks of changing global climate.

Event K043-1314	Life In The Ice: Microbial Diversity and Function in Antarctic Sea Ice Ecosystems
Nov - Dec. 2013	Dr Ken Ryan, Phone: (04) 463 6083, E-mail: ken.ryan@vuw.ac.nz School of Biological Sciences, Victoria University of Wellington, Private Bag 600, Wellington.
Cape Evans	The sea ice is host to a diverse community of algae, bacteria and protists that are likely to be sensitive indicators of changing climatic conditions. These organisms grow between the ice crystals of the sea ice producing a large biomass particularly on the bottom of the ice. They are ultimately the primary food source for all organisms in ice covered areas of the Southern Ocean, much like the grasslands in our farms in NZ. The research will develop baseline long-term data on their biodiversity, abundances and community structure, using a range of traditional and modern techniques including microscopic identifications, DNA fingerprints, high throughput sequencing etc, over broard spatial and temporal scales. Together with international collaborators, we will also establish the responses of the sea ice microbial community to climate-induced environmental changes such as ocean acidification using eco-physiological methods we have developed over more than 20 years of Antarctic research.

Event K049-1314	Roosevelt Island Climate Evolution – RICE Project
Oct. - Dec. 2013	Dr Nancy Bertler, Phone: (04) 463 6196, E-mail: nancy.bertler@vuw.ac.nz Antarctic Research Centre, Victoria University of Wellington, PO Box 600, Wellington.
Roosevelt Island	RICE is an international collaboration between New Zealand, Australia, Denmark, Germany, Italy, People Republic of China, Sweden, United Kingdom, and United States of America. The aim of the project is to interpret an ice core from Roosevelt Island to determine the stability of the Ross Ice Shelf and West Antarctica in a warming world. During the 2011/12 and 2012/13 field season, the international RICE team recovered a 764m deep ice core, reaching bedrock on 20 December 2012. The RICE ice core is to date the highest quality core recovered from the brittle ice zone, which enables the team to study this section of the core (350-764m) also with exceptionally high resolution. This success is attributed to the newly designed hydraulic system in the New Zealand ice core drilling system, which allows for higher precision core penetration and lower impact core breaks. From May to July 2013, the RICE team processed already the top 500m of the core in the National Ice Core Facility at GNS Science in Lower Hutt. Over 60,000 samples were collected and seven instruments provided extremely high resolution, continuous flow analyses as the ice was processed. The data confirmed that the ice at the bottom is at least 40,000 years old and that annual resolution will be achieved for at least the last 20,000 years. The 2013/14 field season focuses on the pull out of the remaining ~70,000 lbs of cargo and fuel from Roosevelt Island. In addition, led by Darcy Mandeno, the NZ/US/UK team will carry out borehole and mass balance measurements and final ground penetrating radar surveys.

Event K055-1314	Assessment of the Current State of the Antarctic Middle Atmosphere and Climate Model Validation
Jan. 2014	Dr Adrian McDonald, Phone: (03) 364 2281, E-mail: a.mcdonald@phys.canterbury.ac.nz Department of Physics and Astronomy, University of Canterbury, Private Bag 4800, Christchurch.
McMurdo Sound	This research programme will underpin improvements in key components of middle atmosphere climate models. We will produce an integrated high resolution database, formed from a wide variety of remote sensing and in-situ measurements, which will elucidate the current state of the Antarctic middle atmosphere. Production of this database will make it possible to validate climate model outputs, produced using the University of Canterbury Super Computer (UCSC), and feed forward the resultant improved fundamental physical understanding of this region to improve these climate model components.

Event K060 - 1314	Space Weather Monitoring (AARDDVARK)

Nov. - Dec. 2013	Dr Craig J. Rodger, Phone: (03) 479 4120, E-mail: crodger@physics.otago.ac.nz Department of Physics, University of Otago, PO Box 56, Dunedin 9016.
Arrival Heights, Scott Base	It is important to understand the response of all regions above the Earth to climate change in order to improve our modelling and prediction capabilities. This should include consideration of the contribution of solar input and its variability through the transmission of solar energy from the Earth's upstream region to the lower atmosphere. This project provides a better understanding of the volatility of near-Earth space, a plasma region populated by ionised gas embedded in the geomagnetic field. One example of the solar variability to lower atmosphere linkage comes from solar-induced energetic particle precipitation leading to ozone losses in the upper stratosphere; experimental observations show increased ozone losses occurring during the polar winter and caused by solar-generated events, particularly dramatic explosions on the Sun and aurora producing geomagnetic storms. This variability may contribute to the recovery times of the man-made ozone hole. Polar ozone depletion has a key-influence on the global climate system, directly impacting NZ both through changes in local ultraviolet (UV) levels and producing regional climate variability.

Event K063 - 1314	**Antarctic sea ice thickness mapping at McMurdo Sound**
Nov. - Dec. 2013	Dr Pat Lanhorne, Phone: (03) 479 7787, E-mail: pat.langhorne@otago.ac.nz Department of Physics, University of Otago, PO Box 56, Dunedin 9016. Dr Wolfgang Rack, Phone: (03) 364 3166 Email: Wolfgang.rack@canterbury.ac.nz Gateway Antarctica, University of Canterbury, Private Bag 4800, Christchurch
McMurdo Sound, Scott Base	Simultaneous and co-incident surveys of sea ice from the air, on the ground and from the ocean, near parallel to satellite overflights. Objectives: 1 - Helicopter survey of sea ice thickness and surface properties; 2 - On-ice survey of snow, ice thickness & oceanography on subset of helicopter grid; 3 - AUV at ice-water interface coincident with helicopter or EM31; 4 - Surveying of tidal movement. The important issue is why has Antarctic sea ice extent in the Ross Sea becomes greater in the past decade when global climate models say that it should be decreasing? We believe (along with others) that part of the discrepancy is that land ice that is floating on the ocean (called an ice shelf) contributes and the effect of ice shelves on the ocean is not a part of global models. Over the past decade our own observations and models have shown that this source can make a 20% increase in sea ice thickness. The only technique that makes direct, airborne sea ice thickness measurements is electromagnetic induction. Our Canadian colleague is the guru of these measurements and will be joining us for the third time at Scott Base with his latest helicopter electromagnetic induction device - the HEM bird. The really great thing about this device is that it not only selects sea ice thickness but can also detect the loose crystals, the refrozen ice shelf melt, beneath the sea ice. In Nov 2013 the team will flying the HEM bird over the sea ice of McMurdo Sound to measure sea ice thickness snow and ice thickness, density and the layer of loose crystals. This will follow the lines of satellites, tying all the measurements together. New technology, a snow radar from the University of Kansas, will also be flown from light aircraft. This will give us snow thickness over a large area. The Kiwi team we will deploy radar reflectors on the sea ice so that the Kansas team can test their technology. NASA will also overfly the satellite tracks. If all the sea ice around Antarctica melts there is little contribution to sea level rise. But sea ice keeps the ocean cool and protects the ice shelves at the boundary of the continent from the ravages of the ocean. Ice shelves around the perimeter of Antarctica protect the inland ice. Once an ice shelf collapses the inland ice flows much more rapidly to the ocean where it melts. The really scary number is that if all the ice on the Antarctic continent melts, then sea level will rise by 68 m. The loss of sea ice is probably the first step in this very complex and disturbing chain of events, it is the canary in the mine. If our predictions of sea ice extent and its trends are wrong then there is something substantial that we do not understand. This is not a comfortable position to be in.

Event K067 - 1314	Does Sea Ice Microbial Production Support Benthic Consumers in the Ross Sea, Antarctica?
Oct. – Nov. 2013	Associate Professor Stephen Wing, Phone: (03) 479 9038, E-mail: steve.wing@stonebow.otago.ac.nz Department of Marine Science, University of Otago, PO Box 56, Dunedin.
McMurdo Sound, Cape Evans, Cape Royds, Cape Bird	The goal of the proposed project is to test whether sea ice microbial communities are an important source of organic material supporting marine communities in the Ross Sea, including important prey for seals and penguins. We will use bulk and compound specific isotopic composition of organic matter sources to trace their contribution to consumers across spatial gradients corresponding to different sea ice extent and persistence. This will be extended to a systems level modeling approach to understand organic matter flux in the Ross Sea marine community. The project addresses an important unknown for Antarctic communities: the connectivity between primary production within sea ice and availability of organic material for benthic consumers. It will provide new understanding of the role of sea ice for ecosystem functioning in Antarctica.

Event K068 - 1314	Developmental and Metabolic Responses of Antarctic Marine Invertebrate Larvae to a Warmer, Acidified Ocean
Oct. - Nov. 2013	Dr Miles Lamare, Phone: (03) 479 7463, E-mail: miles.lamare@stonebow.otago.ac.nz Department of Marine Science, University of Otago, PO Box 56, Dunedin.
McMurdo Sound, Cape Evans.	The objective of our research is to advance our understanding of the effects of climate change (seawater pH and temperature change) on Antarctic marine larvae by applying experimental conditions that realistically simulate predicted future pH and temperature changes in a range of marine environments to quantify responses in terms of metabolic rates, acid-base regulation, the activity and gene expression of the key enzyme, carbonic anhydrase, fertilization, development, mortality and calcification rates. This research will contribute to a greater understanding of the responses of Antarctic marine invertebrates to climate change by addressing: (1) mechanisms that can be used to adjust physiology in response to change, (2) how these adjustments contribute to compensating for change and; (3) trade-offs that result from any such physiological adjustments.

Event K069 - 1314	Monitoring Magnetosphere-Ionosphere Coupling and Space Weather in the Polar Region
Jan. 2014	Professor Brian Fraser, Phone: (+61) 2 4921 5445, E-mail: bhbjf@cc.newcastle.edu.au Department of Physics, University of Newcastle, NSW 2308, Australia.
Arrival Heights	This project will provide a better understanding of the volatility of near- Earth space, a plasma region populated by ionised gas embedded in the geomagnetic field. Energy from the Sun must pass through many important regions and boundaries to reach Earth, including the magnetosphere and the ionosphere. The dynamic behaviour of this plasma system, now referred to as "space weather" is of vital importance to life on our planet, and its

Event K070 - 1314	Whales, seals and penguins: defining functional roles and trophic dependencies of key top predators in the Ross Sea
Dec. 2013 - Feb. 2014	Dr Regina Eisert, Phone: (+64) 3 364 2366, E-mail: regina.eisert@canterbury.ac.nz Gateway Antarctica, University of Canterbury, Christchurch, NZ.
Arrival Heights	Climate change and commercial fishing are two potential drivers of change in the Ross Sea, but our ability to predict or manage impacts is limited by lack of information. Antarctic top predators integrate complex changes in the physical and biological conditions affecting their food resources, which makes them ideal sentinels for the state of the Ross Sea ecosystem. We will study the food requirements of killer whales, Weddell seals and Adélie penguins to provide reference points for detecting future change and to identify what food resources are critical to these predators to allow responsible environmental stewardship of the Ross Sea.

Event K081 - 1314	Identification and Management of Change in Inland Antarctic Aquatic Ecosystems
Jan. 2014	Dr Ian Hawes, Phone: (03) 364 2330, E-mail: ian.hawes@canterbury.ac.nz University of Canterbury, Private Bag 4800, Christchurch.
Lake Fryxell, Lake Vanda, Koettlitz Glacier, Bratina Island, Miers Valley Mouth	This programme's goal is to determine how climate-driven hydrological change controls the biological structure and biodiversity values of Antarctica's inland aquatic ecosystems by quantifying and modelling the climate-hydrology-biodiversity linkages. We will apply new molecular, biological process and environmental modeling techniques in the field and in laboratory experiments to identify key biodiversity and ecosystem components and values. Our programme takes a multi-disciplinary approach to assess the sensitivity of inland aquatic habitats to incremental (eg climatic) and discontinuous (eg invasive species) change. This research will inform environmental management of Antarctic systems of how things are likely to change, which environments are likely to be most sensitive to change, and which areas need to be prioritised for protection. We will identify and categorise the range of aquatic ecosystems within the Ross Sea sector and elucidate the mechanisms by which they are connected, their resilience to environmental change and their vulnerability to invasive organisms. In 2011-12 we will focus on two types of water body; (a) glacially-associated, ice-based meltwaters that are some of the most ubiquitous and diverse aquatic habitats in Antarctica, for which there is little comprehensive biological information; and (b) rock-based pond ecosystems close to and remote from Scott Base that are important biodiversity elements in continental Antarctic landscapes.

Event K082 - 1314	Ice Cube – under sea ice flora and fauna
Nov. 2013	Dr Vonda Cummings, Phone: (04) 386 0602 , E-mail: Vonda.cummings@niwa.co.nz NIWA, Private Bag 14901, Wellington.
Granite Harbour, Cape Evans	Anthopogenic impact s in Antarctica are increasing and a good nderstanding of marine ecosystem function is needed to inform decisions on environmental management and protection. With a focus on coastal benthic (seafloor) communities and the environmental conditions that structure them, the major goal of this research is to advance knowledge of coastal benthic ecosystem structure and function, spatial variance and response to environmental stress, and thus improve management of the Ross Sea region.

Event K085 - 1314	Investigating ozone depletion and climate change: trace gas measurements in the Antarctic atmosphere
Oct. 2013- Feb 2014	Dan Smale, Phone: (03) 440 0424, E-mail: d.smale@niwa.co.nz NIWA, Private Bag 50061, Omakau.
Arrival Heights, Scott Base	The Antarctic atmosphere is an important and unique part of the global climate system. It provides a unique opportunity for us to measure global trends in atmospheric trace gases at sites isolated from anthropogenic sources. The goal of this research is to improve understanding of how the Antarctic atmospheric chemistry drives and responds to global atmospheric change. Research topics include: ozone depletion chemistry, greenhouse gas measurements, sea- ice/atmosphere trace gas interactions and the pole-ward transport of atmospheric constituents. To this end, we measure the atmospheric composition throughout the year using ground-based remote sensing instruments and surface in-situ air samples, located at Scott Base and Arrival Heights.

Event K089 - 1314	Climate Data Acquisition – Scott Base and Arrival Heights, Antarctica
Jan. 2014	Mr Andrew Harper, Phone: (03) 343 7890, E-mail: a.harper@niwa.co.nz NIWA, PO Box 8602, Christchurch.
Arrival Heights, Scott Base	The goal of this programme is to obtain a high-quality continuous climate record for Scott Base and Arrival Heights in Antarctica, and archive it in NIWA's publicly accessible climate database. Scott Base is one of 47 reference climate stations for the New Zealand region managed by NIWA, and climate observations (wind speed and direction, air temperature, relative humidity, barometric pressure, global solar radiation, diffuse solar radiation and direct solar radiation) are recorded there daily. This climate record began in 1957 and is one of the longest continuous records in Antarctica. Wind speed and

	direction, air temperature, relative humidity and global solar radiation are also recorded at Arrival Heights. The measurements are needed for characterising the local climate and state of the environment, identifying climate variations and changes, and in research on climate-sensitive processes and ecosystems. This programme also includes measurements from the sea level recorder installed at Scott Base.

Event K121 - 1314	**Abundance and Spatial Distribution of South Polar Skua (Stercorarius maccormicki) in the Western Ross Sea**
Nov. - Dec. 2014	Dr Phil Lyver, Phone: (03) 325 6700, E-mail: lyverp@landcareresearch.co.nz Landcare Research, PO Box 69, 40 Gerald Street, Lincoln 8152.
Western McMurdo Sound	Our primary hypothesis is that South Polar skua (Stercorarius maccormicki) population abundance broadly tracks summer food availability in the southern McMurdo Sound region. Skuas and Adélie penguins (Pygoscelis adeliae) both prey heavily on Antarctic silverfish (Plueragramma antarcticum) and krill (Euphausia crystallorophias and E. superba) and overlap in breeding space during the summer in this region, though not entirely. If we make the assumption that physical (e.g. persistent sea-ice cover) and biological (e.g. prey abundance) conditions, in the absence of other factors, affect population dynamics and growth of both seabird species', then similar trajectories for each population could emerge. On the other hand, in McMurdo Sound, and especially along the Victoria Land Coast, appreciable numbers of skuas nest where there are no penguins. Therefore, factors not applying to penguins historical human occupation) would seem to be important as well to the skuas.

Event K122 - 1314	**Protecting the Structure and Function of Ross Sea Ecosystems, Antarctica**
Nov. 2013 - Jan. 2014	Dr Phil Lyver, Phone: (03) 325 6700, E-mail: lyverp@landcareresearch.co.nz Landcare Research, PO Box 69, 40 Gerald Street, Lincoln 8152.
Cape Royds, Cape Bird	This research will contribute to showing how Ross Sea ecosystems can be managed to achieve conservation and fishery outcomes in a precautionary manner. It will contribute to the quantification of food web linkages within the ecosystems of the pelagic and benthic communities of the Ross Sea shelf, slope, abyss and seamounts, development of indicators for monitoring change, assessment of risk to critical biological processes, and support the establishment of protected areas. In collaboration with the US Adelie penguin team, demographic rates (e.g., survival, productivity, breeding rates) and provisioning strategies (e.g., foraging behaviour, dietary composition, chick condition) will be recorded annually at the Ross Island colonies. Variation in demographic rates and provisioning strategies will be used to predict population trajectories and plausible sea-ice and krill abundance scenarios that may be mediated by climate change.

Event K123 - 1314	**Environmental Domains Classification for the Ross Sea Region**
Dec. 2013 - Jan. 2014	Dr Fraser Morgan Phone: (09) 574 4149, email: morganf@landcareresearch.co.nz Landcare Research Ltd, 231 Morrin Road, St Johns, Auckland 1072 NZ.
Minna Bluff, Don Juan Pond, Mt Fleming, Bull Pass, Victoria Valley, Granite Harbour, and Marble Point.	The research develops an environmental classification for terrestrial ecosystems of Ross Sea region. The classification includes associated data and models and is underpinned by new knowledge on soil distribution, climate and microbial diversity and/or abundance. Its delivery, via a one-stop web portal will produce a classification that is dynamic, widely accessible, and functional. We provide new data on these ecosystems by: • Developing a terrestrial environmental classification for the Ross Sea region using environmental domains analysis that encompasses climate, landform, soil, and biology layers; • Mapping soil attributes using soil-landscape models, validated with field data to establish the spatial distribution of soils in the McMurdo Dry Valleys; • Extending our existing soil climate network to include upland slopes for monitoring the impact of climate change on soil active layer and permafrost depth;

Event K131 - 1314	Sea Ice and Southern Ocean Processes
Oct. - Dec. 2013	Dr Timothy G Haskell, Phone: (04) 569 0000, E-mail: t.haskell@irl.cri.nz Industrial Research Ltd, PO Box 31-310, Lower Hutt, 5040.
McMurdo Sound, Coulman High, Cape Roberts.	This programme aims to characterise the relationship between the sea ice, ocean and atmosphere of Antarctica in order to better understand and predict high-latitude coupled climate variability, and to underpin the management of Antarctica and the Southern Ocean in the context of th e global climate system. It concentrates on the climate-related processes occurring within McMurdo Sound to the marginal ice zone. It covers a range of scales, from microns in structure of sea ice, to the order of thousands of kilometres in the process of sea ice dispersal in the Southern Ocean, and the relationships linking Antarctica to global climate variability and change.

Event K150 - 1314	Land Information New Zealand
Oct. - Nov. 2013	Graeme Blick, Geospatial Data Analyst, Phone: (04) 460 0191, E- mail: gblick@linz.govt.nz Land Information New Zealand (LINZ), PO Box 5501, Wellington, 6145.
Cape Royds, Cape Evans, Cape Roberts	LINZ and its predecessor agencies have operated surveying, charting and mapping programmes in the Ross Sea region, as well as place naming administration, for some 30 years. The Department has an agreement with the United States geological Survey, which provides for co-operation in these activities and in particular joint topographic mapping, geodetic surveying and place naming programmes.