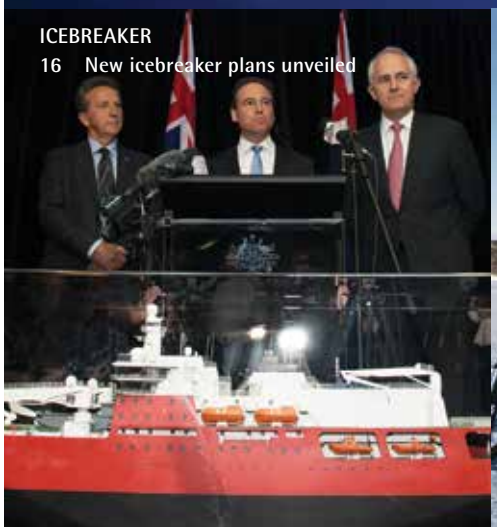
AUSTRALIAN

ANTARCTIC

MAGAZINE

ISSUE 29 | 2015

SCIENCE
12 Measuring algae in the fast ice



ICEBREAKER
16 New icebreaker plans unveiled

HISTORY
24 Two-wheeled Antarctic adventures

CONTENTS

ABOUT THE COVER

Building Services Supervisor, Peter Layt, took the cover photo of ice crystals growing on a window at Mawson station just after mid-winter. The back-lighting by the low-level sun gave the crystals a gold colour. During winter the crystals formed in an endless array of different shapes and patterns, which looked absolutely stunning when the detail was revealed under magnification. Peter used a Nikon D800 camera set at f7.1, 1/320s, ISO 400, with a Micro (macro) 200 mm 1:4D lens.

AUSTRALIAN
ANTARCTIC
MAGAZINE ISSUE 29 | 2015

The Australian Antarctic Division, a Division of the Department of the Environment, leads Australia's Antarctic program and seeks to advance Australia's Antarctic interests in pursuit of its vision of having 'Antarctica valued, protected and understood'. It does this by managing Australian government activity in Antarctica, providing transport and logistic support to Australia's Antarctic research program, maintaining four permanent Australian research stations, and conducting scientific research programs both on land and in the Southern Ocean.

Australia's Antarctic national interests are to:

- Preserve our sovereignty over the Australian Antarctic Territory, including our sovereign rights over the adjacent offshore areas.
- Take advantage of the special opportunities Antarctica offers for scientific research.
- Protect the Antarctic environment, having regard to its special qualities and effects on our region.
- Maintain Antarctica's freedom from strategic and/or political confrontation.
- Be informed about and able to influence developments in a region geographically proximate to Australia.
- Derive any reasonable economic benefits from living and non-living resources of the Antarctic (excluding deriving such benefits from mining and oil drilling).

Australian Antarctic Magazine seeks to inform the Australian and international Antarctic community about the activities of the Australian Antarctic program. Opinions expressed in Australian Antarctic Magazine do not necessarily represent the position of the Australian Government.

The Editor

Australian Antarctic Magazine

Australian Antarctic Division

203 Channel Highway

Kingston, 7050

Tasmania, Australia.

Australian Antarctic Division

Telephone: (03) 6232 3209

(International 61 3 6232 3209)

email: magazine@aad.gov.au

Facsimile: (03) 6232 3288

(International 61 3 6232 3288)

Editor: Wendy Pyper

Production: Sally Chambers, Jessica Fitzpatrick

Graphic Design: WOOF Creative Solutions

Issue 29: December 2015

ISSN 1445-1735 (print version)

Australian Antarctic Magazine is printed on Monza satin recycled paper; a 50% post consumer waste and 50% FSC certified fibre stock.

Australian Antarctic Magazine can be viewed online: www.antarctica.gov.au/magazine

Australian Government
Department of the Environment
Australian Antarctic Division

AAD

1. *Australian Antarctic Division Director, Dr Nick Gales, at the launch of the Antarctic Gateway Partnership in September. The Partnership aims to consolidate Tasmania's place as a global leader in Antarctic and Southern Ocean science and get more scientists on the ice.*

Australia's Antarctic future

In August I was privileged to take on the role of Director of the Australian Antarctic Division, at one of the most exciting times in Australia's Antarctic history.

Top of my 'to do' list is continuing the good work started by our previous Director, Dr Tony Fleming, to support the delivery of an Australian Antarctic strategy and, as part of that strategy, replace our ageing icebreaker ship, *Aurora Australis*, with a new research and resupply vessel.

Australia has maintained an active interest in Antarctica for more than 100 years and these two significant projects will enable us to further our leadership in Antarctic science, policy and operations over the coming decades.

As the backbone of the Australian Antarctic program, our new icebreaker will play a critical role in Australia's Antarctic future. The ship will provide a world-class scientific platform for conducting multi-disciplinary research in the Southern Ocean and sea-ice zone, and a flexible logistical platform for station resupply. The icebreaking performance alone (1.65 m of ice at a speed of three knots, compared to the *Aurora Australis*' 1.23 m of ice) will extend our potential operating season, while the 1200 tonne cargo capacity will increase our ability to carry equipment and infrastructure by 50 per cent. Our new ship will change the way we are able to work in Antarctica.

Continuing this vision, this Antarctic season will see us explore a new aerial logistics capability as we conduct up to five proof of concept flights to Wilkins aerodrome, in a C17A Globemaster, with the Royal Australian Air Force (RAAF). These flights have the potential to enhance Australia's logistical and scientific capabilities in the region and improve the RAAF's capability for search and rescue and multi-casualty air evacuation.

You will not be surprised that I will bring to the role of Director a strong focus on our Antarctic science. I want to ensure that our opportunities to conduct our world class research are maximised and that we deliver the information we need to protect and understand Antarctica and our climate. It is through this research that our strategic collaborations with our neighbours are delivered.

My Executive and I will also continue to lead Australia's engagement with the international Antarctic community to maintain and further develop relationships with other nations to achieve our scientific, environmental and operational goals. This will include negotiations through international bodies such as the Committee for the Conservation of Antarctic Marine Living Resources, the Antarctic Treaty Consultative Meeting, and the Council of Managers of National Antarctic Programs.

Our Australian Antarctic Program is already truly international and highly collaborative. This season, for example, we are involved in logistic collaborations with the United States, China, New Zealand, France and Italy, and recently we reached formal agreements to share logistics with the US, China, New Zealand and France during the 2015–16 season.

Chinese, French and Italian expeditioners will also use Hobart as a gateway for flights to and from Wilkins aerodrome on the Antarctic Division's Airbus. And our science projects this season will involve collaborations with 21 countries and 150 international institutions. Our vision to see Hobart grow as an international gateway to Antarctica and an Antarctic science hub is happening!

As you'll discover in this issue of the *Australian Antarctic Magazine*, this season will involve a major marine science project south of Heard Island to assess habitats, productivity and food webs on the Kerguelen Axis in the Indian Sector of the Southern Ocean (page 2). A wide-ranging geodesy research program will be active in the Prince Charles Mountains, east of Davis and in the Bunger Hills (page 10). Land-fast sea ice studies off Davis will employ remotely operated vehicles underneath the sea ice (page 12). And an airborne geophysics program conducted over a number of years will continue to use airborne instruments to investigate the Antarctic ice sheet over vast distances. These are just a few of the 94 active science projects across the program.

Dr NICK GALES
Director, Australian Antarctic Division

Spotlight on the K-Axis

Draw a line from the South Pole, through the Amery Ice Shelf on the East Antarctic coast, and out into the Southern Ocean, between Heard Island and Kerguelen Island, and you have an 'axis' that intersects three key habitat areas. The Kerguelen Axis or 'K-Axis' is one of only three lines of longitude where the Antarctic Circumpolar Current flows across the Antarctic continental shelf, the deep ocean and subantarctic islands, resulting in one of the most highly productive regions for polar plants and animals, and valuable toothfish, icefish and krill fisheries.

Early next year, the K-Axis will be the focus of a major Australian marine science voyage, led by Dr Andrew Constable of the Australian Antarctic Division and Antarctic Climate and Ecosystems Cooperative Research Centre (ACE CRC). The voyage will study the physical, biological and chemical conditions that drive the krill-based food web in the southern part of the axis, and the fish and copepod (small crustaceans) dominated food web in the north. It will also establish methods for the long-term observation of the region in the face of climate change.

'The K-axis is an important foraging area for seals, whales, penguins and flying seabirds, and is the site of valuable toothfish and icefish fisheries on the northern Kerguelen Plateau and potential krill fisheries in the south,' Dr Constable said.

'Because of its high levels of primary production [phytoplankton growth] the region also contributes significantly to the drawdown of atmospheric carbon dioxide into the deep ocean.

'All these characteristics make the K-Axis an excellent place to identify physical, chemical and biological drivers of the different food webs found in the Southern Ocean, and to measure ecosystem change as a result of climate change.'

Despite the region's importance, the voyage will be the first to study the K-axis as a whole. To ensure maximum return on their research investment, the *Aurora Australis*-based voyage will also coordinate with three other research vessels conducting additional or complementary research in the region – the French ship *Marion Dufresne*, the Japanese *Umitaka Maru* and CSIRO's new national research facility, *Investigator*. There will also be some oceanographic input from the US vessel *Roger Revelle*. The data collected will help address a number of research questions.

The first area of research will investigate the factors that affect the distribution of Antarctic krill and determine the species' northern limits. These factors could include temperature, the distribution of their food source (phytoplankton), sea ice extent, and the southern boundary of the Antarctic Circumpolar Current. This information will be used in ecosystem models of the krill-based food web to understand how the species may be affected by climate change and ocean acidification. This in turn will feed into management measures and catch limits for krill fisheries.

The second area of research will examine the relationships between planktonic species, including phytoplankton, zooplankton and krill, with different habitat characteristics. These characteristics include temperature, salinity, depth, iron supply (for phytoplankton growth) and carbonate concentration (used to form shells and other hard structures in planktonic and other species).

'As the Southern Ocean warms and winter sea ice extent decreases, we could see temperate species migrating south towards the poles,' Dr Constable said.

'So knowledge of the key habitat variables that limit the ranges of species is crucial for determining whether such temperate marine food webs will migrate towards the poles, resulting in a contraction in polar food webs.'

A third research area will assess phytoplankton productivity and food web structure in three habitat areas of the K-Axis – close to the Antarctic continent (continental shelf habitat), the BANZARE Bank and adjacent open ocean, and the northern Kerguelen Plateau, near to subantarctic islands.

The productivity component of the work will focus primarily on iron sources in each habitat area.

'Each of these areas has different potential sources of iron, which is critical for blooms of phytoplankton at different times,' Dr Constable said.

'However, the sources of iron in the Southern Ocean are a big question at present. It could come from the adjacent continents via the wind, or be concentrated in sea ice through a variety of processes. Or it may be released from the sediments or hydrothermal vents.'

If the biogeochemical teams onboard the *Aurora Australis* and *Investigator* can identify which iron sources are the most important in the K-Axis, they can help improve the way ecosystems models represent primary production in the region.

For the food web structure analysis, the research team will examine the distribution of marine mammals and seabirds across the K-axis and look for any 'hotspots' of activity. To do this they will draw on existing predator monitoring work by France and Australia at Kerguelen Island and Davis station respectively.

1. *Dr Andrew Constable is leading the K-axis voyage.*
2. *The K-Axis voyage will study the physical, biological and chemical conditions across the Kerguelen Plateau.*
3. *This graphic shows the environmental (physical, chemical and human) processes affecting the krill-based food web in the more southerly latitudes of the subantarctic, and the copepod-fish-based food web further north. From Melbourne-Thomas et al. in prep.*

'Both France and Australia monitor the movement of penguins, seals and flying seabirds in the region each year,' Dr Constable said.

'The Davis-based predators migrate to the north of the region we'll be traversing by ship and the Kerguelen predators migrate into the south of the region. '

'We'll also use acoustic technology and observers to locate any whales in the region.'

The team will also look at the distribution of small 'mesopelagic' fish. These fish live in the top 200 to 1000 metres of ocean and are an important food source for seals, penguins and other predators. DNA analysis of the stomach contents of the fish will provide information about their diet – different phytoplankton and zooplankton species (see *DNA barcoding plankton*, page 4) – which can in turn be related back to the effects of different habitats and ocean chemistry on plankton productivity.

'The best way to think about all these data is as layers,' Dr Constable said.

'So we will have a layer showing where the predators forage and another layer showing the densities of fish and krill in areas where they are and are not foraging. Below that we will see where the zooplankton are found – are they in the same place as the fish or is there a flux over time, in different places, which the fish exploit? Then we can look at the data layer showing the distribution of phytoplankton and its productivity, so that we can see where it is and how much is available for krill, fish and zooplankton to eat. Below that, we'll have a layer of information about ocean chemistry and dynamics.

'We'll be able to see the relationships between all these layers, which will give us a better understanding of what drives the movement of predators and fish.'

These drivers could include trace metals such as iron, ocean currents, sea ice, or a combination of physical and chemical factors.

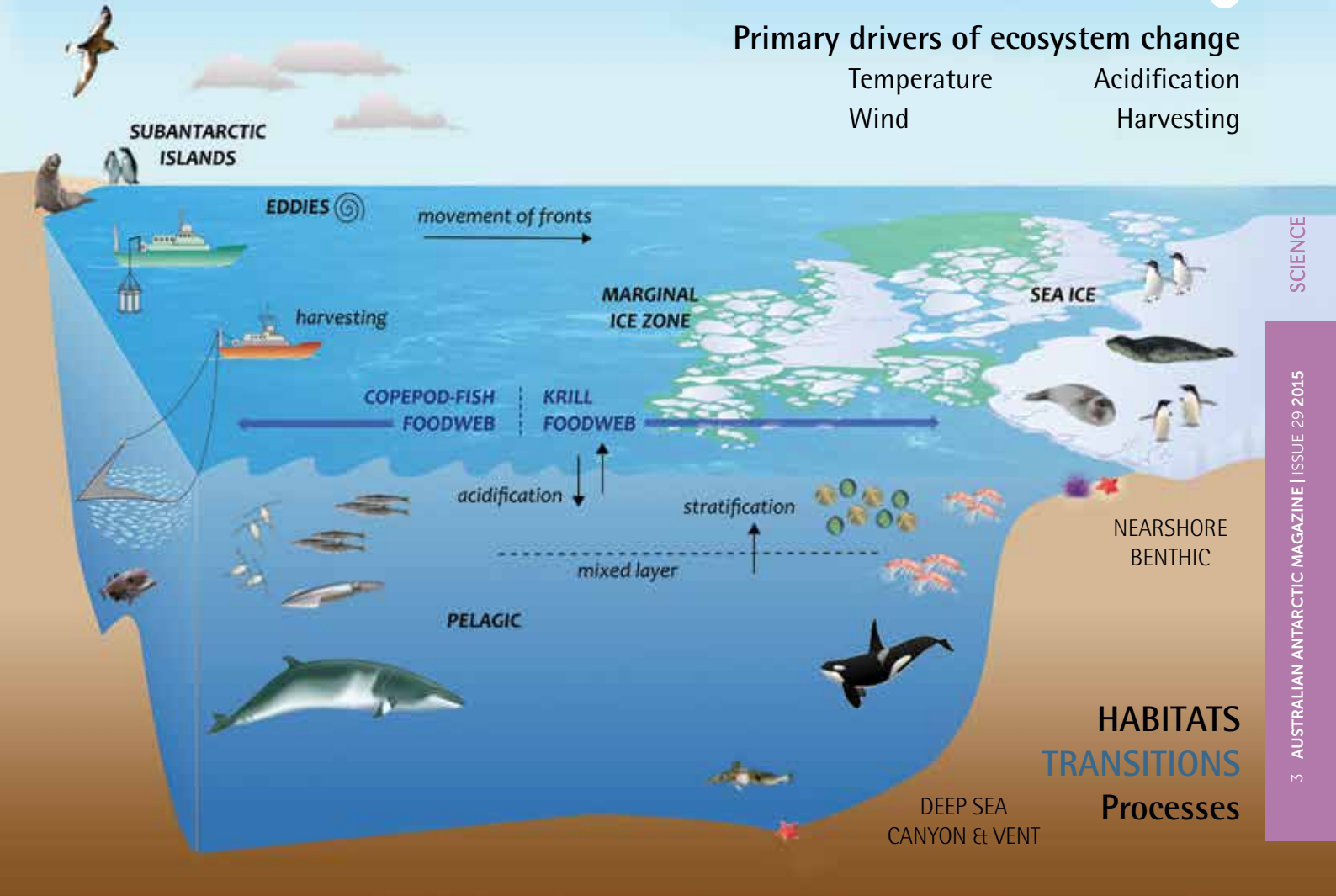
The research team aims to place all the ecological observations in the context of physical and chemical drivers of possible change in the region. This will feed into ecosystem models being developed at the Australian Antarctic Division and the ACE CRC.

'The main outcome of this work will be to enhance the realism of these models, to identify methods and technologies that will allow long-term monitoring of the effects of climate change and ocean acidification on Southern Ocean ecosystems in the region, and to provide information for conservation and fisheries management,' Dr Constable said.

WENDY PYPER
Australian Antarctic Division

This project is funded by the Australian Antarctic Division, ACE CRC and Australian Research Council Special Research Initiative.

3



1. *Dr Bruce Deagle is using advances in DNA technology to identify hundreds of plankton species at once.*
2. *Krill and other plankton species captured on the silk mesh of the Continuous Plankton Recorder can be identified under the microscope or with new DNA techniques.*

DNA barcoding plankton

Genetic technologies pioneered by the Human Genome Project are opening up new realms of discovery for scientists studying microscopic Antarctic marine plants and animals.

Australian Antarctic Division molecular ecologist, Dr Bruce Deagle, said advances in DNA sequencing are enabling scientists to simultaneously identify hundreds of phytoplankton and zooplankton species (collectively called plankton) in a single sample.

Such samples include the stomach contents of fish, water and plankton-net samples collected from the Southern Ocean, and potentially even aquaculture feeds.

'New methods of sequencing mean that we can sequence hundreds of thousands of genes at once, compared to the old days when we could only sequence one at a time,' Dr Deagle said.

The approach for identifying plankton relies on 'barcodes', which are segments of DNA unique to different species. These genetic markers are amplified from the total DNA extracted from a sample and the resulting sequences are then compared to a reference database to identify the organisms.

Dr Deagle and post-doctoral fellow Dr Laurence Clarke, from the Antarctic Climate and Ecosystems Cooperative Research Centre, will use the technology on the K-Axis voyage (see *Spotlight on the K-Axis*, page 2) to monitor plankton biodiversity in different habitats and regions of the study.

'The main goal of the K-Axis study is to look at the shift from a krill-based ecosystem to the fish/copepod-based ecosystem as you move north from Antarctica,' Dr Deagle said.

'We'll be measuring different things that tell us about that change, and we'll provide a genetic perspective on which plankton species are shifting within the study region.'

To do this the pair will analyse the DNA in water and plankton-net samples collected in the study area, and in the stomach contents of small 'mesopelagic' fish (these fish live in the top 200-1000 m of ocean and are an important food source for seals and penguins).

Dr Deagle said the new DNA methods have already revealed some exciting findings in other marine systems.

'Recent research has highlighted that up to a third of the small unicellular organisms in temperate and tropical marine plankton surveys are being overlooked when using only morphological [physical] identification methods,' he said.

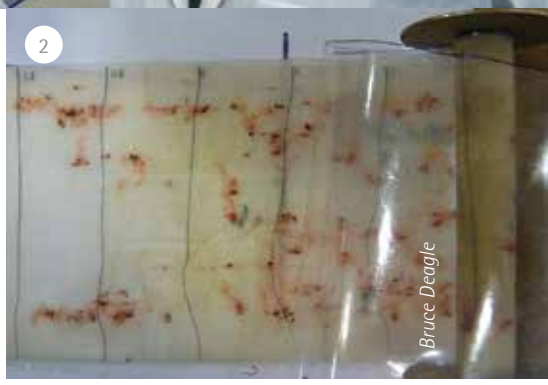
A closely related study underway at the Antarctic Division compares DNA-based identification with traditional morphological identification of organisms collected using an almost century-old technology – the continuous plankton recorder, or CPR.

'The CPR is towed behind the ship and catches plankton on a silk mesh that slowly winds through the instrument,' Dr Deagle said.

'We can then identify organisms captured in the silk, under the microscope, or using genetics.

'Our DNA methodology won't replace this morphological identification, but it will complement it, allowing us to identify species that look physically identical, but that are genetically different.

'The high-throughput nature of the genetic analysis means in the future we should be able to process many more samples to enhance our understanding of Southern Ocean plankton dynamics.'



Dr Deagle will also apply the technology to look at bycatch in the krill fishing industry. Krill fishing vessels filter large volumes of water to collect krill, catching tiny larval fish in the process.

'The fish are a relatively small bycatch, but it's easy to identify the species with DNA barcoding and this can tell you about the distribution of fish larvae and the impact the krill fishery could have on the species,' he said.

Dr Deagle is working with a Norwegian krill fishing company to trial the technology as a quality control for their krill meal.

'DNA barcoding allows us to confirm whether their product is entirely Antarctic krill – *Euphasia superba* – or whether it contains other krill species,' he said.

'The krill are taken from different areas of the fishery at different times, so in theory we could identify which areas have a high proportion of bycatch or non-target krill species. This could allow the company to adjust where they fish to minimise those effects.'

WENDY PYPER
Australian Antarctic Division

Visionary approach to ageing Antarctic krill

The collaborators were recently awarded a $48,200 research grant from the Antarctic Wildlife Research Fund to conduct the work.

Scientists are testing a visionary approach to ageing Antarctic krill – counting annual layers in their eyestalks.

Australian Antarctic Division krill researcher, Dr So Kawaguchi, and his colleagues, Dr Christian Reiss (lead investigator) from the US National Marine Fisheries Service and Dr Raouf Kilada from the University of New Brunswick (St John), Canada, have joined forces to investigate using eyestalks to age Antarctic krill, based on a technique developed by Dr Kilada in 2012 in lobsters, crabs and shrimp.

'The Australian Antarctic Division's role in this collaboration will be to provide krill of a known age, grown in our research aquarium in Kingston, to validate this method in the much smaller and more fragile Antarctic krill,' Dr Kawaguchi said.

The collaborators were recently awarded a $48,200 research grant from the Antarctic Wildlife Research Fund to conduct the work.

'If the technique works as well for krill as it does for larger crustaceans, we'll be able to develop more accurate age-based growth models to improve krill fishery management,' Dr Kawaguchi said.

'We'll also be able to compare krill growth in different parts of Antarctica and we'll have an age-structure baseline against which future changes in krill populations can be observed.'

Unlike many fish and invertebrates that record their age in growth rings deposited in structures such as ear bones, scales and shells, krill do not have any such hard parts that are preserved when they moult. Krill also shrink if food is limited, unlike other crustaceans, so using body length as a proxy for age doesn't work.

While indirect ageing techniques have been developed, including eyeball size or the accumulation of natural fluorescent pigments in nerve tissue, these are affected by seasonal and environmental conditions, such as food availability and temperature. This complicates comparisons of krill age across areas with different environmental conditions.

1

Raouf Kilada

'Our inability to directly age krill limits our understanding of krill ecology, because we cannot compare size at age among areas of the Antarctic with different environmental conditions, or krill growth and recruitment over time,' Dr Kawaguchi said.

'It also limits our understanding of the variability in krill population structure – including growth, recruitment and size at age – at local, regional and circum-Antarctic scales.'

In 2012 Dr Kilada found that annual growth bands are formed in the eyestalk of larger crustaceans, which can be counted under a light microscope. The collaborative research team now aim to determine the efficacy of the technique in aquarium-raised krill of known age, as well as wild krill collected during recent and future Antarctic voyages.

The team will also examine krill samples preserved in formalin during research cruises of the US Antarctic Marine Living Resources Program, conducted between 1991 and 2015.

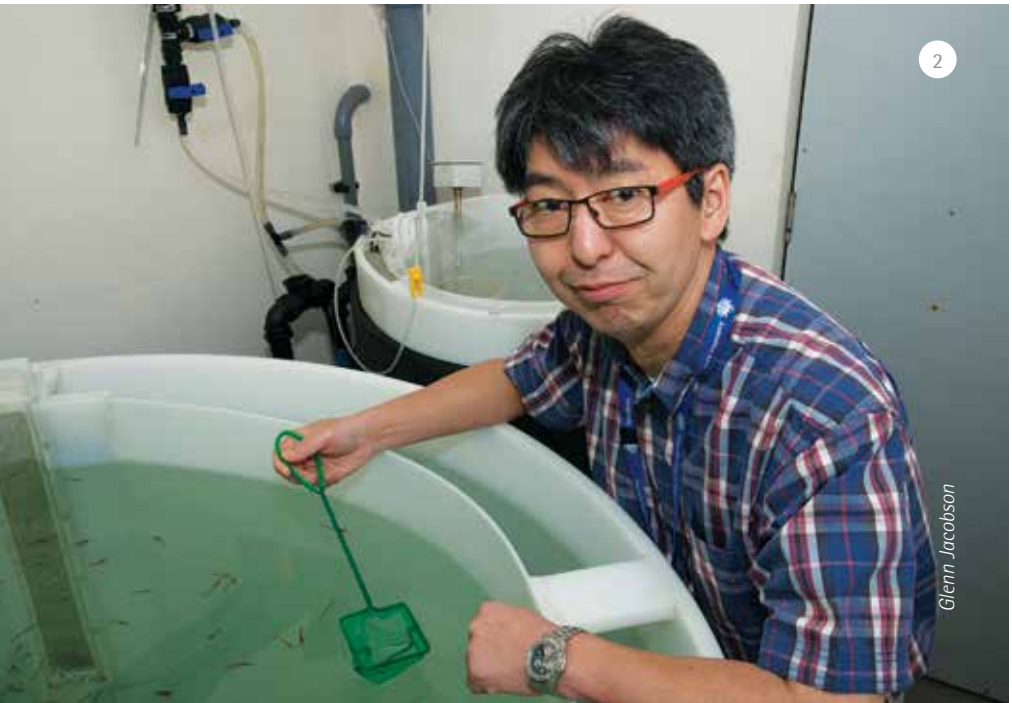
'If this technique works on formalin-preserved samples it would open up the possibility of making direct comparisons of the size at age of krill in different areas and in different time periods,' Dr Kawaguchi said.

'This could include comparing historical growth during Douglas Mawson's *Discovery* expeditions in the early 1930s with contemporary samples, or comparing Weddell Sea with Antarctic Peninsula samples.

'From this we could determine if there's been any change in the age or the size at age structure of populations and what might have caused that change.'

The research team will provide the results and techniques to members of the Commission for the Conservation of Antarctic Marine Living Resources, to enable the age-based assessments needed for fishery management.

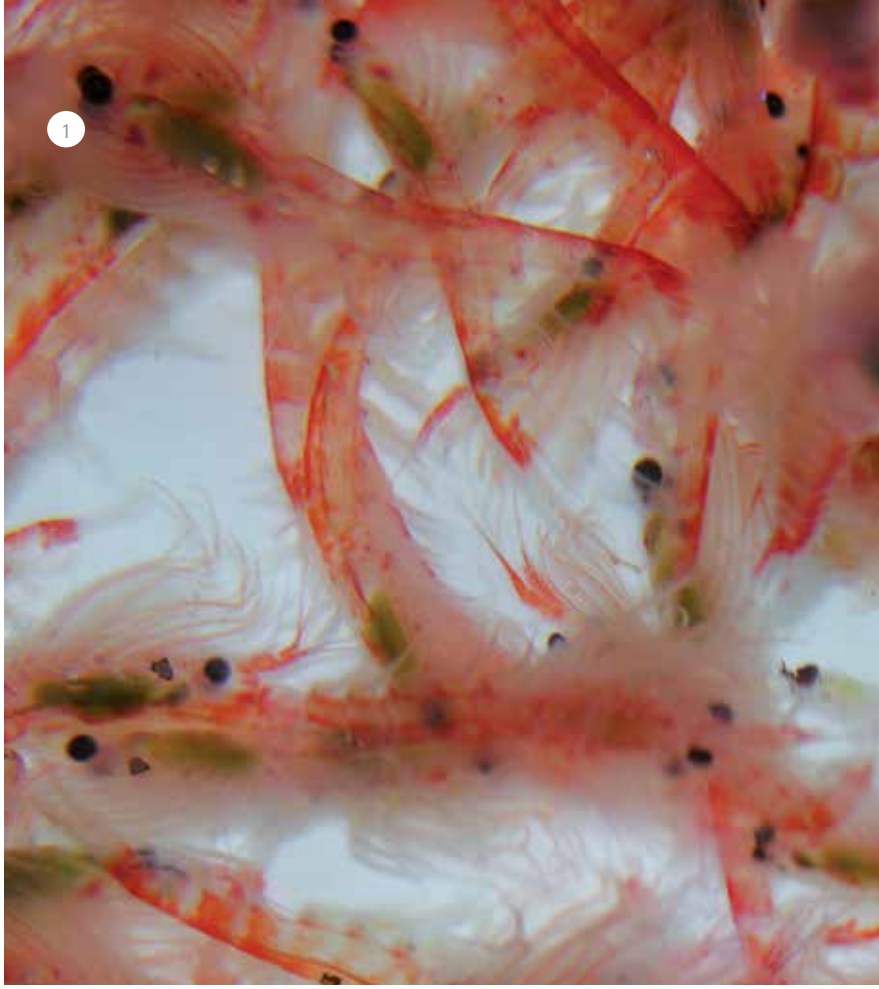
WENDY PYPER
Australian Antarctic Division



2

Glenn Jacobson

1. *The eyestalk of a nylon shrimp (Heterocarpus reedi) from Chile. The top image shows the intact eyestalk with its compound eye. In the bottom image the eye has been removed.*
2. *Dr So Kawaguchi in the krill aquarium at the Australian Antarctic Division. The facility is the only one of its kind in the world.*



Krill focus for inaugural Fellow

Australian Antarctic Division molecular ecologist Dr Bruce Deagle was the inaugural recipient of the R.J.L. Hawke Postdoctoral Fellowship for Antarctic Environmental Science* in 2011. During his three-year fellowship Dr Deagle made significant advances in krill research.

Not long after I started my fellowship project, the size of the krill genome was estimated. At 50 billion base pairs it was huge – about 15 times larger than the human genome. This discovery gave me the opportunity to use 'high-throughput DNA sequencing' (producing thousands of different sequences concurrently) to characterise smaller parts of the genome and, at the same time, address ecologically important questions about this keystone Antarctic species.

The ecological questions fall into two broad categories. First, is there any segregation of krill into semi-independent populations in their distribution around Antarctica? Second, what are the underlying causes behind the sensitivity of krill to ocean acidification, which is caused by increasing amounts of atmospheric CO_2 dissolving in the ocean?

These questions seem quite unrelated, but both can be answered using recently developed cutting-edge genetic methods that allow us to examine DNA sequences in more detail than ever before.

To address the first question on population structure my colleagues and I sequenced genetic markers from throughout the Antarctic krill genome. These markers are DNA sequences shared by all krill, which vary enough to be able to detect potential differences amongst the krill found in different regions around Antarctica. We looked at variation in about 150 krill from five Southern Ocean sites (covering the Atlantic, Pacific and Indian Ocean sectors) and collected over 90 billion bases of DNA sequence data.

The data were incredibly complex due to a large component of each krill genome being composed of repetitive DNA elements. These repetitive elements are a diverse array of DNA sequences that are repeated many times within the genome of an individual krill (from duplicates to thousands of copies).

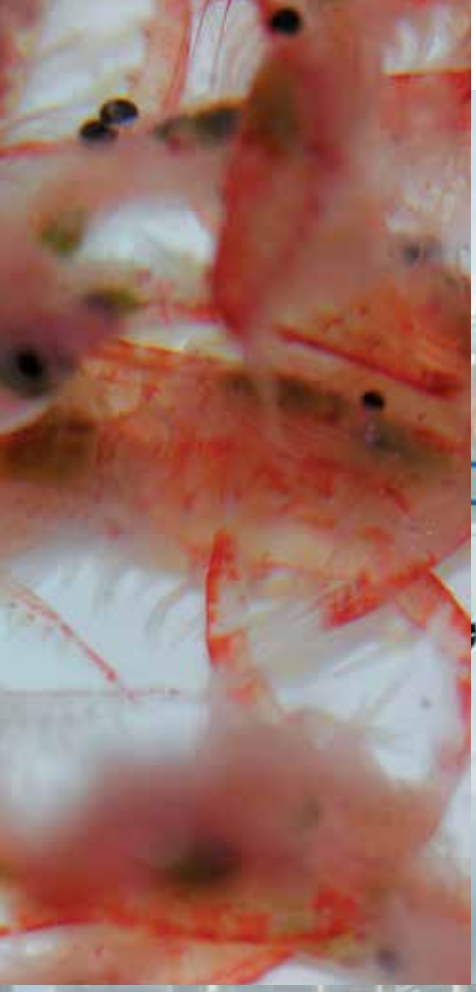
Once we devised a method to reliably characterise these genetic markers we could get a clear DNA 'fingerprint' for an individual krill – a set of genetic markers that distinguish an individual krill from all others. However, we found no signal related to the collection sites. This means that if we took two krill from a swarm in the Ross Sea and one from the South Atlantic 7000 km away, each krill would contain genetic variability, but there would be no set of genetic markers that were more similar in the two Ross Sea krill. This lack of genetic structuring supports the idea that there is a continuous flux of krill between regions carried by the strong Antarctic Circumpolar Current. This research was published in the journal *Molecular Ecology* under the title 'Antarctic krill population genomics: apparent panmixia, but genome complexity and large population size muddy the water' *(http://onlinelibrary.wiley.com/doi/10.1111/mec.13370/abstract).*

The second ecological question we investigated was the underlying causes behind the observed sensitivity of krill to ocean acidification. Specifically, we wanted to understand the physiological pathways in krill that are being affected.

To do this we looked at how krill modify the use of their genes within the genome (known as 'gene expression') under different CO_2 exposure conditions in the laboratory. Since each gene has a particular biochemical function (for example, they may be involved in a particular metabolic process or a cell stress response), we can look at all the changes in gene expression to get a picture of what is going wrong with krill development. This may also tell us whether krill will be able to adapt to future environmental conditions.

Before we could investigate this question we needed to create a detailed 'transcriptome' (a catalogue of genes) for the species. Some work has been done in this area in the past, but based on the data collected at the Antarctic Division during this project, we have been able to extend the number of known genes in krill from about 60 000 to over 140 000.

A large part of the data analysis was carried out by colleagues from the University of Padova in Italy, to assemble an annotated transcriptome database (a list of krill genes and details of their function). This new catalogue is already being used in several other projects at the Antarctic Division and internationally, looking at everything from how krill synchronize with their seasonal environment to the mechanisms of krill sex determination.



1. *Dr Deagle's Hawke Fellowship research supports the idea that there is a continuous flux of krill between regions carried by the strong Antarctic Circumpolar Current.*
2. *Dr Deagle and his collaborators have produced a list of krill genes that are responding to changes in CO_2 concentrations in the ocean. These genes and their functions continue to be investigated.*
3. *Former Australian Prime Minister Bob Hawke (left) congratulates Dr Bruce Deagle, the first recipient of the R.J.L. Hawke Postdoctoral Fellowship for Antarctic Environmental Science, in 2011.*
4. *Dr Bettina Meyer (left) and Ulrich Freier from the Alfred Wegener Institute of Polar and Marine Science in Germany, have worked with Dr Bruce Deagle on some aspects of his krill research.*

We are now in theprocess of producing a web-accessed database to make this transcriptome information widely available.

Our experiments on CO_2 exposure have produced a list of krill genes that are responding to changes in CO_2. These genes and their functions are being investigated in additional krill aquarium experiments by collaborators from the Alfred Wegener Institute in Germany. So this aspect of the work is still in progress.

On a personal level, the fellowship allowed me to return to Tasmania after several years conducting research in Canada, and to continue to do Antarctic science. During the Fellowship I was involved in several other projects within the ecological genetics group at the Antarctic Division (see *DNA barcoding plankton*, page 4) and I hope to make broad contributions to this interesting area of Antarctic science in the future.

BRUCE DEAGLE
Former R.J.L. Hawke Postdoctoral Fellow

**The R.J.L. Hawke Postdoctoral Fellowship was named in honour of former Australian Prime Minister Bob Hawke, acknowledging his contribution to protecting the Antarctic environment. The fellowship is awarded on the basis of scientific excellence for early career doctoral graduates to pursue policy-relevant science aligned to the Australian Antarctic Science Plan*

Sizing up marine ecosystems

Former Rhodes Scholar Dr Rowan Trebilco has been awarded the second R.J.L Hawke Postdoctoral Fellowship in Antarctic Environmental Science. During his project he will develop models focused on mesopelagic fish (see photo) and squid, to better understand how Southern Ocean ecosystems are structured and how they respond to fishing pressures and climate change.

Rowan Trebilco received his open water SCUBA diving ticket at just 14 – the minimum age for aspiring divers. Since then his love of the sea has seen him acquire a range of specialty SCUBA skills and inspired an academic path through the subantarctic and Southern Ocean environments.

Along the way Rowan spent almost two years on Heard and Macquarie islands, working with macaroni penguins, elephant seals, albatross and giant petrels, and led research investigating how to mitigate interactions between seabirds and Australian longline fisheries.

'My fieldwork in the subantarctic primarily involved satellite tracking and population monitoring, and my work in bycatch mitigation sparked an interest in conservation planning,' he said.

'When I finished my undergraduate degree I found myself in a job where my role was to provide scientific advice to guide conservation and fisheries management, but I didn't feel my quantitative [measurement] skills and policy knowledge were as good as they could be.'

To enhance his knowledge of biogeography and conservation policy Rowan successfully applied for a Rhodes Scholarship to study a Masters in Biodiversity Conservation and Management at Oxford University. To improve his quantitative skills, he subsequently enrolled in a PhD at Simon Fraser University in Canada.

'I'd always wanted to do research in subtidal [reef] areas so that I could spend more time SCUBA diving,' he said.

'So I developed a research project focused on reef fish community ecology in the Haida Gwaii archipelago in northern British Columbia.'

His PhD research investigated the body size and number of fish in reef communities and the energy flow of the reef – the transfer of biomass through predator-prey interactions.

The work segued neatly into his new role as a Hawke post-doctoral fellow (named in honour of former Australian Prime Minister Bob Hawke) which began in July. During the two year project Rowan will develop size-based models to understand the role of mesopelagic fish and squid in Southern Ocean ecosystems, and the impact of fishing and climate change on them.

'Size-based ecological models recognise that individual body size is often more important than species identity in determining an individual's role in the food web,' Rowan said.

'Individual metabolic rates and energetic requirements, as well as life history traits like growth rate, reproductive age and lifespan, are closely tied to body size. Body sizes also play a central role in determining interactions between predators and prey – as a predator,

1. *Rowan prepares to weigh an elephant seal pup on Macquarie Island in 2005.*
2. *Mesopelagic fish, such as these Antarctic silverfish (Pleuragramma antarcticum) live in the top 200-1000 m of ocean. Most mesopelagic fish are small planktivores, and many ascend at night to feed in the nutrient rich waters of the epipelagic zone (top 200 m) before descending to depths during the day. Most other mesopelagic species are large-mouthed ambush predators, such as the Antarctic toothfish.*
3. *Rowan prepares for a dive in the Haida Gwaii archipelago in northern British Columbia.*
4. *Rowan drives a zodiac during the 2005 summer resupply at Macquarie Island.*

you can only eat something if it's in the size-range you can handle, and swallow.

'So size-based models provide a powerful way to understand how marine communities are organised and how they respond to fishing and climate change, even if you don't have detailed species and life-stage-specific dietary information.'

Mesopelagic fish and squid are important prey species for penguins, seals and other large marine predators, so they play a key role in transferring energy from zooplankton (which they eat) to higher predators. However the sensitivity of mesopelagic fish and squid to the impacts of fishing and climate change is poorly understood and they are generally poorly represented in current models.

To build his size-based models Rowan will focus on fish and squid in the Kerguelen Plateau region of the Southern Ocean – an area of high productivity and commercially important toothfish and icefish fisheries.

He will consolidate existing data from the region on biomass and size distributions, species abundance, life history parameters and other variables, and collect new data during the K-Axis voyage (see *Spotlight on the K-Axis,* page 2).

The new collection will involve trawling for fish and squid at different depths up to 1000 m. The marine creatures will then be sorted into size classes within species groups. Stable isotope analysis (using two forms of nitrogen – the regular ^{14}N and the heavier ^{15}N) will be used to determine how trophic position changes with body size.

'The higher up the food chain you go the more ^{15}N is enriched in the body of the organism,' Rowan explained.

Using this data Rowan will develop size-based models for mesopelagic organisms in the region, including representations of the effects of fishing pressure. He will also travel to France next year on a Scientific Committee on Antarctic Research Fellowship, to work with international experts on mesopelagic fish to develop and refine the models.

'The model results will allow us to infer how sensitive mesopelagic fish and squid are to potential fishing and climate-related environmental changes in the region,' he said.

'They will also help us identify potential indicators of change, and determine how changes in fish and squid might affect higher predators.'


3

Lynn Lee

The models will contribute to larger ecosystem modelling efforts being developed by the Australian Antarctic Division and the Antarctic Climate and Ecosystems Cooperative Research Centre.

WENDY PYPER
Australian Antarctic Division

4

Chris Brown

Time Machine earth reveals icy past and future sea level

University of Tasmania Professor of Polar Geodesy, Matt King, has the weight of the world on his mind. Or rather, its mass; and in particular, the mass of Antarctica.

By understanding how Antarctica's land mass changes in response to its icy blanket melting or accumulating over thousands of years, he and his Australian and British colleagues hope to provide better models and estimates of present-day sea-level change.

'If we can understand the behaviour of the solid earth and how that's changing, we can work out how the ice is changing and how that contributes to sea-level change,' Professor King said.

When Earth started to deglaciate following the Last Glacial Maximum about 20 000 years ago, the ice that was covering and depressing the continents melted into the ocean. Over thousands of years, as the weight of ice lifted, the continents generally started to rise and the ocean basins generally began to subside.

This process, called Glacial Isostatic Adjustment (GIA) is happening in Antarctica in response to both past and present ice changes. But it's not a consistent movement across the continent and it's not all uplift – with thick ice and heavier snowfalls in East Antarctica likely to be depressing that part of the continent, while past and present ice loss in West Antarctica is causing it to rise.

'The speed at which Antarctica is uplifting now depends on how and when the ice changed and the characteristics of the earth's crust and mantle,' Professor King said.

'Some parts of Antarctica may have responded quickly to ice loss or gain in the past, while other areas may still be responding today.

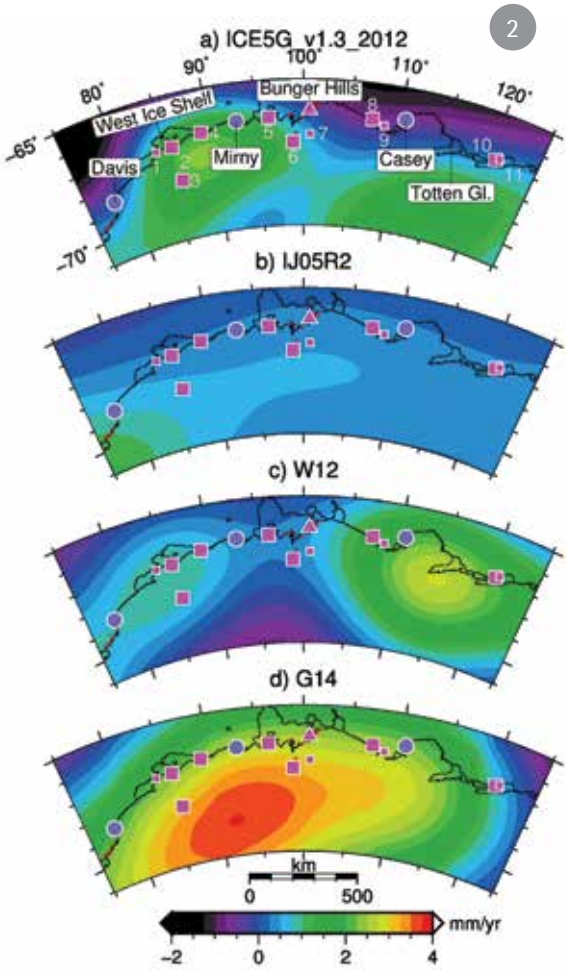
'By combining accurate measurements of GIA with satellite measurements of the change in Antarctica's total mass [of land and ice], we can differentiate the mass change due to ice and calculate its contribution to today's sea level.'

There is already comprehensive and reliable data that West Antarctica is losing ice at an accelerating rate of about 120 billion tonnes per year. However, model estimates of East Antarctica's contribution to present day sea-level change vary from +30 to -109 billion tonnes of meltwater per year – the difference between a small contribution to sea-level rise or a substantial offset to further rise.

One of the primary reasons for this uncertainty is the limited knowledge of the GIA of East Antarctica, due to the dearth of information on how the ice sheet changed since the Last Glacial Maximum and the properties of the earth beneath the region. This is the very information that GIA models rely on for accuracy.

'One of the largest disagreements is within the Casey-Davis sector, where predictions of present-day bedrock motion due to GIA vary between uplift of 4 mm/yr and subsidence of 1 mm/yr for the same location,' Professor King said.

'Our project aims to collect new field data on bedrock uplift and how ice thickness changed over time and apply those data to improve ice sheet reconstructions and a model of GIA. We'll then apply our new GIA model to produce an improved estimate of East Antarctica's contribution to present-day sea level.'



To do this the team will deploy GPS and seismometers at seven inland rock outcrops across a 1400 km transect between the West Ice Shelf and the Totten Glacier, this season (see graphic). Over three years the GPS will measure horizontal and vertical movement at each location with a precision of better than 1 mm/year. The seismometers will provide information on the crust and mantle characteristics such as temperature and composition, based on propagating earthquake waves from around the world.

The team will also collect ice history data from a number of sites, looking at boulders and moraine lines left by past glacier movement.

'Chemical signatures in boulders will tell us when they were exposed to the radiation from deep space as glaciers retreated, while

moraine lines will indicate the level of the ice and enable us to track its retreat,' Professor King said.

'These studies will help to constrain past ice sheet configurations and simulations of past ice sheet behaviour in our models.'

The installation of new GPS and seismometers deeper inland, will complement and enhance existing GPS sites established by Geoscience Australia at coastal sites including Casey, Davis, Mawson and the Bunger Hills, and by the Australian National University further to the west.

'The new inland data will allow Professor King and his colleagues to identify which existing GIA models and estimates of bedrock uplift are most accurate and to improve on these.'

The new inland data will allow Professor King and his colleagues to identify which existing GIA models and estimates of bedrock uplift are most accurate and to improve on these.

'We'll have the first direct observations of bedrock uplift for most of this region, which will provide truly independent data for validating GIA model predictions,' Professor King said.

'We'll also be able to develop the first detailed ice loading history for the West Ice Shelf to Totten Glacier region using new observations on past ice extent. This will allow us to develop ice-sheet reconstructions that can be used to drive the GIA models for East Antarctica.'

To estimate the East Antarctic contribution to sea level, the validated GIA models will be applied to data collected by the GRACE (Gravity Recovery and Climate Experiment) satellites. These satellites, launched by NASA and the German Aerospace Centre in 2002, measure Earth's gravity field, which is affected by the mass of ice, oceans, atmosphere and land below.

'We can infer mass change in Antarctica from these satellite gravity measurements, but the GRACE satellites measure the total mass change, rather than the change due to ice or oceans, and so on,' Professor King said.

'However, using computer models – including the updated GIA models – we can separate the different components that make up the total mass. Once we've identified the mass change due to ice we can estimate the contribution of East Antarctica to sea level.'

Professor King is right to equate the solid earth to a 'time machine' – one that can finally provide a realistic insight into East Antarctica's icy past, and a future sea level.

WENDY PYPER
Australian Antarctic Division

This project receives an Australian Antarctic Science grant, and logistics is supported through the Australian Research Council Special Research Initiative.

1. *The bedrock beneath Antarctica's ice sheet is constantly changing in response to changes in the gain or loss of ice. Scientists can use this movement in combination with gravity measurements from satellites, to determine the mass of the land, and from there the changes in ice mass and its contribution to sea level.*
2. *This graphic shows present-day bedrock uplift rates (mm/year) for the Casey-Davis region of East Antarctica from three models (top three graphics) and satellite data/snow modelling (bottom graphic, G14). The three different models predict substantially different patterns and magnitudes of uplift, which affect mass balance estimates based on gravity measurements from the GRACE satellites. The fourth data-driven representation is consistent with GPS uplift rates elsewhere in Antarctica and suggests a much larger ice sheet during the Last Glacial Maximum in the region. The large squares mark the seven sites for GPS/seismometer deployment, while small squares mark alternate sites. The triangle is a previously established GPS site at the Bunger Hills. Long-term GPS observations are ongoing at the circled sites. From King et al 2014.*

This Picture
A GPS system similar to, but smaller than this set-up in West Antarctica, will be deployed on seven rocky outcrops in East Antarctica for three years, and will measure tiny movements in the earth due to Glacial Isostatic Adjustment. In this system the GPS antenna is on the right, with a radome above to protect it from snow, while its power source appears on the left.

(Matt King)

Measuring algae in the fast ice

A remotely operated underwater vehicle (ROV) will be used to measure algae growth within the sub-surface layers of 'fast ice' (sea ice attached to land) at Davis this summer.

The ROV will be operated by a team lead by Dr Klaus Meiners, of the Australian Antarctic Division, and will use a range of sensory equipment to measure the under-ice structure, ice thickness, light penetration from above, and the amount and distribution of algae living in the ice.

'We will use the ROV to carry out weekly observations of the physical and biological properties of the fast ice sub-surface in 200 square metre areas, over about five weeks during the spring-summer transition period,' Dr Meiners said.

'Last season we did some initial ice coring survey work with our New Zealand colleagues to develop and fine tune the method in the Ross Sea, and this season we will build on that.'

A key aim of the research is to understand primary productivity (algae growth) in the Antarctic fast-ice zone. Ice algae are an important food source for pelagic (open ocean) herbivores such as amphipods and zooplankton. These critters in turn are preyed upon by fish. As a result, ice algae growth and distribution may influence the location of suitable foraging habitat for predators, such as penguins and seals.

'We think early season productivity in the fast ice kick-starts the food web, as algae in the ice begin growing earlier than algae in the water column,' Dr Meiners said.

'Understanding this process is important for developing models of fast-ice algae growth on local, regional and circum-Antarctic scales, and assessing climate change impacts on ice-associated primary production and overall ecosystem function.'

The joint Australia-New Zealand project will combine the ROV measurements with 'point measurements' from ice cores taken within and outside the ROV survey areas. These core samples will measure the physical, chemical and optical properties of the fast ice, the thickness and structure of snow cover on the ice, and the abundance of algae in the ice.

'Ice and snow thickness are key factors that control the growth of fast-ice algae in the sub-surface of the ice, due to their effect on light transmission through the ice,' Dr Meiners said.

'These ice core measurements will help calibrate and validate the ROV measurements.'

To complement and enhance the ice algae work, Australian Antarctic Division sea ice scientist, Dr Petra Heil, will operate automated fast ice 'observatories' at Davis. These mass-balance buoys are deployed vertically through the snow cover, fast ice and water beneath, and measure the gain and loss of sea ice over time. The buoys have been used in established locations at Australian Antarctic stations since the 1950s, providing a long-term dataset of sea ice formation and decay.

'A key aim of this project is to develop methods to simultaneously measure sea ice physical characteristics and ice-algae biomass to improve physical and biological sea ice models,' Dr Meiners said.

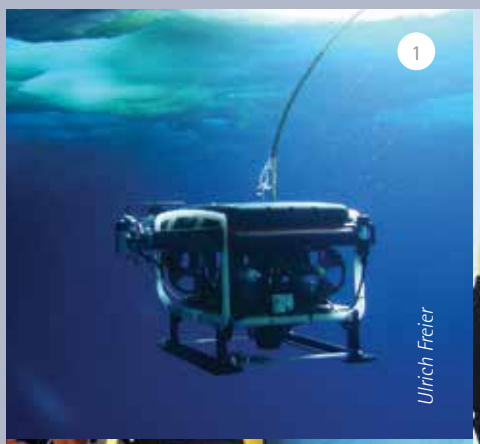
'This includes improving automated observatories which have been used successfully to collect monthly seasonal measurements of physical sea ice characteristics. In the future these observatories will be equipped with radiometers to measure the amount of light that can penetrate the sea ice. This information will be used to estimate ice-algal biomass.'

The research project will also compile historical data of ice algae growth and fast-ice formation and decay from around Antarctica from ice observatories, ice cores and satellites; work that will contribute to research programs at the Antarctic Climate and Ecosystems Cooperative Research Centre.

'The historical data will allow us to test theories on the effect of light and nutrient limitation on ice algae growth, understand the life cycle of algae across seasons, and look at patterns of algae growth in different geographic regions,' Dr Meiners said.

'Altogether, the data collected during this project will be used to determine the relationship between snow and ice thickness and ice algae growth, and develop a physically informed model of the seasonal development and fate of ice algae in the fast ice, at regional and circumpolar scales.'

WENDY PYPER
Australian Antarctic Division



1. *The ROV being deployed under the sea ice in Antarctica.*
2. *Dr Klaus Meiners with the Remotely Operated Vehicle (ROV), which will be used to investigate the under-ice environment and algae growth in the fast-ice zone in Antarctica.*
3. *Scientists collect ice cores to study the physical, chemical and optical properties of the ice, the thickness and structure of snow cover on the ice, and the abundance of algae in the ice.*

This Picture
Ice algae are an important food source for tiny marine herbivores such as zooplankton. Studying algae growth in the 'fast ice' (attached to land) early in the season will help scientists develop models of fast-ice algae growth on local, regional and circum-Antarctic scales, and assess the impact of climate change on ice algae and the broader ecosystem.


Kerry Steinberner

Adélie penguins on the rise in East Antarctica

Adélie penguin populations in East Antarctica have almost doubled over the past 30 years according to new research published in *PLOS ONE* in October.

Australian Antarctic Division seabird ecologists, Dr Colin Southwell and Dr Louise Emmerson, alongside colleagues from France and Japan, found that the five main regional populations of Adélie penguins in East Antarctica had increased between 1.8% and 2.5% per year since 1980.

Using aerial photographs and ground-based observations, the team counted Adélie penguins during recent summer breeding seasons at 99 breeding sites located along 4500 km of the East Antarctic coastline.

The breeding sites were distributed amongst five regional populations – close to the French station Dumont d'Urville, Australia's Casey, Davis and Mawson stations, and Japan's Syowa station. They included over 70% of the known breeding sites in East Antarctica.

The team compared these recent population counts with historical counts made at the same sites 30 years ago. From this they estimated rates of population change across the entire East Antarctic area, and at regional and local scales.

'We found that the overall population across sites had increased by 69% at an average rate of 1.9% per year,' Dr Southwell said.

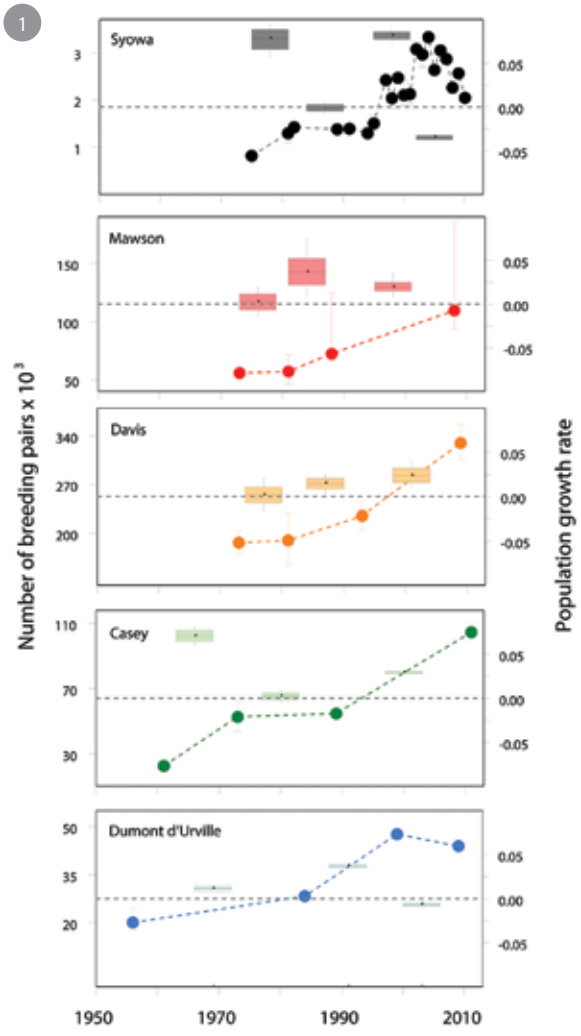
The researchers then examined the relationship between population changes and environmental conditions over shorter time scales at 72 of the sites.

'We saw a faster rate of population increase five years after periods when winter sea-ice cover decreased,' Dr Emmerson said.

'This probably indicates that changes in winter sea ice primarily affect young penguins before they become breeders at around five years old.'

Although population surveys have been made at many breeding sites, scientists have only snapshots of penguin numbers in time. This makes it difficult to identify exactly how

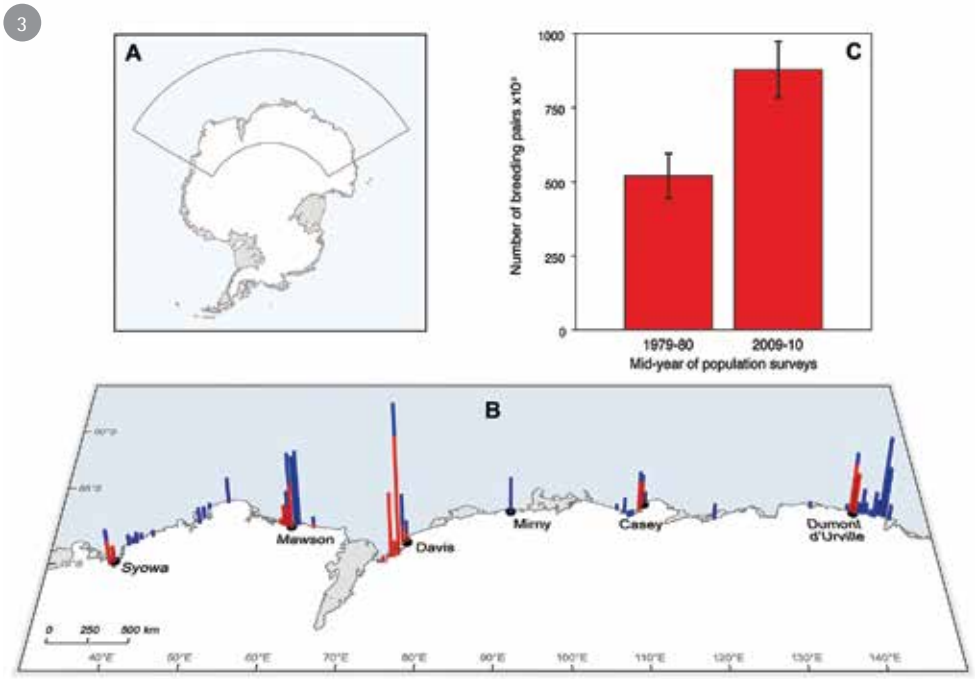
1



2

(Louise Emmerson)

3



1. *This graphic shows the change in Adélie penguin breeding population size at five regional populations over the last 35-54 years. Population changes are represented by time series of abundance estimates (solid circles with error bars) and boxplot summaries (coloured boxes) of population growth rates between estimates. Grey dashed lines indicate zero growth rate.* ***(Reproduced from Southwell et al 2015. PLOS ONE http://dx.plos.org/10.1371/journal.pone.0139877)***
2. *Adélie penguin populations have increased by 69% in East Antarctica over the past 30 years.*
3. *This graphic shows the change in the East Antarctic Adélie penguin breeding population over the last 30 years. (A) shows the extent of survey region, (B) shows the distribution of Adélie penguin breeding sites and population counts within the survey region, and (C) shows estimated Adélie penguin breeding population at 99 sites surveyed recently and 30 years ago. In panel B, bars indicate the number of sites within half-degree longitude increments, with red bars for repeat surveys that contributed to estimates of population change and blue bars for sites that did not contribute to estimates of change. For scale, the largest incremental bar (at Davis) indicates 30 breeding sites.* ***(Edited from Southwell et al 2015. PLOS ONE. http://dx.plos.org/10.1371/journal.pone.0139877)***

changing environmental conditions affect population growth. However a number of hypotheses have been advanced.

'Two aspects of the East Antarctic marine environment have changed over a large area and at a time that may be linked to the long-term population increase,' Dr Southwell said.

'Firstly, the harvesting of baleen whales, krill and fish across East Antarctic waters through the 20th century could have altered the food web dynamics and reduced competition with other species for food.

'Secondly, a proposed reduction in sea-ice extent around Antarctica in the mid-20th century may have benefited Adélie penguins by enabling better access to the ocean for foraging.'

Despite the consistent increase in the five regional populations, local population growth rates within the regional populations varied between 11.4% to -5.8% per year. This variation indicates that local processes – such as localised prey depletion or limited breeding habitat – affect population growth in addition to regional processes such as reduced competition and sea-ice change.

The population increase in East Antarctica contrasts strongly with widespread decreases in the West Antarctic Peninsula over the same time.

'With Adélie penguins there is a delicate balance between too much and too little sea ice for accessing foraging grounds, capturing prey and resting,' Dr Emmerson said.

'It has been proposed that in areas where ice is very extensive, such as East Antarctica, a reduction in sea-ice extent will initially benefit the species up to a point, and then further reductions will be detrimental – as we are seeing in West Antarctica.'

The study authors said the future global status of Adélie penguins will depend on the complex interplay between the changing physical environment and the effects of human activities such as fishing and tourism.

'Further studies such as this that look at penguin responses over space and time and in different environments are critical for understanding ecosystem change and improving predictions of future changes in Adélie penguin populations,' Dr Emmerson said.

WENDY PYPER
Australian Antarctic Division

Wendy Pyper

New icebreaker plans unveiled

The Australian Antarctic Division presented plans for its new Antarctic icebreaker in October.

Prime Minister, the Hon. Malcolm Turnbull, and Environment Minister, the Hon. Greg Hunt, unveiled a scale model of the ship, which will be faster, larger, stronger and offer increased endurance compared to the existing icebreaker *Aurora Australis*.

The new ship provides a modern platform for marine science research in both sea ice and open water and a moon pool for launching and retrieving remotely operated underwater vehicles. A multi-beam bathymetric echo sounder will enable seafloor mapping, while portable science laboratories will offer scientists space to conduct research.

The once-in-a-generation investment by the Australian Government will form the centerpiece of Australia's Antarctic presence and influence the shape of Australia's Antarctic program for decades to come.

Australian company DMS Maritime Pty Ltd has been selected as preferred tenderer to undertake the ship design and building process, and will then operate and maintain the icebreaker.

The Department of the Environment and DMS Maritime Pty Ltd have recently commenced formal contract negotiations.

Subject to successful contract negotiations, the icebreaker will be built by Damen Shipyards, a highly reputable global shipbuilder that has produced a broad range of bespoke vessels, including scientific, hydrographic, naval and ice-class ships.

The new icebreaker is expected to be commissioned in October 2019.

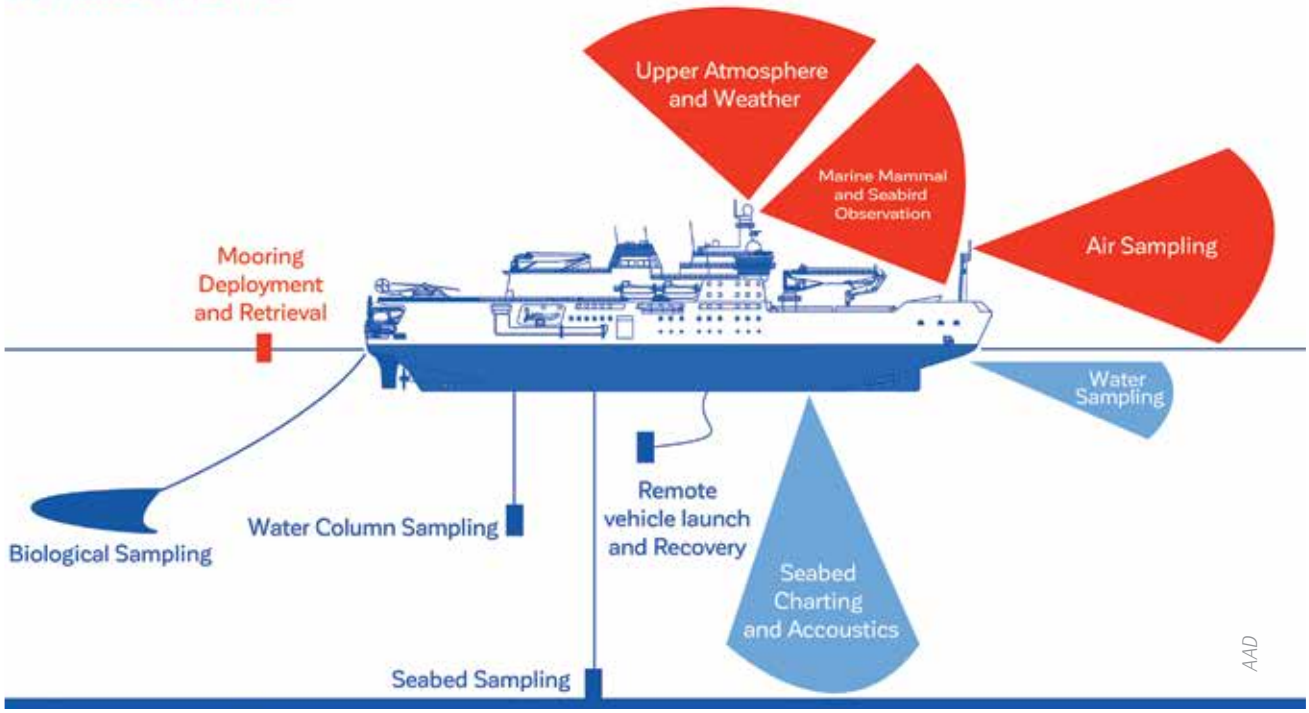
CORPORATE COMMUNICATIONS
Australian Antarctic Division

1. *The new icebreaker will have a range of technologies for marine research, including a moon pool for launching and retrieving underwater vehicles.*
2. *L-R: Antarctic Division Director Dr Nick Gales, Environment Minister Greg Hunt and Prime Minister Malcolm Turnbull, with the scale model of Australia's new icebreaker.*

This Picture
A graphic showing helicopter operations from the new icebreaker.

MARINE SCIENCE

1



AAD

2

Jenni Klous

Domen/DMS Maritime/Knud E Hansen A/S

Remote medicine

Training on the coldest, driest and windiest continent on earth may seem like a formidable challenge. But for Felix Ho, 33, a placement with the Australian Antarctic Division was a dream opportunity.

A paramedic turned medical student, Mr Ho was interested in pursuing a career as a doctor in rural and remote health. When he applied for the John Flynn Placement Program (JFPP) in 2012, which is managed by Australian College of Rural and Remote Medicine, the Antarctic Division was a brand new offering.

'I was so lucky to be one of the first ones to go,' he said.

Preparation is intense to brace students for the arduous conditions. Before heading off, he was required to complete two placements at the Antarctic Division's headquarters in Hobart and get medical clearance (*Australian Antarctic Magazine* 24: 30-31, 2013).

Mr Ho finally landed in Antarctica last summer, and his placement was split between two settings. The first was Casey station, the largest Australian base in Antarctica and which houses more than 100 people. Then he boarded the *Aurora Australis* icebreaker to treat about 50 people on board, including research scientists and crew, while crossing the iceberg-studded waters.

Mr Ho said working in Antarctica, a 'one-doctor environment', was particularly challenging for his supervisor Dr Grant Jasiunas, who had a variety of responsibilities not usually asked of General Practitioners.

'I was amazed by his ability to deal with so many things,' Mr Ho said.

'You're expected to do everything yourself, from treating dental problems to doing your own imaging.'

And while the environmental conditions were extreme, medical conditions were surprisingly mild. Mr Ho encountered no major illnesses or accidents, and no trauma. There were the 'usual coughs and colds and quite a few dental problems,' he said.

Of more significance was that the isolated conditions and tight-knit community meant people frequently reached out for emotional and mental health support.

'The real reasons people came to see us were mostly psychological,' Mr Ho said.

'People wanted to chat and touch base with the doctor.'

The typical rounds lasted a whole day, as Mr Ho and Dr Jasiunas had a coffee or lunch with different people, making sure to touch base with all on-board.

'The real consultation happened in the community,' Mr Ho said.

'You're expected to spend a lot of time with people and build a rapport with them. There was a lot of camaraderie and peer support.'

With plenty of remote experience under his belt, Mr Ho has returned to Darwin and is gearing up for his final studies in medicine at Flinders University, as part of its Northern Territory Medical Program.

Meanwhile, his interest in rural and remote health remains.

'Hopefully, I could head back down to Antarctica with a few more years of experience following medical school,' he said, adding that he's keeping his mind open about general practice.

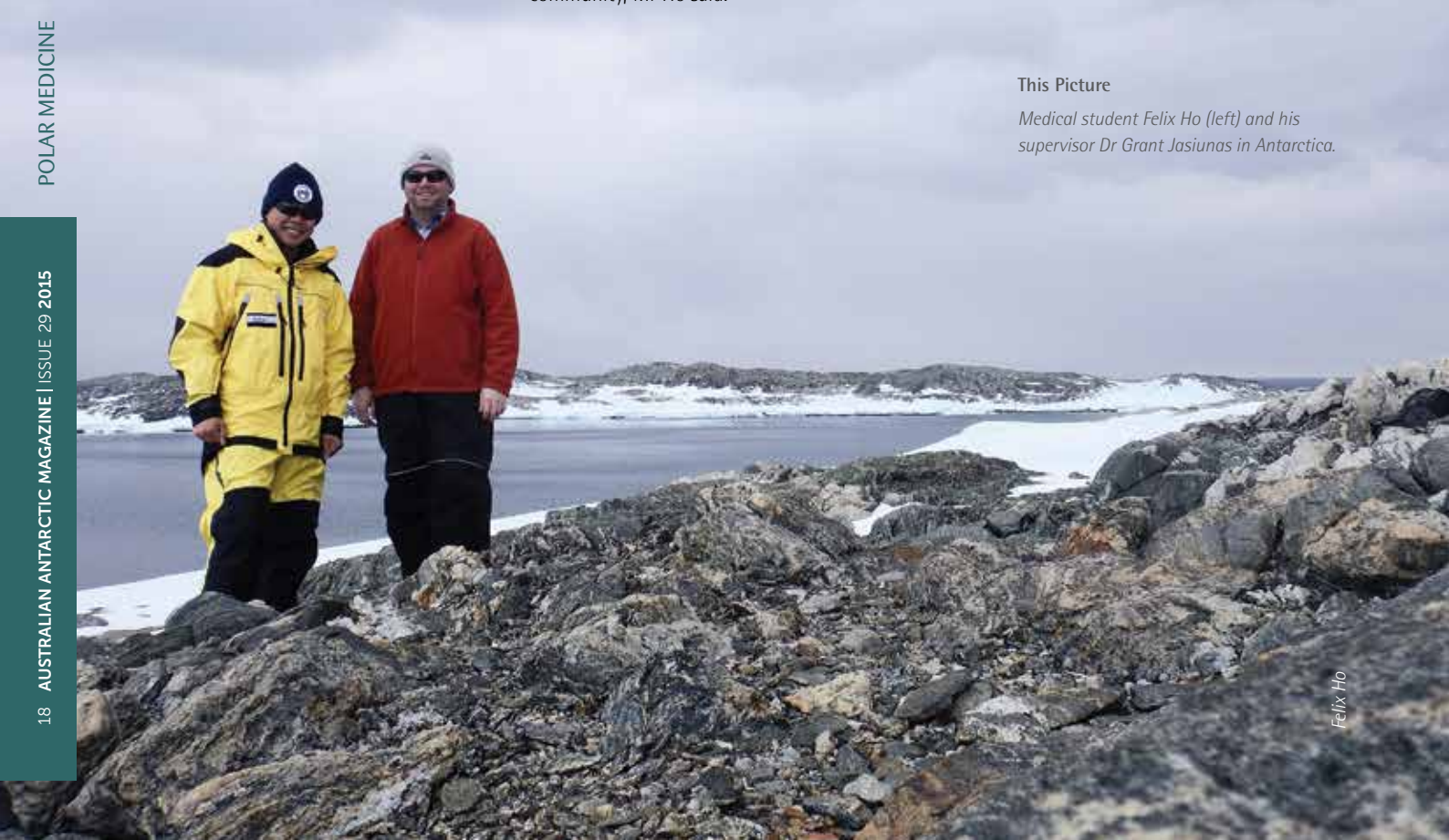
'The opportunities are quite exciting and I'm not ruling it out.'

The JFPP was established in 1997 and selects about 300 students each year for placement. Participants work closely with a rural doctor in a wide variety of health settings and experience one-on-one mentoring.

Other rural and remote placement communities include Christmas Island and the Pilbara.

SHESHTYN PAOLA

This story was originally published in the 28 August 2015 issue of Medical Observer. www.medicalobserver.com.au



Felix Ho

This Picture

Medical student Felix Ho (left) and his supervisor Dr Grant Jasiunas in Antarctica.

Antarctic Treaty Consultative Meeting

This year's meetings of Antarctic Treaty Parties and the Committee for Environmental Protection, considered a range of issues and endorsed an online Antarctic Environments Portal to connect scientists and policy-makers.

The internationally-agreed arrangements for the management and protection of Antarctica are discussed and decided during the annual Antarctic Treaty Consultative Meeting. The countries with active Antarctic science programs take it in turn to host, with the 38th meeting being held in June this year in Sofia, Bulgaria.

Australia was represented by a delegation of officials from the Australian Government Department of Foreign Affairs and Trade, the Department of the Environment, and representatives of the Tasmanian State Government and Australian non-government organisations.

The Committee for Environmental Protection (CEP) held its meeting in parallel, to discuss environmental matters and prepare a report containing advice and recommendations to the Antarctic Treaty Parties.

Some of the main outcomes from discussions included:

- Recognition of the value of international cooperation on high-priority scientific research, with an emphasis on encouraging initiatives such as the Southern Ocean Observing System (an Australia-led multi-national program) that will contribute to a greater understanding of Antarctica's important role in global climate processes. The Parties also adopted a 'Climate Change Response Work Programme' to guide the work of the CEP to better understand and address the environmental implications of such change.
- Endorsement of two new information tools to inform effective environmental management. The Antarctic Environments Portal *(https://www.environments.aq/)* is an online source of high-quality scientific information relevant to the environmental challenges facing Antarctica. It has been developed over several years by New Zealand, in collaboration with the Scientific Committee on Antarctic Research, Australia, Belgium and Norway, and will be a valuable tool to underpin the work of the CEP. A report on 'Important Bird Areas in Antarctica' was also prepared by Birdlife International, using criteria that have been applied elsewhere in the world. The report identified over 200 locations that are important breeding habitat for Antarctic bird species. Among other applications, the report will be used to consider the extent to which these Important Bird Areas are, or should be, represented in the current series of Antarctic Specially Protected Areas.
- Agreement to hold a symposium in 2016 to commemorate the 25th anniversary of the Protocol on Environmental Protection (Madrid Protocol), which protects Antarctica as a natural reserve devoted to peace and science, and places a permanent ban on mining. The symposium will enable Parties to celebrate past successes and consider the environmental challenges facing Antarctica in the next 25 years.

The 39th Antarctic Treaty Consultative Meeting and 19th meeting of the CEP will be held in Santiago, Chile, in May 2016.

EWAN McIVOR
Senior Environmental Policy Adviser - Australian Antarctic Division, and CEP Chair

1. *Delegates to the 18th meeting of the Committee for Environmental Protection. The meeting was chaired by Ewan McIvor, Australian Antarctic Division Senior Environmental Policy Adviser.*
2. *The Antarctic Environments Portal bridges the gap between peer-reviewed Antarctic scientific research and the governance and management work of the Antarctic Treaty System and the Committee for Environmental Protection. The portal is structured around the CEP's priority topics and includes summaries of the state of knowledge of these issues, their management and environmental pressures.*

Building Team Mawson

One thing incoming Mawson Station Leader Jenny Wressell is not afraid of, is dealing with unusual scenarios in remote and challenging locations.

The former nurse and hospital coordinator has just returned from an 18 month posting to Saudi Arabia, where she was part of the management team for a hospital providing healthcare to oil giant Aramco's 350 000 employees.

Prior to that Jenny spent 10 years working in health management and as a remote area nurse across small indigenous communities in the Northern Territory, South Australia and Torres Strait.

She's conducted clinics under trees and in outback dongas, attended births, deaths and car accidents, managed chronic illnesses, travelled to far-flung communities by foot, troop-carrier and helicopter, and smoothed relations between machete-wielding patients and their pilot.

Her experiences have set her in good stead to lead her 14-strong team of Mawson men.

'Working in remote areas I've learnt to cope with what gets thrown at me and to effectively prioritise what needs to be done,' Jenny said.

'I'm good at identifying risks and hazards and mitigating them as much as possible.

'I've also seen how difficult it is for some people to adjust to being in a different culture or away from their families and I've developed skills to help them, and myself, which I'll be able to draw on if I need to in Antarctica.'

Among her cultural challenges has been her experience in Saudi Arabia where she lived in a 10 000 person expat compound that reminded her of the movie *The Truman Show* (starring Jim Carey), with its perfect houses, gardens and fountains, its yoga studios, supermarkets, gyms and pools. But that's where any similarities with the West ended.

'If I went outside the compound I had to wear an abaya and a head scarf and have a driver,' Jenny said.

'The labour force within the hospital also had a mix of different standards, training and language. To manage that I had to decide what was important to focus on and make processes as simple as possible.'

Jenny completed a Masters in Health Care Administration while she was there, drawing on her experiences to write a thesis on how culture and gender affect leadership styles.

Fresh in her mind are also her learnings from the Australian Rural Leadership Program that she is completing on a scholarship. Her first experience of the program was a trip to the Kimberly in Western Australia in May (2015) with five other people, where they spent

'Working in remote areas I've learnt to cope with what gets thrown at me and to effectively prioritise what needs to be done,' Jenny said. 'I'm good at identifying risks and hazards and mitigating them as much as possible.'

This Picture
Mawson station will be Jenny's home for the next year.

Chris Wilson

12 days being challenged to work effectively as a team.

'We were six strangers with completely different backgrounds, ideas and world views,' Jenny said.

'We were dropped in the bush with a facilitator who just observed how we worked together for the first 48 hours.

'We had our electronic devices confiscated and we had to go night caving, climb down waterfalls and walk through the bush in the middle of the night to find our tents, which had been moved. Each day we had to lead a portion of the day and then provide and receive feedback on our leadership skills.

'At the end of the 12 days I had some real strategies for how to manage a team, how to bring it together and develop it. The experience put theory into practice and gave me the confidence to move forward into my Antarctic role.'

Jenny said one of the most important things she has learned about leading a team is the need for shared goals and values – an idea she implemented when she met her Antarctic team for the first time in November.

1. Jenny will miss her beloved dogs.

2. Jenny abseiling during the Australian Rural Leadership Program in the Kimberly.

3. Jenny in her abaya and headscarf in Saudi Arabia.

4. Jenny and her husband Will Johnson.

'It's critical we create a team vision and team goals, so we know who we are as a group and we can define ourselves by a set of values that the team decides on,' she said.

'This will give us something to reflect back on if we run into trouble.'

With this vision and her intuition and ability to accept and reflect on feedback, Jenny is confident the team will weather the dark winter months and isolation.

'I want the station to be a safe space where people can express when they're unhappy and try to work through any problems,' she said.

'My goal is to bring everyone back safely, and to help everyone to get their projects done and have a good time.'

While she will miss her three dogs and her rose garden, Jenny will be able to transport her other interests to Antarctica, include cross-stitch, yoga, meditation and, if the hydroponics facility cooperates, making tomato chutney. She will also complete the Bachelor of Psychology she began three years ago.

Although a 'first-timer' to Antarctica, Jenny is trying not to harbour any expectations for her own experience. As Station Leader she will have to manage other peoples' expectations. However, she is hoping to visit the emperor penguin colony and see an aurora.

'I saw my first and only aurora when I was about nine years old, living in Hobart, and from then on I wanted to see one in Antarctica,' she said.

As unpredictable as Antarctica is, it's likely Jenny will get her wish.

WENDY PYPER
Australian Antarctic Division

Alex Rogers

This Picture
Alex enjoys capturing cloud formations with his camera, including these mid-altitude altocumulus stratiformis clouds.

Expeditioner with an eye to the sky

What's it like to be a meteorologist in Antarctica? We asked Davis station's weather observer and meteorology technician, Alex Rogers.

In Antarctica the weather observer is responsible for recording accurate weather observations, launching the daily weather balloons, collecting atmospheric science data and, at Davis, running the upper air ozone program. The data collected is used by forecasters, either at Davis or in Hobart, and is also collated as a climatological reference.

The weather is arguably one of the biggest impacts to daily operations in Antarctica and, along with our forecasters, the Bureau of Meteorology (BoM) works hard to offer accurate and objective advice.

The Antarctic summer flying season at Davis is the busiest time of year for the observer. It features a 5.00 am balloon flight, followed by half-hourly weather observations all day, capped off with another balloon flight at 6.00 pm. The winter season winds back to three-hourly observations, a balloon flight in the evening, a few hours of snow shovelling, and upper air ozone preparatory work. In between observations I fit in maintenance, repairs and upgrades as required. Being a weather observer, with an eye ever to the sky, I certainly have developed a good feel for the local weather patterns. I think I could smell a blizzard coming.

The BoM has a lot of sensitive equipment and instruments installed throughout the Antarctic and it's my role as technician to maintain, fault find and rectify any issues that may crop up during normal operations. We have weather instrumentation, hydrogen generation and storage equipment, ozone analysis gear, weather satellite receivers, and an extensive networked system of remote weather stations. My favourite phrase is 'have you tried turning it off then on again?' Joking aside, you might find me climbing an anemometer tower, travelling to a remote weather station, drawing up some schematics and, more often than not, with a snow shovel in my hand on the balloon ramp.

This is my first time in Antarctica and the sights, sounds and experiences I have had since arriving, are poles apart from everyday life in Australia. When I first saw an iceberg, I remember thinking how staggeringly beautiful

'This is my first time in Antarctica and the sights, sounds and experiences I have had since arriving, are poles apart from everyday life in Australia. When I first saw an iceberg, I remember thinking how staggeringly beautiful frozen water can be. The first Adélie penguins running across the ice also surprised me with their speed and agility.'

frozen water can be. The first Adélie penguins running across the ice also surprised me with their speed and agility.

I must say I felt some trepidation towards the infamous mid-winter swim. After a quick dive, a lap and a climb back up the ladder, the swim was over before it began, and it is still one of my favourite memories from the year.

I never expected to end up in Antarctica. In my youth I was fascinated with all things space and technology, and in 2002 I discovered a degree at the University of New South Wales that I believed would suit my interests perfectly. Four years, and a few grey hairs later, I graduated with a small class of aerospace engineers.

In my third year at university I developed an interest in biofuels, which led to my fourth year thesis on biodiesel use in aviation. I was fascinated by the concepts of renewable energy, renewable fuels and recycling of waste materials. When I finished my degree I picked up a position in the middle of the biggest biofuel project underway in Australia, which happened to be in Tasmania.

While in Tasmania I came across a job ad for a meteorology technician in Antarctica with the BoM. Having always had a fascination with the weather and experience in electro-mechanical fault diagnosis, I applied.

While my original life plan was to go to the Moon or Mars, Antarctica is the next best thing. It presents a landscape that is virtually untouched by the effects of tourism, and features similar weather conditions to an equatorial summer on Mars.

I love watching the changing weather and seasons here. I have observed extreme winds, heavy snowfalls, amazing cloud arrangements, and of course the light shows in the night sky. The challenge of finishing a complex project in difficult Antarctic conditions is another part of what makes this one of the best jobs on Earth.

In my experience the unexpected is to be expected in Antarctica. For example, living and working amongst large wildlife means that sometimes there is no choice but to wait for them to move along before you can finish a job. There is also the challenge of daylight hours, from 24 hours a day to zero sunlight in the space of only six months. My body took some time to adapt to these changes, but some excellent local tips on artificial light made a world of difference.

Probably the most challenging aspect of my job at Davis is scheduling a trip away from station. The BoM work strange hours and odd schedules, so we don't always fit into everyone else's holiday plans. My field trips have been the highlight of my time at Davis and they often come with challenges, usually related to weather. One in particular involved an overnight vehicle dig-out at our skiway, which was a very satisfying, yet tiring, adventure.

There is an amazing variety of things to do here in our spare time. I am a gym junkie and the gym manager, so I spend some time every day keeping fit. When the weather permits, I walk across the sea ice to one of the local islands. I always take my camera as you never know when the perfect shot will present itself.

I am a regular in the hydroponics facility where I can sit in some humidity and enjoy the greenery. Picking my favourite herbs I then head for the kitchen where I love to whip up something for smoko (morning tea) or a nice dessert. It's an amazing community to live in and hard to find oneself bored.

If anything, spending time on the great white continent has strengthened my beliefs in preserving the beauty and majesty of these pristine places around Earth. I have also discovered an inner 'zen' and a bigger world perspective from my time here; one which I will carry with me for life. After spending a year battling the 'A-factor' (Antarctic-factor) I have learned that life does not need to be such a rush. Stop and smell the roses, or the elephant seals in my case. Although, I would suggest the roses take preference.

ALEX ROGERS
Meteorology Technician, Davis station 2015

1. *Alex climbs an anemometer tower to service the equipment, which is used to measure wind speed.*
2. *A stunning view from the living quarters at Davis.*
3. *Alex launches a weather balloon at least once a day.*

Two-wheeled Antarctic adventures

For the past 18 months former Antarctic expeditioner (Mawson, 1960), oceanographer and vintage motorbike enthusiast, Dr George Cresswell, has been corresponding with Antarctic Division staff and scores of former expeditioners (from 1960-1980) to track down yarns and photos related to motorcycles at Australian stations.

This story is the result of two events that were separated by 53 years. The first was when, as a 22 year old, I rode my 350 cc Velocette motorcycle to the *Thala Dan*, tied up alongside the Melbourne docks in January 1960, and asked the ship's Danish coxswain if he could load it on board for me. 'No worries,' he said, 'just drain the petrol out of it.' And so the bike went to Mawson, where it gave many of us a lot of enjoyment when we rode it on the sea ice.

The second event was in 2013 when Doug Farr of the Velocette Owners Club of Australia asked me if I would give a talk to members at their annual get-together. That started me on a search for yarns and photos of other motorbikes that might have been taken south by Australian National Antarctic Research Expeditions (ANARE) personnel. I thought initially that there might have been three or four, but now, thanks to emails and other communication from past expeditioners, I've counted 32 between the years 1960 and 1980.

In most cases the motorbikes were taken down unofficially, with 17 going to Mawson, six to Davis, nine to Wilkes/Casey, and one to Macquarie Island. In 1947 Doctor Alan Gilchrist took an Indian to Heard Island, but the terrain proved too challenging for it to be used very much. The first motorbikes on the Antarctic continent were two 120 cc machines that had been donated to the 1949-52 Norwegian-British-Swedish Expedition to Dronning Maud Land by the Husqvarna company. Charles Swithinbank, the youngest member of that expedition took the motorbikes out of their crates and used one for riding around and adapted the other to become a back-up generator for use on field trips with tracked vehicles. The Husqvarna that he rode had factory-fitted skis on both sides and these proved very useful. Charles said that he managed to start the motorbike at temperatures as low as -46°C. It was an honour to exchange emails and photos with Charles before he died in early 2014.

In 1960 we used the Velocette to explore beyond Mawson station, usually on Sunday afternoons, and to tow skiers and dog sleds with two or three passengers. The speed was exhilarating. Photos from later years and the other continental stations record similar activities. The Velocette played a central role in finding our DC3 Dakota, which had broken its tie-down cables 20 km inland in a blizzard in December. The aircraft was carried into crevasses high above the sea ice. It was beyond recovery, but the motorbike and dog teams recovered navigational and photographic equipment.

As one reads through the yarns sent by ANARE motorcyclists, one behavourial trait seems to recur: a belief that the sea ice in late spring and early summer will support the rider and his machine, as it did all winter, even when it's obviously thin and even looking black. I had the experience of having to change direction when an Adélie penquin popped up through a hole in thin ice 50 m in front of me – and I was silly enough to move closer to take a photo.

Others had similar stories. In 1970, Dave Parer, on foot, broke through black sea ice when he and Malcolm Robertson rode the 500 cc Matchless from Mawson to one of the outlying islands. As Malcolm told it, getting him back onto ice sturdy enough to hold him was touch and go, and the ride back to the station in shared clothing was anything but pleasant. They didn't tell anyone about the saga for 40 years.

Two riders lost their motorbikes through the sea ice, with the first being Don Seedsman in 1964, out from Mawson. He was doing about 50 km/hr when his 150 cc Bantam broke through a frozen-over tide crack.

'The 50 km/h forward inertia of my body deposited me on the far side of the hole, and I only got one wet leg as I climbed out of the crash-hole', Don said

1. *George Cresswell on the Velocette, with Doug Machin and Viv Hill on the sea ice near Mawson.*
2. *Don Seedsman and the Triumph 650 cc near Mawson in 1964. The bike was originally taken south by 'Snow' Williams in 1962.*
3. *The stricken Dakota high up in crevasses, west of Mawson in December 1960. The Velocette and dog teams were used to help rescue navigational and photographic equipment from the aircraft.*
4. *Bill Kellas and George Cresswell (on skis) take the Velocette for a spin on Horseshoe Harbour.*

'Luckily the cuffs on my trousers didn't snag on the footpegs of the bike. I just had time to look around and see the tail-light disappearing into the water; everything happened so quickly!

'Phil Jacquemin came past on his locally-made ice yacht and offered me a lift back to base, which I readily accepted.'

The second loss was at Wilkes in 1965 when Mark Forecast was delivering fresh bread across the bay from Wilkes to REPSTAT ('Replacement station' which later became the old Casey station).

'The bike lurched into a tide crack and I went over the handlebars. I was hanging onto them to prevent the Bantam from sinking and I could see blokes on the roof of a new building looking at me, but they couldn't do much to help. I hung on as long as I could, but eventually I could hang on no longer.'

His fellow expeditioner, John McKenzie, added that 'Mark was wearing non-porous American thermal boots that he had left undone to reduce the perspiration effect and they flew off as the bike went in. He watched them fill up and sink and then ran two kilometres across the sea ice in his socks to Wilkes station.'

Mark said the owners of the Bantam, Ken Shennan and Tony Warriner, 'were understanding, telling me that I looked like a drowned rat and that it was my shout for beers.'

A property of sea ice that many of us discovered independently was that when it is thin, say 10 cm, it is rubbery and will bend under a weight and even make a wave as a motorbike moves across it. The account that I like most is when Bill Burch, who wintered at Wilkes in 1961, was riding on thin ice and saw a wave following him.

'I remember that the only reasoning I was capable of at the time was to keep the throttle wide open, turn in a very wide arc for shore and look out for thicker ice to get home on. It seemed important to psyche myself to prepare for the machine to break through and to try to make as slow and as spread-eagled a descent to the ice as possible, in the hope I would not follow it through. After another mile or so – which felt like an eternity – the "bow wave" vanished and clearly both the bike and I made it back.'

In 1961 I sold the Velocette to the Mawson chef, Ted Giddings, and he made a sidecar using a wheelbarrow wheel. It was a great success, with sidecars being very common thereafter. In the company of a Snotrac, Ted returned the roughly 100 km from Taylor Glacier in just a few hours. He towed a sled with tent, radio and food in case of problems.

The use of motorcycles at the Antarctic Division stations seemed to come to an end in about 1980, possibly the result of quad bikes being taken to the stations officially, as well as a tightening of safety rules.

GEORGE CRESSWELL
ANARE 1960

'The 50 km/h forward inertia of my body deposited me on the far side of the hole, and I only got one wet leg as I climbed out of the crash-hole'

This Picture
The BSA Bantam and sled beside an iceberg near Wilkes, 1961.

Lost: Antarctic history etched in a bottle

Just before Mawson sailed from Hobart in December 1911 on the Australasian Antarctic Expedition (AAE), he was presented with three bottles of Portugese Madeira by Mr John Young Buchanan.

Buchanan was a chemist and one of the founders of modern oceanography and had recently completed a multi-year voyage on the HMS *Challenger*, taking in the Southern Ocean. He instructed Mawson to drink the wine at the traditional festival observed by all Antarctic expeditions – midwinter. Mawson handed one bottle to Frank Wild, the leader of the party going to the Western Base (now known as Queen Mary Land), and another to George Ainsworth who was to lead the small radio relay station party at Macquarie Island. The third was kept for the Main Base party that landed at Commonwealth Bay.

One of Frank Wild's team, Charles Harrisson, kept a detailed diary and he records the midwinter function of 1912 as follows:

Hoadley, in the chair, gave 'The King'. I had to propose 'Dr Mawson and the AAE' in a little speech. Jones, 'Old Explorers', Wild, 'Mr Buchanan'. These last two toasts were drunk in 'Madeira', laid in by Mr Buchanan on the Challenger 40 years ago, and given by Mr Buchanan for us to drink on this day. Afterwards Dr Jones had all our signatures scratched on the bottle with his diamond, and I did a penguin on one side and a ship on the other. The bottle is to be returned to Mr. Buchanan.

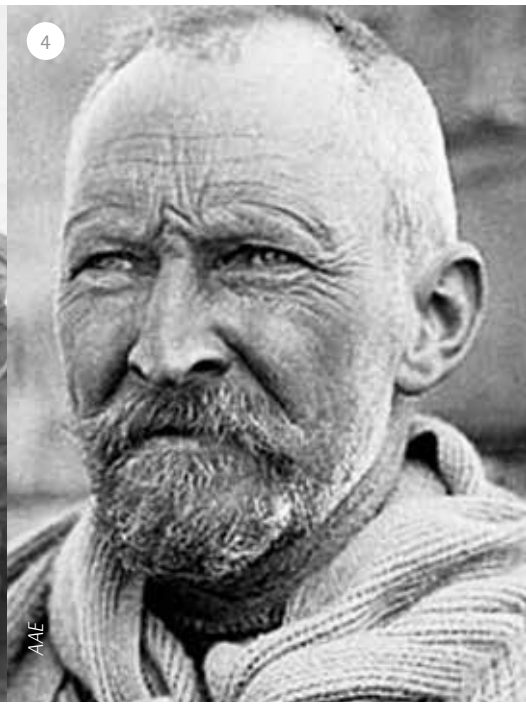
Harrisson was the artist of the party and it seems there was some pressure for possession of this 'souvenir' of the occasion. That was when Wild intervened and declared the bottle would be returned to the original donor of its contents. It would appear that Morton Moyes then grabbed one of the other standard wine bottles, and had the eight names etched onto it with Jones' diamond.

Nothing more is known about either bottle until two totally conflicting reports appear 15 years later on the same day in newspapers 1000 km apart. On May 24 1927 one story appeared in the Mt Gambier-based *Border Watch*, claiming a bottle with the words 'Shackleton Glacier, 22 June 1912' and eight names engraved on it, was found on Tuggerah Beach in New South Wales (NSW) by a local resident, George Bressington. The story goes on to relate the find to the loss of SY *Aurora* with all hands in 1917 off the NSW coast, and presumes the bottle was from the wreck and was washed up by the tides.

The second story was published in the *Barrier Miner* in Broken Hill, and relates that the bottle was picked out by a worker at the NSW bottle works in Ultimo, Sydney, and handed to his supervisor, George Bressington, in 1917, telling him it had come from an unknown boat. Bressington thought it might be of special value, but did not make the Antarctic connection. He took it home and stashed it away in a cupboard for the next 10 years.

The timing of some of the anecdotes surrounding subsequent confirmation of the bottle's identity is a bit vague, but what is critical is that Sir Douglas Mawson read the story of the beach find of the bottle, doubted its authenticity, and wrote to George Bressington asking him if he would take it to the Mitchell Library in Sydney. There, the former

' Hoadley, in the chair, gave 'The King'. I had to propose 'Dr Mawson and the AAE' in a little speech. Jones, 'Old Explorers', Wild, 'Mr Buchanan'. These last two toasts were drunk in 'Madeira', laid in by Mr Buchanan on the Challenger 40 years ago, and given by Mr Buchanan for us to drink on this day. Afterwards Dr Jones had all our signatures scratched on the bottle with his diamond, and I did a penguin on one side and a ship on the other. The bottle is to be returned to Mr. Buchanan. '



Adelaide University librarian, could set about validating it. Bressington took the bottle in and a library assistant wrote a note from an interview with him, testifying that the bottle was handed in originally at the bottle works in Ultimo, 'in 1917 or 1918'.

It transpires that the expedition's ship, *Aurora*, had been undergoing major structural repairs in the Jubilee dry dock in Balmain, not far from Ultimo, in May 1917, having been recently sold for use as a coal freighter. No doubt, as part of the new owner's function, it was cleaned, so it is entirely credible that empty bottles left on board would be taken to a bottle recycling facility nearby.

Mawson no doubt lost interest in the bottle after that, as there remains only a confirmation that Bressington reclaimed the bottle from the library. But one of the signatories on it, A.D. (Andy) Watson, who was then (1927) Headmaster of the North Sydney Boys High School, made arrangements to view it.

The trail remains cold until 1932, when one of the Main Base Party, John Collison Close, decided to try and find the bottle and have it recognised as an historic icon. He contacted George Bressington, who by then was an Alderman at Homebush, and went to see the bottle in the Homebush chambers, confirming that it had the eight names clearly engraved on it. After liaising with Mawson, Close decided that the person who should take charge of its ultimate fate was Mawson's former Deputy, and also one of the signatories, Morton Henry Moyes. Close wrote to the Mitchell librarian to that effect on 27th April 1932.

Despite strong support and cooperation from George Bressington's and Andy Watson's descendents, the Mitchell Library staff, and inquires to other possible repositories, no trace of the bottle has since been found.

W.M. (BILL) BURCH

Bill was a geophysicist at Wilkes station in 1961 and went ashore at Commonwealth Bay in January 1962. If you have any information on the whereabouts of the bottle he can be contacted through the Australian Antarctic Magazine magazine@aad.gov.au.

1. *A bottle of Portugese Madeira – possibly one of the bottles on this table – was signed by members of the Western Base party during the midwinter dinner (pictured) in 1912. L-R (behind): Hoadley, Dovers, Watson, Harrisson, Wild, (front) Jones, Moyes, Kennedy.*
2. *Did Mawson's former Deputy, Morton Moyes, take final responsibility for the historic bottle?*
3. *The Western Base party on their return from Antarctica in 1913. L-R: Harrisson, Watson, Dovers, Moyes, Kennedy, Jones, Wild, Hoadley.*
4. *John Collison Close – Assistant Collector with the Main Base Party – wanted the bottle recognised as an historic item.*

Commemorating Antarctic ANZACs

In this centenary of the Gallipoli Campaign, where the Great War ANZAC† legend was born, the ANARE Club* has researched and recorded the names of 12 Australian and New Zealand expeditioners who served in the 'Heroic Age of Antarctic Expeditions' and who subsequently lost their lives in the First World War. The club commissioned and presented a Memorial Board in honour of these men to the Australian Antarctic Division, which is now on display at the Division's headquarters in Kingston, Tasmania.

ANARE Club

1. *The Memorial Board commissioned by the ANARE Club is now on display at the Australian Antarctic Division.*

The Heroic Age expeditions and their quest to reach the South Pole captured the public's imagination in the early years of the 20th Century. With the outbreak of the Great War (1914–18), most of the men who were part of these expeditions signed up and paid a terrible price for their patriotism.

The names of the 12 Australian and New Zealand expeditioners who served either as members of a land party or manned the ships, and who lost their lives in the Great War have been recorded. While their names are usually listed on honour boards in their home towns or districts across Australia and New Zealand, their association with the Antarctic expeditions has been lost with the passage of time.

To address this, the Memorial Board honours those men who were part of the Australasian Antarctic Expedition 1911–14 and/or the Aurora Relief Expedition 1916–17; or had served on an earlier expedition and were either born in Australia or New Zealand or born elsewhere and enlisted in the Australian or New Zealand armed forces.

The mens' fates roughly reflect the involvement of Australia and New Zealand in the Great War – one died at Gallipoli, five on the Western Front, one in Germany, two at sea, one in the Middle East, and two at home. It is also interesting to see the military skills to which they turned their hands – six of the eight sailors chose to serve in the Australian Imperial Force or the New Zealand Expeditionary Force rather than at sea.

Lincoln moved to a 'ship of the desert', in the Camel Corps. Blake switched from geology to gunnery and Bage from astronomy to engineering. Dennistoun went from caring for ponies to flying. Clearly, adaptability was a characteristic of those early expeditioners!

Able Seaman William Knowles was the first to die. He was part of a small naval raiding party that landed on the Turkish coast in February 1915. Ambushed and forced to retire, Knowles succumbed to his wounds back on board HMS *Philomel*.

Captain Robert Bage, Mawson's astronomer and magnetician, was killed at Gallipoli obeying an order that was questionable.

Lieutenant James Dennistoun, in charge of the ponies with Scott's second expedition, joined the Royal Flying Corps as an observer. He was shot down and severely wounded in June 1916 and died of his wounds whilst a POW on August 9, 1916; the same day Leonard Pettit was killed in France. Later that year Joseph Hancock died of his wounds in France.

In 1917 Francis Desmond was killed-in-action at Messines Ridge and Harry Coombe was killed at Westhock Ridge. They had served together on the SY *Aurora*, which was herself lost that year with 'Scottie' Paton on board (the most experienced sailor of the heroic age), possibly sunk by mines from the German raider Wolf.

Bertrum Lincoln was killed in Jordan in 1918 and is commemorated on the Jerusalem memorial. Captain Leslie Blake, who had mapped Macquarie Island, died of his wounds a little more than a month before the Armistice, almost certainly from friendly fire; described officially and euphemistically as 'by a stray shell'.

William Kavanagh, who had served on Shackleton's Imperial Trans Antarctic Expedition (ITAE) and the Aurora Relief, was invalided home as a result of wounds and disabilities. He succumbed to post-war influenza, as did Captain Archibald McLean, who had been twice gassed.

All these men had survived the dangers of the Antarctic yet cheerfully volunteered for the higher risk of the battlefield. They did so that the world might be a better place, and it is most appropriate that their sacrifice be commemorated at the Australian Antarctic Division, the modern home of Australia's Antarctic endeavour.

Shackleton, dedicating his account of the ITAE, has provided the appropriate words to describe this memorial:

To my comrades who fell in the white warfare of the south and on the red fields of France and Flanders.

Lest we Forget.

HERBERT DARTNALL, DAVID DODD and JOE JOHNSON

ANARE Club

†ANZAC – Australian and New Zealand Army Corps.

**ANARE Club – Australian National Antarctic Research Expeditions Club.*

Ice in your paintbrush

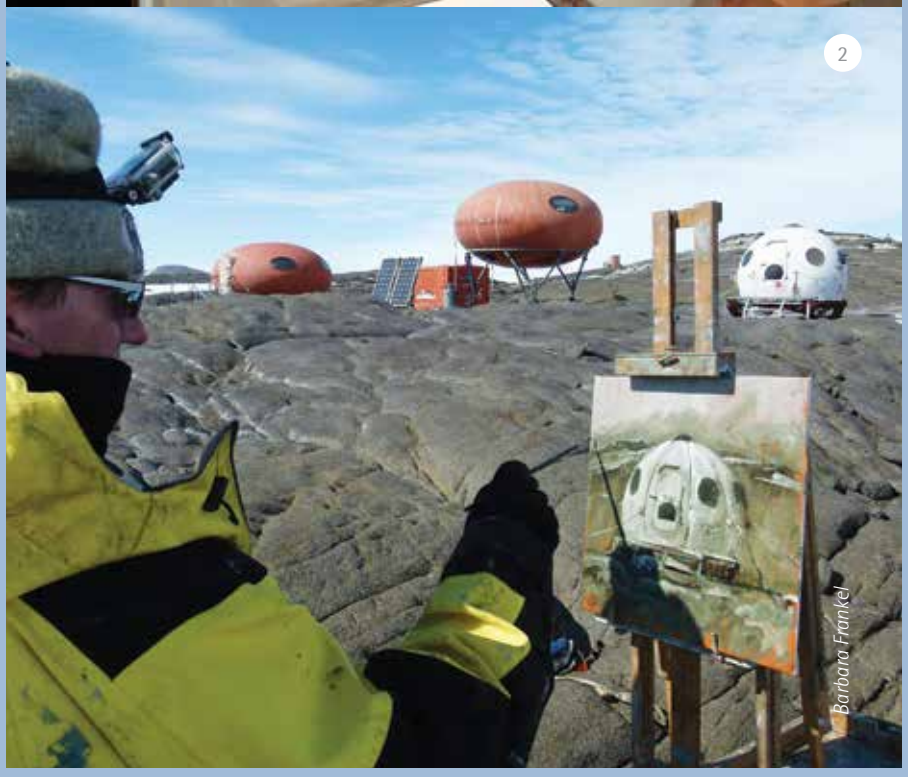
Ice in your veins. It's a term well-known by those who've been to Antarctica, portraying the hold the icy continent can have over people. But ice in your paintbrush…your microphone…your sketchbook? Far from being a one-off artist's residency, the Antarctic Arts Fellow's experience is often one that ignites an ongoing passion, sparks a new direction, and which has personal and professional impacts that reach beyond their expectations.

Lisa Roberts' 2002 Fellowship inspired her to pursue a PhD investigating the use of animation in combining scientific data and subjective responses to the environment. Dr Roberts subsequently initiated the Living Data program at the University of Technology, Sydney (UTS), which she said aims to highlight understandings shared between scientists and artists.

'My Antarctic experience inspired a passion to make climate change visible. Some of my ongoing work is developing the Oceanic Living Data installation which, like a scientific model, evolves to reflect new knowledge. Unlike a scientific model, this installation can be touched. You can move through it and feel part of it,' Dr Roberts said.

In June last year she received the inaugural 12-month C3 Creative Fellowship at the UTS which she used to develop an exhibition in collaboration with UTS and Australian Antarctic Division scientists. Her work has been shown at events in Hobart, Buenos Aires, Sydney and Melbourne.

Stephen Eastaugh has definitely had ice in his paintbrush, with six Antarctic trips under his belt. Mr Eastaugh's first visit to Antarctica in 2000 led him to seek opportunities to travel south again almost every year after that, culminating in an over-winter Arts Fellowship at Mawson station in 2009. During that year he produced over 350 artworks and wrote an artist's travelogue. While he continues to travel and live around the world, Antarctica remains part of his work. Mr Eastaugh said some recent pieces he created in Broome marry nacreous clouds and floating boulders seen near Mawson station, with the "very Broome" medium of the pearl shell.



'As I have spent big chunks of time in both these landscapes they had to join up somehow,' he said.

Over the past year, some of Mr Eastaugh's Antarctic works have featured in exhibitions in Melbourne, Broome, Amsterdam, St Petersburg, and Hong Kong.

Favel Parrett travelled on *Aurora Australis* for her 2012 Fellowship to research her novel *When the Night Comes*, based around the ship *Nella Dan*. As the character in her book is the ship's cook, Ms Parrett asked to be allowed to work. She helped the crew in the kitchen, mopping decks, and with many other jobs.

'It was the greatest trip of my life and I couldn't have written the book without it,' she said.

1. *Artist John Kelly (right) talks about his Arts Fellowship experience at the opening of an exhibition at the Tasmanian Museum and Art Gallery in June this year.*
2. *John Kelly painting the field huts on Béchervaise Island near Mawson.*

Since the launch of her book last year, Ms Parrett has appeared at writers' festivals and bookshops across Australia, and her book is now published in four countries.

2013 Arts Fellow, John Kelly, has held many exhibitions of his Antarctic works in London, New York, Miami, San Francisco and Dublin, and published a book, *Beyond Woop Woop*, featuring the series of works and essays he created during his Fellowship, along with photography by some of his fellow expeditioners. He also held a major exhibition at the Tasmanian Museum and Art Gallery, which will travel to Ireland in 2016.

Sound artist Philip Samartzis is this year's Arts Fellow, travelling to Casey station in January. Dr Samartzis was awarded a Fellowship in 2009, which he said had an enormous impact on his arts practice and his sense of self and the world. In the years following, Antarctica has been a focus of his work, with journal articles, book chapters, a book, radio commissions, performances and exhibitions in conferences, solo and group exhibitions and festivals across the globe.

'After five years of developing various projects from my initial foray into the region I began to think about the new types of experiences and observations I could convey through a new body of work,' Dr Samartzis said.

'With recent advances in sound recording technology I saw an opportunity to render vivid new experiences of Antarctica, particularly weather events, which are often difficult to capture due to their extreme nature. I also want to connect my fieldwork with archival research of polar weather records to create a link between past and present.'

Now in its 30th year, the Australian Antarctic Arts Fellowship looks set to offer inspiration to artists for many years to come.

KRISTIN RAW
Program Manager, Australian Antarctic Arts Fellowship

'After five years of developing various projects from my initial foray into the region I began to think about the new types of experiences and observations I could convey through a new body of work.'

This Picture
This artwork by Stephen Eastaugh combines his Antarctic experiences with northern Australian pearl shells.

Stephen Eastaugh

New Australian Antarctic Division Director


David Parer

Dr Nick Gales took up the position of Director of the Australian Antarctic Division in August.

Dr Gales was the former Chief Scientist of both the Antarctic Division and the Department of the Environment. He has worked in a scientific role at the Division since 2001 and as a member of the Executive since 2012.

Prior to joining the Antarctic Division in 2001, Dr Gales worked as a vet, completed a PhD on Australian sea lions, and ran marine mammal research programs for the Western Australian and New Zealand governments (*Australian Antarctic Magazine* 23: 1-3, 2012). In the late 1980s he spent two and a half years working as a biologist on elephant seals and penguins at Heard Island and Davis station.

As a senior research scientist at the Antarctic Division, Dr Gales developed a marine mammal program for the Southern Ocean, which provided scientific data and advice to inform the Convention for the Conservation of Antarctic Marine Living Resources. He developed a similar science delivery model for the International Whaling Commission, through its Scientific Committee; a role that culminated in him acting as a witness for Australia in the successful International Court of Justice finding against Japan's Southern Ocean whaling program in 2014. Dr Gales was also responsible for developing the Australian Marine Mammal Centre at the Antarctic Division in 2006, which acts as a central point for researchers in the Australasian region to seek funding and collaborate on marine mammal research that informs policy.

In 2011 Dr Gales was appointed Chief Scientist and focused his attention on shaping and delivering a high impact and efficient Antarctic science program. He sits on several Boards and a wide range of international science committees.

As Director, Dr Gales will support Government in its delivery of a 20 year strategic plan for Antarctica, and finalise the acquisition of a new icebreaking research vessel, scheduled for completion in 2019.

Read more about Dr Gales' vision for Australia's Antarctic future on page 1.


Expeditioner photo

The 'Tall Poppy' of marine science modeling

Ecological modeller Dr Jess Melbourne-Thomas has been named Tasmania's Young Tall Poppy Scientist of the Year for her work in communicating science.

Dr Melbourne-Thomas, who works at the Australian Antarctic Division and Antarctic Climate and Ecosystems Cooperative Research Centre, received the prestigious award in September at the Australian Institute of Policy and Science Young Tall Poppy Awards ceremony.

The awards recognise and celebrate the achievements of Australia's young scientific researchers and communicators. The award winners are encouraged to take part in education and community outreach programs.

'Probably the biggest buzz I get from the work I do is communicating my research and I strongly believe that it is a fundamental component of our role as scientists', Dr Melbourne-Thomas said.

Dr Melbourne-Thomas' research uses ecosystem models to simulate and test different management strategies and to help determine what's driving change in particular components of the ecosystem. These results can then inform where and how to best coordinate and invest in further research and monitoring.

For more information on the Tall Poppies awards visit www.aips.net.au/tall-poppies/tall-poppy-campaign/.

Phillip Law Medal 2015

The former Head of Polar Medicine at the Australian Antarctic Division, Dr Desmond Lugg, was awarded the prestigious Phillip Law Medal during midwinter celebrations in Hobart in June this year.

The award, convened by the Australian National Antarctic Research Expeditions (ANARE) Club, recognises an individual who has made an outstanding contribution to Antarctic affairs and the Antarctic community.

Dr Lugg joined the Australian Antarctic Division as a Medical Officer at Davis station in 1962-64, before returning to head the Polar Medicine unit for 33 years, from 1968 to 2001. During this time he also led two summer parties in the Prince Charles Mountains in the 1970s, and an International Biomedical Expedition to Antarctica in 1980-81.

Dr Lugg left the Australian Antarctic Division in June 2001 to take up a prestigious position with the US National Aeronautics and Space Administration (NASA), where he worked for six years (*Australian Antarctic Magazine* 2: 2001).

Dr Lugg was awarded the Polar Medal in 1969, made a Member of the Order of Australia in 1984, and was awarded a Centenary Medal and the NASA Distinguished Public Service Medal in 2006. He is the author of a formidable array of scientific papers and is currently working on a history of Australian Antarctic medical practice.

ANARE Club
www.anareclub.org/web/pl-medal/pl-2015-lugg.php


David Parer

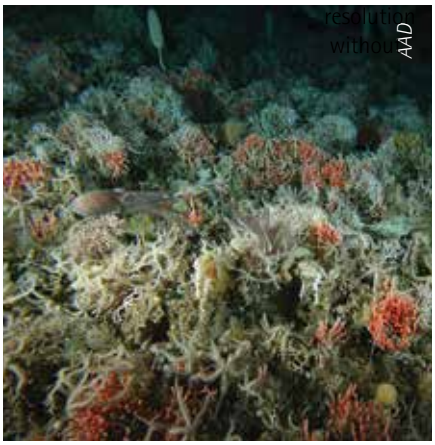
CCAMLR meeting

The 34th annual meeting of the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) was held in Hobart from 19–30 October 2015. The Australian delegation was led by the Director of the Australian Antarctic Division, Dr Nick Gales, and included officers from across the Australian Government and representatives from the Australian fishing industry, environmental non-government organisations and state and territory governments.

One of the key initiatives for Australia again was the proposal for a marine protected area in East Antarctica. Although consensus could not be achieved on the proposal, important progress was made. China indicated its willingness to progress the Ross Sea Region Marine Protected Area proposal, which we hope will be a catalyst to seeking agreement on the East Antarctic Marine Protected Area proposal.

Key achievements for Australia included:

- Agreement to a joint proposal by Australia and Norway to establish a climate change focused group to provide information and develop advice and recommendations on how to integrate climate change considerations into the work of the Commission.
- Agreement to a on Vessels Nationality. Actions called for by Contracting Parties include prohibition of landing and transhipping of catch, access to ports and strengthening legal, operational and institutional capacity.



- The Commission continued its work on the orderly and precautionary development of the krill fishery with discussion on increasing observer coverage in the fishery and continuing negotiations on developing a feedback management system.
- Securing a biennial stock assessment for the Heard Island and McDonald Islands toothfish fishery and endorsement of associated finfish bycatch and seabird mitigation measures.

Conservation award

Australian Antarctic Division quantitative marine ecologist, Dr Andrew Constable, has been recognised for 30 years of service to the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR).

Dr Constable and six international colleagues were presented with awards for 30-plus years of service by the Governor of Tasmania, Her Excellency Professor the Honourable Kate Warner, AM, at the opening session of CCAMLR's 34th meeting in Hobart in October.

Dr Constable has used his scientific knowledge to assist in ecosystem-based management of fisheries, the conservation of biodiversity, and understanding the implications of change in marine ecosystems.

Antarctic Gateway launch

The $24 million Antarctic Gateway Partnership, launched on 1 October, aims to consolidate Tasmania's place as a global leader in Antarctic and Southern Ocean science and get more scientists on the ice.

The three-year, federally funded partnership is a collaboration between the Australian Antarctic Division, CSIRO and University of Tasmania.

Fourteen national and international scientists have been employed under the partnership, while a number of existing projects and scientific teams will also benefit. These include the K-axis marine science voyage in early 2016 (see *Spotlight on the K-Axis,* page 2).

The partnership will fund research into ice-shelf and ocean interactions, marine and sea-ice food webs, solid earth–ice sheet interactions and polar marine technology.

For more information about the partnership see http://www.imas.utas.edu.au/antarctic-gateway-partnership/home.

ANTARCTIC GATEWAY PARTNERSHIP

A Special Research Initiative of the Australian Research Council

National Science Week

The Australian Antarctic Division brought back its popular 'Icy Tweets' series for this year's National Science Week. Antarctic scientists, expeditioners and communicators shared stories of work and adventure on Twitter, and answered questions from the public. You can view the tweets in conversation form at *https://storify.com/AusAntarctic.*

Antarctic Newsletter

Keep up to date with the latest news, events and activities in Antarctic with our online newsletter Antarctic Insider *www.antarctica.gov.au/news/antarctic-insider.*

GORDON TAIT

Freeze Frame

Doug McVeigh is a Supervising Communications Technical Officer responsible for all satellite, LAN, radio and other communications and science equipment on station. He has wintered at all four Antarctic and subantarctic stations and summered at various times as well. He has been part of the fire and search and rescue teams, and the lay medical teams, and is heavily involved in science work during winter – including sea ice monitoring, penguin camera maintenance, remediation activities and lake sampling.

This photo was taken with a Sony CyberShot point and shoot that I keep with me no matter what the weather. The Red Shed, at Casey, on this particular day seemed totally different from how I had seen it before. It had a magical view about it, with the way the snow clung to the shed and the contrast of the red showing in places on the structure. The landscape, weather conditions and every other aspect of Antarctica is different from one minute to the next, and if one does not capture the moment at the time, the opportunity is unlikely to happen again. I just admired the beauty that was before me at the time and then took the photo to capture this memory.

ANTARCTICA
valued, protected and understood

www.antarctica.gov.au

Australian Government
Department of the Environment
Australian Antarctic Division