AUSTRALIAN ANTARCTIC MAGAZINE

ISSUE 13 2007

CONNECTING ANTARCTIC SCIENCE AND POLICY

AUSTRALIAN
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FRONT COVER: CHRIS WILSON
Ice crystals growing on a window of the Wilkes Hilton hut at old Wilkes station, near Casey. The photo was taken in mid-winter when the sun was at its lowest in the sky. The yellow glow is from the rising sun reflected in the window.

The Australian Antarctic Division, a Division of the Department of the Environment and Water Resources, leads Australia's Antarctic programme 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 programme, maintaining four permanent Australian research stations, and conducting scientific research programmes both on land and in the Southern Ocean.

Australia's four Antarctic goals are:

- To maintain the Antarctic Treaty System and enhance Australia's influence in it;
- To protect the Antarctic environment;
- To understand the role of Antarctica in the global climate system; and
- To undertake scientific work of practical, economic and national significance.

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

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TURNING ANTARCTIC SCIENCE INTO POLICY

Issue 13 of the *Australian Antarctic Magazine* features articles on an important and increasingly topical issue for the Australian Antarctic Division and Antarctic researchers generally: directing the results of scientific research in Antarctica into practical and relevant policy measures and, where appropriate, using policy to direct research.

MARIE DAVIES

The Montreal Protocol, which phased out the use of ozone-depleting substances, is a dramatic example of research guiding policy. Ozone and atmospheric research continues today at Australia's Antarctic stations.

As the articles in this issue reveal, there are many connections between Antarctic science and policy and the Australian Antarctic Division is currently focusing on the quality of these interactions. Antarctic research is expensive and, as a publicly funded organisation we must ensure that the research we support is effective and delivers maximum benefit to those that fund us, the Australian public, and the Antarctic community. Our research must be cost-effective, relevant and inform public policy.

Antarctic scientists have been describing the physical world of Antarctica for over a century. They have worked with colleagues in temperate and tropical regions to build sophisticated models of the interactions between different components of the global physical environment. They have also recorded changes over time including, as we now well know, climate change.

While the evidence that human activities are changing the world's climate is convincing, significant changes in human behaviour will be best achieved when dialogue between policy-makers and scientists leads to coherent and effective responses based on the best available science. Governments around the world are now responding to the science presented to them, and Antarctic scientists can be proud of their direct link into policy-makers' understanding of climate issues (see page 6).

Climate science is not the only area of Antarctic research to have resonated with policy makers. Over 20 years ago, a dramatic example of research guiding policy was the 1985 report by British Antarctic scientists of the 'ozone hole'. This research led directly to the negotiation in 1987 of the Montreal Protocol, which provided internationally agreed arrangements to phase out the production of chloroflurocarbons and other ozone depleting substances (see page 15).

Research into the Southern Ocean marine environment also directly informs policy-making. For example, the scientific assessments of krill and fish stocks form the basis for the Commission for the Conservation of Antarctic Marine Living Resources to establish precautionary, sustainable catch limits for Southern Ocean fisheries. Research on seabirds has also lead to the development of new designs and practices to minimise the incidental catch of seabirds during fishing operations – one of the most significant conservation achievements in recent years (see page 2). In addition toxicology research helps decision-making on waste management at Antarctic stations, and the clean-up of abandoned sites.

There will always be more research demands and opportunities than we will be able to support, so one of our great challenges is to prioritise Antarctic research, taking into account its relevance to policy, its quality, and our ability to deliver research outcomes in the difficult Antarctic operating environment.

The issues that arise in trying to prioritise science are not new, but in the process of doing so it is important to understand the distinction between research that is unambiguously driven by immediate policy requirements, the desire to conduct basic research in Antarctica (continuing to describe the natural world through a raft of disciplines), and opportunities for serendipitous discovery that may turn up critical information.

There are strong arguments for maintaining the capacity for simple observations - the discovery of ozone depletion occurred by analysing routine measurements and observing how they changed over time. And policy users need the capacity to direct research into areas that could be regarded as mundane, but which could be critical to environmental decision-making by, for example, providing monitoring data on key environmental indicators that inform human impact management decisions, and the assessment of the effectiveness of those decisions. Antarctic science serves multiple purposes and getting the balance right is the key. Ultimately, publicly funded research, such as that conducted by the Australian Antarctic Division, must meet the policy requirements of the Government of the day.

This issue of the *Australian Antarctic Magazine* provides plenty of food for thought on these issues, as well as an insight into some of our other research and outreach activities, including new projects for the Australian Centre for Applied Marine Mammal Science, and the activities of some very busy Australian Antarctic Arts Fellows.

A.J. PRESS
Director, AAD

SCIENCE AND POLICY IN THE MARINE REALM

Some people say there is a 'gap' between policy development and scientific research. But in many areas related to conservation and management in the Southern Ocean it is often difficult to detect where the transition between fields occurs.

Resource management in the Southern Ocean began with the International Whaling Commission (IWC), but was later developed through the Seals Convention and CCAMLR (the Convention on the Conservation of Antarctic Marine Living Resources). CCAMLR has a scientific committee to provide expert advice to the commissions through which management decisions are made. The close relationship between scientists and policy-makers in this forum, and the technical nature of the discussions, has resulted in a collaborative approach to the development of policy, and a strategic approach to science, based on policy needs. Additionally, scientists can provide the continuity of representation that is often lacking from diplomatic or policy areas.

Australia entered the field of Antarctic marine research in the early 1980s, after development of the krill fishery and the emergence of CCAMLR as the international body established to manage this, and other fisheries, in the Southern Ocean. CCAMLR adopted an ecosystem approach to management, after scientists advised that harvesting the key organism in the food chain (krill) might severely impact the animals that depended on them (seals, whales and seabirds), and other organisms within the Southern Ocean ecosystem. Harvesting krill was new territory in fisheries management, and required a close alignment of science and policy. Over the years this linkage has become even closer. Initial Australian marine research focused on krill, particularly its distribution and abundance. However, the absence of any baseline ecosystem data meant that a decade or two of exploratory research was necessary to begin to understand how the ecosystems off Antarctica function.

With the development of domestic fisheries for Patagonian toothfish and mackerel icefish at Heard Island and McDonald Islands (HIMI), and at Macquarie Island in the 1990s, the Australian Antarctic Division focussed on providing targeted information to policy-makers that enabled direct management of these fisheries. In fact, the Australian HIMI fishery was the first in the CCAMLR Area to proceed only after assessments of the stock had been carried out – a precedent in world fisheries.

In the late 1990s it was apparent that information necessary to manage the living resources of the Southern Ocean was required continuously – both for domestic fisheries operating off the Australian


FREDERIQUE OLIVIER


BRETT FREE

Grey-headed albatross are one species that has benefited from actions taken by CCAMLR to protect Southern Ocean seabirds.

The Australian Antarctic Division's cetacean research contributes to Australia's policy position in the International Whaling Commission.

Antarctic Territory and to inform the sustainable management of international fisheries. In 1999 the Antarctic Division developed a research programme, mandated to provide information to CCAMLR and the domestic fisheries management authority, to ensure the sustainable development of Southern Ocean fisheries.

The ecosystem approach of the new research programme made the Australian Antarctic Division a logical home for other priority areas of conservation science that emerged in the late 1990s. The numbers of albatrosses and petrels were known to be declining in the 1990s but it took a few years for the full extent of the problem and its cause to be recognised. Many species of highly endangered seabirds, such as albatrosses, were being accidentally caught when they seized bait from fishing lines being deployed by vessels in the Southern Ocean. The problem is a worldwide issue because such birds can cover vast distances on foraging trips — birds that breed in the Antarctic region can be accidentally caught near the equator on the other side of the globe. CCAMLR was one of the first bodies to recognise this as a serious conservation issue and invoked management measures to reduce the death of seabirds as a result of fishing practices. In the last few years these mitigation measures have been highly successful and their adoption resulted from a very close working relationship between scientists, policy-makers, fishing gear manufacturers, fisheries managers, politicians and diplomats. Scientists at the Antarctic Division and in the Australian Antarctic programme have been instrumental in the process of developing practical solutions to this difficult conservation problem.

One of the most contentious conservation issues in the Southern Ocean is whaling. During the brief period of industrial whaling over 1.3 million great whales were killed in Antarctic waters. Recovery of all stocks has been slow but there have been calls to begin commercial harvesting again. Australia has staunchly opposed a return to commercial whaling since 1978 and has advocated this position in the IWC. In 2002 the Australian Government transferred responsibility for the IWC to the Australian Antarctic Division, and a robust scientific research programme was developed to inform the consideration of conservation options in the IWC. The natural fit of cetacean research into the Antarctic Division's ecosystem research programme, and the successful interactions between science and policy within CCAMLR, meant Australian whale research had a new home.

Today, the Antarctic Division's Southern Ocean Ecosystems programme maintains its focus on supporting Australia's position in key forums – including CCAMLR, the IWC and the Agreement on the Conservation of Albatrosses and Petrels. Because of the broad base of research and expertise necessary to provide advice to these bodies, the programme is also able to contribute to other forums. In collaboration with our partners at the Antarctic Climate and Ecosystems Cooperative Research Centre we are also able to address issues relating to the effects of climate change on Southern Ocean ecosystems. Such strongly focussed research programmes are thus capable of serving several masters simultaneously, whilst at the same time producing world-class science.

STEVE NICOL
Programme Leader, Southern Ocean Ecosystems, AAD

More information

Southern Ocean ecosystems research:
www.aad.gov.au/default.asp?casid=221


AAD

Mackerel icefish, Champsocephalus gunnari*, captured by Australian trawlers around Heard and McDonald Islands (HIMI). The Australian HIMI fishery proceeded only after a stock assessment was completed.*

LICENSED FOR KRILL

When So Kawaguchi is not skiing the piste in Japan, you might find him conducting scientific experiments on an icebreaker in the middle of the Southern Ocean, tending krill in the Australian Antarctic Division's krill aquarium, or crunching fisheries data on his computer.

The multi-talented krill biologist, and qualified ski instructor, began work with the Antarctic Division five years ago, after leaving his fisheries research job with the Japanese Government in Tokyo. His reason? 'This is the best place in the world to study krill, and the krill aquarium is the world's best facility to do krill research,' he says.

Krill research at the Australian Antarctic Division began when Japanese scientist, Tom Ikeda, joined the organisation in 1982. During his five-year tenure, Dr Ikeda undertook pioneering work to show that krill live for 7-11 years, rather than 3-4 years, which was the conventional wisdom at the time. This finding had major ramifications for the management of the krill fishery. He also demonstrated that krill shrink in the absence of food.

So and his team have subsequently significantly advanced scientific knowledge about krill biology and behaviour, and contributed to the practical and sustainable management of the Southern Ocean krill fishery through the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR).

School behaviour

A recent success was to get wild Antarctic krill (*Euphausia superba*) to school in captivity – something that has never been achieved before. It means that the Antarctic Division team can now study the animals' natural behaviour and response to various stimuli, and collect more accurate information on their growth and metabolism.

'Krill are very social animals, but in captivity they tend to behave individually, rather than as a group, and you can't get much information from them,' So says.

'Observations and measurements made on schooling krill are really important because the information is used in modelling for fisheries research and defining sustainable krill catch limits for CCAMLR,

LUCIA SIMION

So monitors phytoplankton cultures (microscopic marine algae) which make up the bulk of a krill's diet.

Recent changes in krill fishing methods will change the dynamics of how fishing fleets interact with the resource, and the impact on krill predators.

So recently collected Antarctic krill from the sea ice environment, during the Sea Ice Physics and Ecosystem Experiment, *to help improve scientific understanding of the krill life history.*

and normal behaviour means they should be physiologically normal, rather than stressed.'

So and his colleagues are now taking advantage of this success to conduct behavioural experiments.

'Recently, we put different sized objects in different colours in or near the tank,' So explains. 'The krill weren't worried by small, black objects at a distance from the tank, but when we put a large, fake penguin in their tank they went crazy. They escaped to the other side of the tank and started schooling and swimming rapidly – as they might do when confronted by a real penguin or some other predator.'

Synchronised swimming

The team also observed that when krill are feeding they swim around randomly, but when schooling, they swim faster, with their bodies close to horizontal and all pointing in the same direction. This information is important when measuring the abundance of krill at sea using acoustic 'echo-sounders'. These instruments send pulses of sound into the water and record the echo strength as the sound waves bounce off objects. However, as the echo-sounder is sensitive to krills' body orientation, the echo strength may be different depending on what the krill are doing. If they are swimming horizontally, for example, the echo strength will be far stronger than when krill are more vertical.

'A better understanding of natural krill behaviour will help us interpret and extrapolate echosounding results from field surveys,' So says. 'This work will ultimately enable more accurate measurements of krill density in the field, which is important for developing sustainable catch limits.'

Modelling growth

So's work has also resulted in a new growth model for krill. In the past, krill growth rates were determined by measuring the size of krill in the wild at different times during the growing season (November to April). However, this method relied on a lot of assumptions, including that the same population of krill was sampled each time.

The new model measures the growth of individual animals – in the wild and the aquarium – each time they moult (shed their shell). This allows for changes in krill size as a result of temperature, food availability, sex (males grow faster than females), and reproductive state, and gives a more accurate picture of the population growth rate. It means a lot of work for the aquarium team, however.

'Krill moult in the aquarium every three to four weeks, and we collect moults every day,' So says. 'We also capture krill when we're at sea and take measurements for the duration of the voyage.'

Practical fisheries management

Another aspect of So's work involves analysing information on the size of krill catches and fishing fleet behaviour (where ships fish and for how long), which is voluntarily provided to CCAMLR by most member countries. His results are then presented to CCAMLR, both for its scientific value and for practical management.

'You can't put scientific knowledge in place without understanding the commercial nature of the fishery,' he says.

'It is also important to understand fleet behaviour in relation to the krill predators' foraging ground. CCAMLR allows rational use of the resource, but we need to make sure that as the fishery develops – and it's really starting to take off now – it does not have any irreversible effect on the ecosystem.'

Some krill boats have recently begun using new equipment that allows larger volumes of krill to be caught and processed efficiently. This will change the dynamics of how fishing fleets interact with the resource, and the impact on krill predators – something So and his colleagues will monitor with interest.

In the mean time So is busy analysing data collected during an early-season sea ice voyage in August 2007. During the Sea Ice Physics and Ecosystem Experiment, an International Polar Year project (www.acecrc.sipex.aq), So and his team used a variety of equipment to study the distribution and condition of krill under the sea ice. Initial results indicate that krill associated with sea ice are in better condition than those in open water, underscoring the importance of sea ice to this valuable crustacean.

WENDY PYPER
Information Services, AAD

CONNECTING ANTARCTIC CLI

In this period of rapidly moving climate science and increasing policy focus on the issues surrounding climate change, it is interesting to look at how the climate-related science of the Australian Antarctic programme interacts with policy.

CHRIS WILSON

Policy outcomes from Antarctic climate research require the integration of this research into the global understanding of climate.

A substantial portion of the Australian Antarctic programme is directly focussed on the Australian Government's goal to *Understand the role of Antarctica in the global climate system*, which involves work within the Australian Antarctic Division, CSIRO, Bureau of Meteorology and universities. This effort has its focus within the Antarctic Climate and Ecosystems Cooperative Research Centre (ACE CRC), which extends the work of the earlier Antarctic CRC.

So how does this research find its way into policy and how does it respond to policy demands? These are difficult questions that have challenged those on both sides of the science-policy interface. This article aims to outline some of the key ways that these connections are made. With something as large as climate change, the connections between the science and policy communities are necessarily multi-layered and complicated.

Climate science, particularly that of the Australian Antarctic programme, is mostly concerned with large, globally interlinked issues, such as sea-level rise, and with probing large-scale climate processes – which requires basic research and an understanding of climate components. It differs from other applied research that serves policy interests (such as monitoring or measuring), in that the ultimate outputs typically cannot be appreciated from the results of a single project or experiment. The big results and answers for which policy implications are apparent, depend on integrating the research into a global understanding of climate. It is the vastness of this task that necessitates a body like the Intergovernmental Panel on Climate Change (IPCC) to synthesise an overall assessment of climate change for use by policy-makers. The IPCC is the primary vehicle for conveying climate science to the policy arena, and it is for its efforts in this area that the IPCC shared the Nobel Peace Prize this year (see box).

The IPCC provides its synthesis in the form of an Assessment Report, issued approximately every 5-6 years. The most recent, the Fourth Assessment Report, was produced in 2007 and captures key research findings up until early 2006. The process of producing these reports – by distilling the published scientific literature – is a huge undertaking. The Report is authored and reviewed by hundreds of scientists and constitutes the most complete snapshot of our understanding; albeit a snapshot that is soon made out of date by fresh results!

Australia's Antarctic research and researchers play an important role within the IPCC process and, in this dynamic environment, continue to conduct work that will be picked up in the next IPCC assessment. But there are other ways that Antarctic climate science interacts with and serves policy needs, and these also depend on a vibrant climate programme.

MATE SCIENCE AND POLICY

Good policy requires good public education. Scientists communicate their research through such avenues as public displays (pictured), lectures, and the media.

Firstly, the climate expertise across the whole Australian Antarctic programme provides advice to Government in evaluating and interpreting new developments (political responses, environmental events etc.), and in assessing the impacts and effectiveness of various policy options. This includes advice on setting research directions that both consider national priorities and needs, and that address major international research needs. This dialogue takes place through a range of channels including formal ministerial briefings, government policy responses, learned academies, non-government policy bodies and parliamentary committees.

Secondly, as a major Southern Hemisphere nation with a considerable Antarctic claim, Australia's ability to drive research in the geographical area, which is tailored to our own specific interests, is a key capability with obvious policy imperatives. Specifically, the proximity of Australia to Antarctica and the Southern Ocean, and our unique vulnerabilities to climate change, shape our priorities. Our high quality national programme allows us to attract and influence international efforts, harnessing external resources (such as ship time and satellite data) to further our national priorities in this area.

A third strand of interaction between policy and climate science is through contracted research. Specific studies, often on more local or targeted issues, are requested by local, state or federal governments, and these often draw in the expertise of the Antarctic and Southern Ocean research community.

A final connection between science and policy arises from public interest. There is a public thirst for high quality information and a clear interest in the issues. Also, it is the public who fund the great majority of climate research, and public opinion has an obvious impact on the long-term framing of policy. If this public push is to be towards good policy, then good public education is also an important function of science programmes. Scientists generally take this role seriously and make efforts to communicate their science in accessible ways through such avenues as public lectures and the various media.

This is a challenging and rewarding time to be working in climate science. The relevance of the research to major policy concerns, and the urgency of these issues, provides strong impetus for the work. The difficulties of conducting large and complex science programmes, which can take years to plan and execute, while providing timely advice across a broad and interlinked field, are considerable. To do this well requires a strong science programme and robust use of all the channels that link policy-makers and scientists.

TAS VAN OMMEN
Ice, Ocean, Atmosphere and Climate programme, AAD and ACE CRC

More information

Climate research at the Antarctic Division: www.aad.gov.au/default.asp?casid=248 and www.acecrc.org.au

Nobel Peace Prize

The Intergovernmental Panel on Climate Change (IPCC) shared the 2007 Nobel Prize for Peace with climate change champion Al Gore. Work undertaken by Australian Antarctic Division scientists, largely through the Antarctic Climate and Ecosystems Cooperative Research Centre (ACE CRC), is highly relevant to the work of IPCC, and will continue to be so into the future. A number of Antarctic Division staff contributed to the IPCC's Fourth Assessment Report, released in 2007. Ian Allison, leader of the Ice, Ocean, Atmosphere and Climate programme, sea ice scientist, Tony Worby, and biologist, Harvey Marchant, were lead and contributing authors to the IPCC Working Groups 1 and 2 reports, while glaciologist, Tas van Ommen, was an IPCC reviewer.

Other Australian Antarctic programme colleagues who contributed to the reports as either lead or contributing authors were Nathan Bindoff (ACE CRC), John Church, Steve Rintoul and David Etheridge (CSIRO), Kurt Lambeck (Australian National University), Ian Simmonds (University of Melbourne), and Helen Fricker (formerly of the University of Tasmania). John Hunter and Will Howard of the ACE CRC were also IPCC reviewers.

A number of Bureau of Meteorology staff who are not directly involved in the Australian Antarctic programme, also contributed directly to the IPCC through their Antarctic and sub-Antarctic weather and climate observations.

Congratulations to these individuals and to their teams and colleagues who support the Australian Antarctic programme.

COUNTING WHALES IN THE ICE

KEVIN NEFF IA10740b

Minke whale.

For the first time, Australia will use aircraft to count minke whales in the pack ice around Antarctica.

Since 1978 the International Whaling Commission (IWC) has been counting whales in the Southern Ocean for management and conservation purposes. Each year ships, provided by Japan, cover about one tenth of the Southern Ocean, with each survey in the unstrengthened vessels necessarily ending at the edge of the pack ice around Antarctica. Thus, every 10 years, a circumpolar snapshot of whale abundance is obtained. Surveys over the past two decades, however, suggest that there has been a significant decline in minke whale abundance, leading to disputes over whether the decline is genuine, or an artefact caused by the survey technique.

One theory is that changes in the ice edge boundary each year, and changes in the number of minke whales present in the pack ice beyond this boundary, could be responsible for the differences in estimates of the whales in open water. In other words, could there be more minke whales hiding under the hundreds of kilometres of pack ice (and open areas within the pack ice), where the ships can't search?

Using icebreaker ships to access the pack ice is not ideal for a number of reasons, including the whales' responses to engine noise. In the 2007-08 Antarctic season*, a team from the Australian Antarctic Division aim to use the Division's two C212 fixed-wing aircraft to trial an aerial survey of the relative abundance of whales off the coastline adjacent to Casey. The plan is to fly the planes at an altitude of about 180 m and cover at least 2500 nautical miles – flying over a mixture of pack ice and open water.

The aerial survey will be conducted at the same time as the annual ship-based survey (the Southern Ocean Whale Ecosystem Research survey), covering the pack ice region that the ship cannot access. It will be done in such a way that the data from both methods can be compared.

Information from the surveys will be used by the IWC, but will also contribute to the Australian Antarctic Division's research (through the Australian Centre for Applied Marine Mammal Science) into minke whale distribution and abundance, and their interaction with other whale species and krill predators. This research feeds into conservation management, setting sustainable catch limits for whales and krill, and contributes to scientists' understanding of ecosystem changes due to climate change. This first aerial survey will also act as a proof of concept.

WENDY PYPER
Information Services, AAD

* Scientists undertaking this research will be amongst the first to fly to Antarctica on the new Airbus A319 (see page 31). The timing of this research will therefore depend on the weather.

Modifying aircraft for whale surveys

The C212 aircraft have been modified for the survey in a number of ways including:

- digital video and infrared video systems mounted under the aircraft to record everything within a strip at least 50 m on either side of the aircraft;
- a wide-angled, still, digital camera mounted under the aircraft to record ice images at least 100 m either side of the aircraft at regular intervals; and
- additional software incorporated to access altitude information from aircraft data logging systems, improving survey result accuracy.

In addition to these modifications the Global Positioning System will be available to accurately record whale sighting locations, and the two front and two rear observers will be visually and audibly isolated from each other to ensure independent recording of information.

Due to the nature of the operation (including the potential for extended periods of flight over open water at low altitude) project team members have undertaken additional emergency training relating to egressing ditched aircraft, cold water hazard, and life raft deployment.

FREDERIQUE OLIVIER

ADRIAN PATE

The C212 aircraft have undergone a range of modifications for whale survey work, including the mounting of still and digital cameras (inset) under the aircraft.

Practical management of Southern Ocean fisheries

Scientific information provided by the Australian Antarctic Division is instrumental in the development of Australia's well-founded policies on managing fisheries in the Southern Ocean.

JASON HAMILL, AFMA

Researcher, Robbie Kilpatrick, attaches the deep sea camera to the trawl net on board the Southern Champion.

Large scale fishing in the Southern Ocean began in the 1960s and was largely unregulated, as much of the Southern Ocean is beyond the jurisdiction of any nation. As stocks were discovered, many, such as the marbled rock cod (*Notothenia rossi*), were rapidly fished to near extinction and in many instances are still rare, despite having been effectively unfished for decades.

As a result of this experience and international concern that krill – important in the diet of many species in the Southern Ocean – may also be overfished, CCAMLR (the Convention on the Conservation of Antarctic Marine Living Resources) was established in 1982, with Australia as an original signatory.

Australia did not begin to fish in the Southern Ocean until 1997. Following research surveys conducted in the early 1990s by the Australian Antarctic Division, in the 200 nautical mile Exclusive Economic Zone around the Heard and McDonald islands, the Australian Fisheries Management Authority (AFMA) issued permits to fish in the area for mackerel icefish (*Champsocephalus gunnari*) and Patagonian toothfish (*Dissostichus eleginoides*). A fishery for Patagonian toothfish also commenced around Macquarie Island. All these fisheries continue today.

To ensure that targeted fish stocks and the ecosystems within which they live are not permanently affected, Australia uses a system of rigorous management controls. These include limiting the number of vessels allowed to fish, restricting the amount of fish that can be caught, and requiring the use of techniques that avoid seabird and marine mammal bycatch. Both Macquarie Island and the Heard and McDonald islands also have some of the world's largest Marine Reserves adjacent to them, to protect the marine environment from the direct impacts of human activities.

Vessels are also required to implement research programmes developed by Australian Antarctic Division scientists; such as tagging and releasing fish and conducting a large annual survey to estimate the abundance of icefish and juvenile toothfish, around the Heard and McDonald islands. The tagging programme has revealed that toothfish can move very large distances, with fish tagged at Heard Island being recaptured by French vessels near Crozet Island, over 2000 km away. These results indicate that there are links between widely separated toothfish stocks. French scientists are currently collaborating with the Antarctic Division to develop a more complete picture of stocks throughout the Indian Ocean sector of the Southern Ocean.

As a further management measure, all vessels fishing in the Southern Ocean must carry two scientific observers. Australia's observer programme is administered by AFMA, with technical and data management support from the Antarctic Division. The Antarctic Division also uses the research and observer data collected each year to model the toothfish and icefish stocks and recommend catch limits for future fishing seasons. The observers are tasked with collecting large amounts of data on where vessels fish, what species they catch and how much, and any interactions with seabirds or marine mammals. All this occurs while sailing in some of the roughest conditions on the planet.

New technology for future management

The Australian Antarctic Division, with the assistance of AFMA, the Fisheries Research and Development Corporation and the fishing industry, is currently developing sophisticated underwater camera systems that can be deployed on fishing gear by observers. These cameras are designed to record digitised video and still photos while attached to trawl, longline and pot gear. This footage will then be analysed to identify the types of habitats where fishing occurs, and the vulnerability of these habitats to damage from fishing gear.

The cameras were successfully trialled recently by Antarctic Division staff aboard a trawler fishing for toothfish around the Heard and McDonald islands. The footage captured so far provides a tantalising glimpse of the undersea world hundreds of metres below the surface, and has attracted interest from other fisheries in Australia and overseas, as a method of assessing the effects of fishing on the deep sea environment.

DIRK WELSFORD
Southern Ocean Ecosystems programme, AAD

More information

Heard Island and McDonald Islands:
www.heardisland.aq/index.html
Fisheries research and management:
www.aad.gov.au/default.asp?casid=29303;
www.afma.gov.au/; and www.frdc.com.au/

A large Patagonian toothfish, Dissostichus eleginoides, *captured on camera entering a trawl net deployed at 700 m.*

ROBBIE KILPATRICK

The deep sea camera system developed by the Australian Antarctic Division, which is being trialled to assess the effects of fishing on the deep sea environment.

CULTURE CREATURES

ANDREW SMITH, 4856D5

During the peak movie-going period of Christmas 2006, the blockbuster hit was not, as many people anticipated, the new Bond film, *Casino Royale*, but rather an animated musical about a tap-dancing Emperor penguin, entitled *Happy Feet*.

The lead character encounters a variety of Antarctic animals during his travels, including skuas, killer whales and an elephant seal voiced by Steve Irwin. Only a year earlier, another film about Emperor penguins had been an unexpected success: *March of the Penguins*, the second highest-selling documentary ever made. The intervening months had seen the release of *Eight Below*, a children's film about a group of huskies accidentally abandoned over winter at an Antarctic base, who must scrape by on petrels and washed-up killer whales (judiciously, they choose not to feast on the other hit Antarctic animal of the season).

Successful films starring animals are nothing new, but currently it is the combination of animals and Antarctica that is generating considerable public interest. While these films may be designed primarily as entertainment, they have sparked intense political debates. *March of the Penguins* created controversy in the US when the religious right championed the film's subjects as models of proper parenting and proof of Intelligent Design. Environmentalists were frustrated by its failure to mention the threat that climate change posed to Antarctic wildlife. *Happy Feet*, by contrast, was criticised in some circles for wearing its environmental message on its sleeve.

While the recent flurry of films has raised the profile of Antarctic animals (particularly penguins) to an unsurpassed level, it draws on a rich tradition of cultural engagements with the continent's fauna. One of English literature's best-known works, Samuel Taylor Coleridge's 'Rime of the Ancient Mariner' (1798), pivots on the mistreatment of an Antarctic animal – an albatross. Both native and introduced animals play central roles in famous narratives of Antarctic exploration: Apsley Cherry-Garrard's *Worst Journey in the World* revolves around a quest for Emperor penguins' eggs, and historians argue endlessly about the consequences of Robert

Antarctic animals in popular culture

F. Scott's reluctance to use (and then eat) dogs in his fateful polar journey. More recently, Antarctic wildlife has become a popular topic of television nature documentaries, such as David Attenborough's *Life in the Freezer* (1993). The current craze for Antarctic animals is the latest episode in a long and complex cultural history.

How do books and films influence public attitudes towards animals in the far south? What kinds of stories do we tell about our encounters with animals in the Antarctic, and how have these stories changed over the last few centuries? In what ways do highly popular texts, such as *Happy Feet* and *March of the Penguins*, affect our treatment of Antarctic animals? To what extent might they impact upon policy decisions?

Happy feet: emperor penguins and other Antarctic animals have inspired numerous films. How do these films influence our perceptions of these animals, our treatment of them and our policy decisions?

An interdisciplinary team of researchers will be investigating these questions over the next three years as part of a project entitled *Creatures of the Ice: A Cultural Analysis of Human-Animal Relations in Antarctica*, funded by a $137,000 Australian Research Council Discovery Grant. The team consists of Professor Helen Tiffin and myself, both from the School of English, Journalism and European Languages at the University of Tasmania, and Australian Antarctic Division biologist Dr Steve Nicol.

Professor Tiffin is an internationally known literary critic who, over the last decade, has turned her attention to representations of animals in literature and culture. I am a past recipient of an Australian Antarctic Arts Fellowship, and completing a book entitled *Fictions of the Far South: Imagining Antarctica*. Dr Nicol will act as a partner investigator in the project, providing expert scientific advice and suggesting ways in which the research might draw from and potentially feed into policy.

The project's scope is ambitious: we will survey a range of genres, including popular science books and articles; exploration accounts; diaries, published and unpublished; travel narratives; feature articles in the media; documentaries and films; and literary texts. We will look not only at animals native to Antarctica, but also those that humans have (until recently) brought with them. Dogs have been an important part of human occupation in Antarctica, particularly in its initial stages, but the early explorers didn't stop there: ponies, cows, cats, rabbits, squirrels, pigs, guinea pigs and pigeons all went along for the ride. They played an important role in exploration, both as companions and as resources.

Animals are central to the human experience of Antarctica; surveys have shown that wildlife is the number one drawcard for tourists. However, most people will never see Antarctic animals in their native habitat. What they will encounter are highly mediated, textual representations of these animals on page and screen. By examining these representations, *Creatures of the Ice* aims to deepen our understanding of humanity's relationship with the Antarctic continent.

ELIZABETH LEANE
University of Tasmania

Elizabeth with Adélie penguins during her 2003-04 Arts Fellowship.

MONITORING AUSTRALIA'S OCEANS

As climate change and over-fishing take their toll on ocean ecosystems, an ambitious new five-year project is underway to monitor physical ocean changes and track the movement of sea creatures around Australia.

The IMOS will monitor physical ocean changes and track the movement of sea creatures around Australia. In the Southern Ocean - perhaps the most difficult of the world's oceans to observe and understand – monitoring will provide insights into the speed of change in ocean temperature, salinity and chemistry.
GBROOS – Great Barrier Reef Ocean Observing System; STIMOS – Subtropical IMOS; NSW IMOS – New South Wales IMOS; SAIMOS – South Australian IMOS; WAIMOS – West Australian IMOS

The $94 million Integrated Marine Observing System (IMOS), headquartered at the University of Tasmania, will use a battery of high-tech instruments and infrastructure to monitor Australia's coastal and 'bluewater' open oceans for information that will support research on critical marine issues facing Australia, including the role of oceans in climate variability and change, and the sustainability of marine ecosystems.

Among the instruments to be used are:

- A fleet of Argo robotic floats, to measure temperature, salinity and currents in the upper 2000 m of ocean;
- High frequency coastal radars to observe inshore currents;
- A fleet of 'gliders' – autonomous underwater vehicles – to monitor boundary currents such as the Leeuwin and East Australian currents;
- Lines or 'listening curtains' of acoustic receivers to monitor the movement, mortality and predator-prey interactions of fish tagged with acoustic transmitters, off the coasts of Western Australia, South Australia and New South Wales;
- Shallow water moorings around the country to measure temperature, salinity and other ocean properties.

IMOS Director, Dr Gary Meyers, said the technology will be delivered through 11 facilities, including Argo Australia, the Australian Coastal Ocean Radar Network, and the Australian Acoustic Tagging and Monitoring System. Information will be channelled through eMarine Information Infrastructure, based at the University of Tasmania, and will be freely available to researchers.

IMOS is being run in collaboration with CSIRO and involves 27 partners from Australian and international research institutions. Australian Antarctic Division scientists will contribute to the project through their involvement in related marine science activities, such as the Australian continuous plankton recorder survey (see page 13).

The project is supported by $55.2 million from the Australian Government's National Collaborative Research Infrastructure Strategy and a further $39 million from in-kind partner contributions.

WENDY PYPER
Information Services, AAD

More information www.imos.org.au

Southern Ocean plankton surveys are blooming

Since 1991 the Southern Ocean Continuous Plankton Recorder Survey (SO-CPR) has been monitoring changes in plankton distribution patterns, as an early warning indicator of changes in the health of Southern Ocean ecosystems.

The survey was initiated by Australian Antarctic Division scientists and initially operated between Hobart and Australia's three Antarctic stations. Since 1999 tows have also been conducted from Japanese research vessels, during resupply of Syowa station and other opportunistic voyages.
In 2004, Germany joined the survey effort with tows from their research vessel, *Polarstern*, between Cape Town and Antarctica (see map, page 14).

The importance of this work in detecting and monitoring natural and human-induced changes in the biological systems of the Southern Ocean was acknowledged in 2006, when the international Scientific Committee on Antarctic Science (SCAR) formally recognised the SO-CPR Survey as an official SCAR project. The Committee also established an Action Group on CPR research to oversee the development and expansion of the CPR Survey in Antarctica, and help to improve access for users of the data.

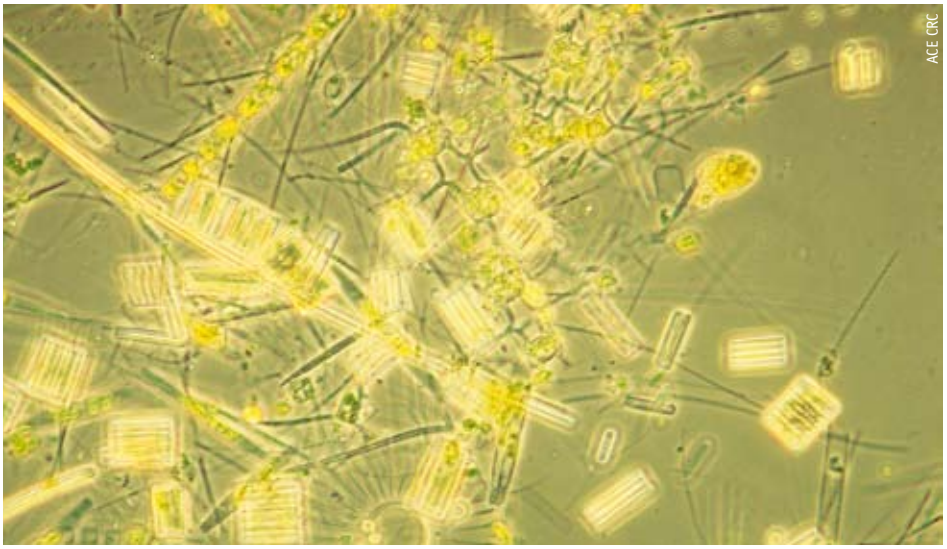
Already, New Zealand has joined the Survey, with tows between New Zealand and the Ross Sea, and the British Antarctic Survey is towing CPRs in the South Atlantic, to South Georgia and South Orkney. This extends the Survey range from Drake Passage east to Ross Sea, or about 70% of the Southern Ocean.

The Australian Antarctic Division is also working with France to add *l'Astrolabe* to the CPR fleet, in support of both SO-CPR and AusCPR (page 13). By the end of the International Polar Year in 2009, we plan to include the South American chapter of the Census of Antarctic Marine Life – the consortium of Brazil, Uruguay, Argentina, Chile, Peru and Ecuador – as regular CPR partners. The United States has also expressed its interest in towing CPRs.

GRAHAM HOSIE
Director SCAR SO-CPR Survey, AAD

Australian plankton survey

A new plankton survey will provide critical information on the current status of these important microscopic marine plants, in Australian waters.



Plankton, which includes phytoplankton (microscopic marine plants) are sensitive to small changes in the marine environment, making them useful early warning indicators of changes the health of ocean ecosystems.

Much of the Integrated Marine Observing System (IMOS) will be dependent on a suite of high technology instruments such as robotic floats, autonomous profiling gliders and mooring systems (see page 12). However, IMOS will also use 1930s technology in the form of continuous plankton recorders (CPR) towed behind ships, to monitor changes in plankton patterns.

Plankton are particularly sensitive to subtle changes in their environment, which makes them useful early warning indicators of the health of ocean systems. CPRs have proven to be the most cost effective and reliable methods for rapidly and repeatedly surveying large ocean systems. They have identified significant changes in the plankton of the North Sea, North Atlantic and North Pacific, long before indications were observed at other levels of the food web. The Southern Ocean CPR (SO-CPR) Survey (see page 12), developed by Australia and Japan, has been running since 1991 and has also detected substantial changes in the plankton.

There have been few plankton studies or monitoring programmes in Australian waters. Through IMOS, however, we have received AU$1.7 million over five years to support two new Australian CPR (AusCPR) runs – across the Tasman Sea, and between Hobart and the French Antarctic station Dumont d'Urville (see map, page 14).

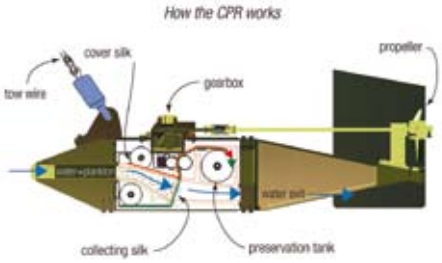
The Tasman Sea route will traverse the East Australia Current (of *Finding Nemo* fame). This region is forecast by global climate models to experience a high degree of warming in the Southern Hemisphere over the 21st century. For the Southern Ocean route we will use the French resupply ship l'Astrolabe, which makes numerous runs each season from October to March. This route will also support the SO-CPR Survey. AusCPR will also complement existing monitoring programmes on these routes that collect information on phytoplankton (via pigments), carbon dioxide, and chemical and physical oceanographic patterns.

It is hoped that AusCPR will forge strong collaborative links with the Sir Alister Hardy Foundation for Ocean Science, which coordinates the northern hemisphere surveys, and with the SO-CPR Survey, to produce a more effective global plankton monitoring programme.

Over the next five years AusCPR will produce unprecedented knowledge of the composition, distribution, seasonality and relationship of plankton to other oceanographic patterns in Australian waters. In the years to come, this information will provide a rare baseline in the region in order to assess the effects of climate change on the marine food web. The first tows are expected to commence by the end of 2007.

GRAHAM HOSIE
Co-director AusCPR, AAD

ANTHONTY RICHARDSON
Co-director AusCPR, CSIRO



When the Continuous Plankton Recorder is towed behind the ship, sea water and its associated plankton enters the device through a small opening in the nose cone. This opening expands into a wider collection tunnel, slowing down the water flow. The plankton are trapped between two layers of very thin (270 µm) mesh silk which then wind around a spool inside a chamber filled with a preserving fluid. Each tow represents 450 nautical miles (830 km) of continuous sampling. Back in the laboratory, the two layers of silk are unrolled and cut into sections representing five nautical mile samples. Plankton are then identified and counted under the microscope.

Collaborative East Antarctic Marine Census

A tri-nation survey of the plankton, fish, benthos (sea-floor life) and oceanography is underway in the waters off the East Antarctic coastline.

The Collaborative East Antarctic Marine Census, or CEAMARC, involves scientists from Australia, Japan and France, and forms part of a major Australian Antarctic Division-led project for the International Polar Year – the Census of Antarctic Marine Life (*Australian Antarctic Magazine* 12: 6-7).

The collaborative census aims to understand the processes that have lead to the evolution and survival of marine life existing in the region today, so that scientists can predict how these organisms may respond to future climate-related changes in their environment.

CEAMARC leader, Dr Graham Hosie, of the Australian Antarctic Division, says the census region, adjacent to Terre Adélie and George V Land in Antarctica (see map), offers some of the best conditions to study the effects of sea ice dynamics on the resident marine life, especially the krill-salp-plankton interaction and its flow-on effects to fish, penguins, seals and benthic organisms.

Of particular interest to the scientists is the diversity of fish, cephalopods (such as squid and octopus), plankton and benthic organisms below 200 m depth, and the environmental conditions in which they live.

'Some important differences in the biology and genetics of fish caught between the surface and 200 m depth were observed during previous studies in the region, suggesting divergences between populations,' Dr Hosie says.

'So we are investigating the diversity of the pelagic (open ocean) and benthic fauna, from gene to habitat level, and comparing these with similar studies in other sectors of the Southern Ocean.'

Components of the zooplankton, such as these juvenile octopus, are difficult to study because of their fragility. Video imaging will be used to study these types of animals during the CEAMARC voyage.

Understanding the fish community composition and structure is particularly important to explain the distribution of bottom- and near-bottom-dwelling fish, and the impacts of commercial trawling. The research will also help scientists understand how communities have adapted to the unique Antarctic environment.

The census will also target different zooplankton (free drifting marine animals) ranging from gelatinous zooplankton, such as jelly fish, to mesozooplankton (0.2-20 mm in size) and deep water zooplankton. Many of these organisms have been poorly studied and some are difficult to sample and preserve because of their fragility.

To overcome this problem, the census is using video imaging to observe gelatinous zooplankton and cephalopods. More traditional sampling equipment, such as plankton nets, beam trawls, benthic sleds and sediment grabs will be used to sample more robust organisms.

The census will be conducted from three ships: Australia's *Aurora Australis*, Japan's *Umitaka Maru* and France's *l'Astrolabe*. The ships will also be used to collect oceanographic data for another International Polar Year project and to sample plankton on route for the Southern Ocean Continuous Plankton Recorder Survey (see page 12).

All data collected will be transmitted to the Scientific Committee on Antarctic Research Marine Biodiversity Information Network (www.scarmarbin.be) – the central repository for the Census of Antarctic Marine Life.

WENDY PYPER
Information Services, AAD

This map shows the Southern Ocean Continuous Plankton Recorder Survey tows that will be conducted during the International Polar Year (page 12) and the countries that will undertake the tows. Results from the tows will contribute to the Census of Antarctic Marine Life, a major Australian-led IPY project. Dotted lines show the proposed survey tracks for the Aus-CPR survey (page 13). The blue circle shows the sampling area of the Collaborative East Antarctic Marine Census.

REBUILDING THE OZONE LAYER

International Ozone Day on 16 September this year marked the 20th anniversary of the Montreal Protocol on Substances that Deplete the Ozone Layer – arguably the world's most successful multilateral environmental agreement.

The Montreal Protocol limits the production and release of certain human-made substances that trigger damage to the protective blanket of ozone in the stratosphere (10-50 km above the Earth's surface).

Over the past 30 years the action of such chemicals and the special meteorological conditions found in the winter polar stratosphere, particularly over Antarctica, have resulted in dramatic episodes of enhanced ozone destruction during spring – and the formation of the 'ozone hole'. The scientific study of this phenomenon in the 1980s provided the basis for the swift cooperative action that lead to the Montreal Protocol.

After 20 years of international action there has been a 95% reduction in global emissions of ozone depleting substances and there are initial indications of ozone recovery in certain parts of the atmosphere. However, the international scientific community is still intensively examining human influences on ozone to ensure that we can accurately assess the state of the atmosphere and the effectiveness of our actions.

During this, the International Polar Year (IPY), the 'ORACLE-03' project (also know as 'Ozone layer and UV radiation in a changing climate evaluated during IPY') will conduct extensive measurement and modelling studies of ozone in the Antarctic and Arctic (*Australian Antarctic Magazine* 12: 12-13). The Antarctic measurements include a network of nine stations that are measuring the vertical distribution of ozone with balloons – with Australia's Davis station contributing ozone and other atmospheric measurements to the project.

ANDREW KLEKOCIUK
Ice, Ocean, Atmosphere and Climate programme, AAD

MANDY McKENDRICK
Information Services, AAD

More information Montreal Protocol: http://ozone.unep.org/index.shtml
ORACLE-03 project: www.awi-potsdam.de/www-pot/atmo/ORACLE-03/

First harbingers of ozone depletion detected

The first Polar Stratospheric Clouds (PSC) for 2007 were detected over Davis, Antarctica, by Australian Antarctic Division lidar scientist, Didier Monselesan, in May. PSCs promote chemical changes in the atmosphere that lead to the depletion of the ozone layer over Antarctica each year. They occur only at high polar latitudes in winter, when temperatures in the stratosphere (8-50 km above ground) fall below about -85°C.

Average temperatures in the Antarctic lower stratosphere were below average at the time of the sighting – as they were in 2006 when persistently low winter temperatures led to record levels of ozone destruction.

Although invisible to the eye, the PSCs were detected by the Davis atmospheric lidar. The lidar uses pulsed light from a powerful laser to map clouds and measure atmospheric temperatures. The PSCs first appeared on May 28 as a thin layer at an altitude of 22 km.

In the accompanying lidar image, the sloping wavy features in the cloud layer arise from a rising and falling motion due to atmospheric waves propagating up from the lower atmosphere. Based on the prevailing temperatures and characteristics of the lidar measurements, it is likely that the PSCs consisted of micron-diameter particles comprised of an icy mixture of water with nitric acid and sulphuric acid.

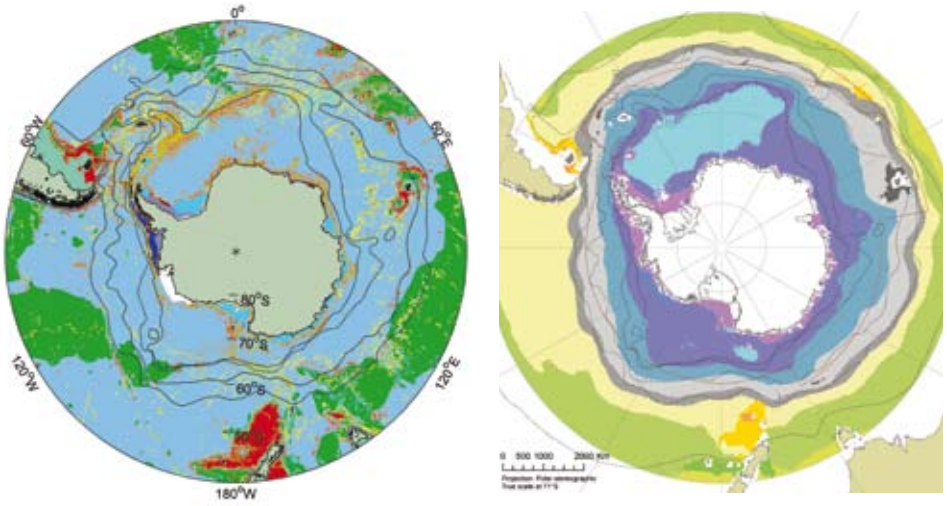
A photograph taken by Didier on the same evening shows the green laser beam of the lidar, the green arcs of the aurora australis (right side of image) and a waxing moon. Also visible are a few wispy stratus clouds at an altitude of about one kilometre.

ANDREW KLEKOCIUK and DIDIER MONSELESAN
Ice, Ocean, Atmosphere and Climate programme, AAD

More information
www.aad.gov.au/default.asp?casid=222

DEFINING BIOREGIONS FOR BIODIVERSITY CONSERVATION IN THE SOUTHERN OCEAN

Marine Protected Areas (MPAs) are a hot topic in the conservation world. They are used to protect important areas by controlling the types of activity that can take place within their borders – such as fishing. 'Comprehensive, adequate and representative' are the fundamental principles for a system of MPAs, with the ultimate goal being to protect marine biodiversity.



These figures illustrate the results of the process of defining benthic (sea floor; left) and pelagic (open ocean; right) bioregions in the Southern Ocean. Areas sharing the same colour have similar combinations of physical characteristics and are likely to share similar biological communities. As no two areas are exactly the same, we have to decide how many groups to show on the map – in these cases we have shown 20 groups.

But how do you know where to locate MPAs if you want representative coverage? A crucial first step in any systematic conservation plan is to define the 'bioregions' – geographic areas that are relatively distinct in terms of the complement of species inhabiting them. In some parts of the world this can be relatively straightforward – consider the difference between forests and grasslands. But how do you identify such differences in the vast expanse of the Southern Ocean, extending to depths of thousands of metres? Quite a challenge!

Defining bioregions in the Southern Ocean was the goal of a recent workshop held in Brussels, Belgium, as a joint initiative of the Commission for the Conservation of Antarctic Living Marine Resources (CCAMLR) and the Antarctic Treaty's Committee for Environmental Protection (CEP). Two earlier workshops had discussed the role of MPAs within the CCAMLR area and developed a proof of concept for defining bioregions. Our task now was to put some meaningful lines on maps.

The first major step was to separate the surface waters (pelagic zone) from the seafloor (benthic zone), as species living attached to the seafloor, or close to it, represent a different biological community from those freely swimming in the water column. There is limited information about what species occur where in the Southern Ocean, but it is possible to use physical characteristics – such as temperature – as proxies for biological communities and ecosystem processes. These physical characteristics have a strong and defining influence on where species live, forage or breed.

Workshop participants analysed combinations of temperature (surface or seafloor), depth, nutrient concentrations and sediment type, to group similar areas together. The end result was a set of maps covering the CCAMLR area and showing the considerable variation of the physical environment in space. These are likely to reflect variation in where different biological communities may occur.

These maps provide sufficient detail to guide MPA planners, particularly in identifying areas representing many different habitat features. Knowledge of bioregions, together with considerations of size, shape and connectivity between MPAs, will now feed into a separate process to identify and design representative MPAs in the Southern Ocean.

Care will be needed to manage small-scale activities, such as fishing, in the Southern Ocean, so as not to prejudice future conservation options while the MPA boundaries are determined. To identify these boundaries we will need to consider how biological communities might vary in relation to the physical features and how the biodiversity might best be represented within an MPA. A number of sophisticated techniques are available to do this, some of which were explored at the workshop.

Reports on this work were submitted to the 26th Meeting of CCAMLR in October and were welcomed by CCAMLR as a significant advance in our understanding of the Southern Ocean. Further work, including finer-scale definition of bioregions, and consideration of MPA selection, will be undertaken in 2008 through the Working Group on Ecosystem Monitoring and Management.

KEITH MARTIN-SMITH
Southern Ocean Ecosystems programme, AAD

More information
www.environment.gov.au/coasts/mpa/index.html

Biological prospecting in Antarctica

The growth of genetic and biochemical research techniques has stimulated interest in 'biological prospecting' – the search for useful and beneficial compounds and gene sequences hidden in the world's extraordinary biodiversity.


MARTIN RIDDLE

Biological prospecting of Antarctica's biodiversity, such as these marine creatures under the sea ice near Casey, has become a hot discussion topic for Antarctic Treaty Parties.

Some of these compounds have surprising applications, and a ready market can await those who isolate them and establish a commercial use. Lucrative applications can be found, for example, in medicine, pharmaceuticals, cosmetics, agriculture and food processing.

Research interest extends to Antarctica where, for example, the United Nations University – Institute of Advanced Studies (UNU-IAS) has reported Actinobacteria belonging to a genus which elsewhere has produced pharmaceutically active compounds. UNU-IAS has also reported research into a glycoprotein that may increase the tolerance of commercial plants to freezing, extend the shelf-life of frozen food, improve cryosurgery, or enhance the preservation of transplant tissues; and research into the use of cold-active enzymes from bacteria, for better detergents and cleaning agents.

While some patents involving Antarctic organisms have been granted, no windfall profits have emerged from biological prospecting in Antarctica…yet. Elsewhere, the growth in the industry is substantial and Antarctica is unlikely to be immune from significant future investment. Biological prospecting requires painstaking research and an expectation of many disappointments along the way — but the potential benefits are huge. If successful in Antarctica, the financial return could dwarf the value of tourism, which is currently the most significant commercial activity in the region.

Parties to the Antarctic Treaty must now begin to grapple with this potentially contentious activity. Some say biological prospecting is environmentally benign, has been underway in Antarctica for some years, and that it is consistent with the Antarctic Treaty and the environmental Protocol and needs no further regulation. Others say biological prospecting is a significant commercial challenge facing the region, and that it is risky if a proper regulatory framework is not in place. Discussions have drawn distinctions between the impacts of large-scale harvesting of valuable organisms, and the negligible impacts of small samples that are removed from the environment so that the biochemical properties can be identified and synthesised elsewhere.

The Antarctic Treaty System does not specifically regulate biological prospecting, although some elements of the system may be relevant. For example, the Treaty provides for the free exchange of scientific observations and results from Antarctica, and the environmental Protocol subjects all activities to prior environmental impact assessment. Some argue that biological prospecting can be managed successfully within existing rules, like any other Antarctic research, but others are not so confident.

While biological prospecting has been discussed in Treaty meetings since 2002, consideration of the issue has been intermittent and has not addressed regulatory measures. The discussions have been informed by the work of UNU-IAS and by Treaty Parties that have contributed a number of useful papers. Several potentially complex legal and political issues have been raised, and a number of related issues have been identified for further consideration. These include, for example, the question of how the potential commercial value of the research findings sits with the obligation for free exchange of the scientific results.

During the 2007 Antarctic Treaty Consultative Meeting (ATCM) in New Delhi, The Netherlands proposed discussions on a regulatory framework for biological prospecting. The Treaty Parties decided that inter-sessional work should prepare the ground for a more considered analysis of the issues at the 2008 ATCM. A contact group was established to identify issues and current activities related to Antarctic biological prospecting, to assist ATCM discussions, and recommend ways to advance the work in the future. The Netherlands will convene the group and the Treaty Secretariat will provide support, including setting up an interactive discussion forum through the Secretariat web site.

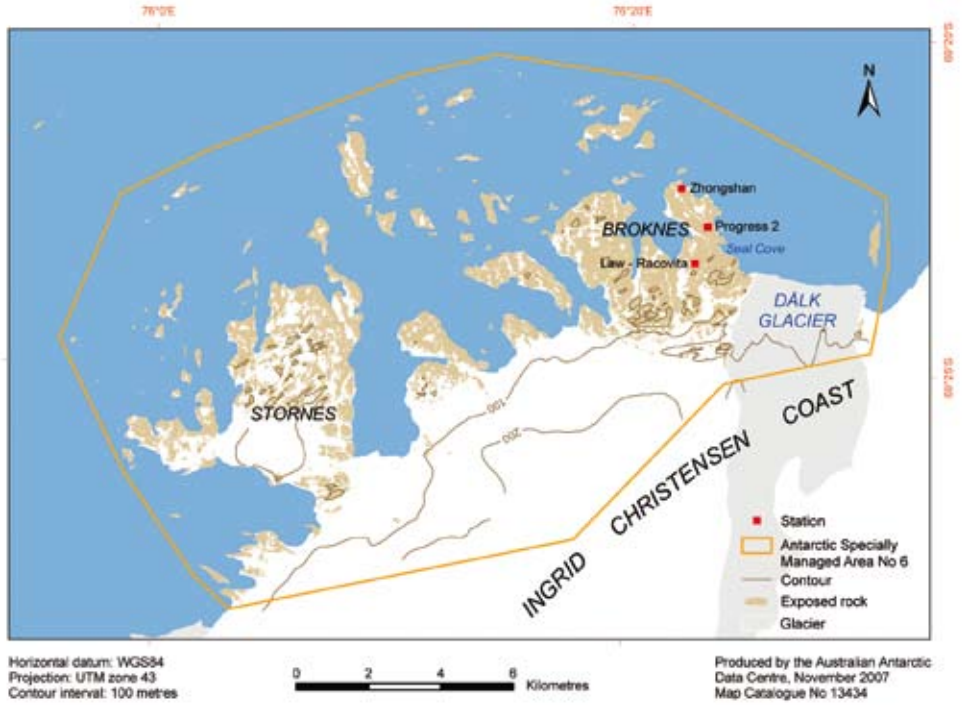
Australia has signed up for the inter-sessional discussions and will pursue the issues with interest. In Antarctica, it really may turn out to be true that great things come from (microscopically) small beginnings.

ANDREW JACKSON
Principal Policy Advisor, AAD

More information
www.ias.unu.edu/sub_page.aspx?catID=35&ddlID=20

A treasure trove of minerals disco

The Larsemann Hills was first sighted by Norwegians in 1935, but it was not until the late 1980s that detailed geological investigations commenced.



The Larsemann Hills, on the eastern shore of Prydz Bay, was first sighted by a Norwegian whaling expedition in 1935. Many prominent geographic features were named by the Norwegians, including Broknes and Stornes ('nes' meaning peninsula). Several reconnaissance geological studies were conducted in the region during the 1950s and 60s, and detailed geological investigations commenced in the late 1980s, with three nations establishing research bases on Broknes – namely Progress 1 and 2 (USSR/Russia), Zhongshan (China) and Law (Australia).

These early investigations reported large, abundant prisms of a near-black mineral, which the geologists described as 'tourmaline'. Several years later, Chinese and Australian geologists showed that the prisms, as large as piano keys, were actually 'prismatine' – a much rarer mineral containing boron and silicon (Figure 1) – and another rare borosilicate, 'grandidierite'. The rocks making up a prominent peak on central Stornes contain prismatine in such abundance that it has been named Prismatine Peak (originally called Tourmaline Peak).

In 2003-04, we found the mineral bands to be associated with nodules of the common calcium phosphate mineral, 'apatite'. Both the boron-rich rocks and the apatite contained a variety of minerals, four of which are new to science.

Boron-rich rocks

The Larsemann Hills contains sedimentary and volcanic rocks that were laid down between 900 and 550 million years ago. Some of these rocks were unusually rich in boron. The rocks were subsequently buried, 'metamorphosed' (changed from one type of rock into another) at temperatures of 800-860°C, and squeezed by tectonic forces during the collision of East Gondwana and West Gondwana some 515-530 million years ago. The resultant amalgamation formed the super-continent Gondwana. Under these conditions the metamorphic rocks melted, resulting in two other rock types, 'granite' and 'pegmatite', both of which are common in the Larsemann Hills.

Six borosilicate minerals have been found so far in the Larsemann Hills – prismatine, grandidierite, boralsilite, werdingite, dumortierite and tourmaline. The most unusual of these is boralsilite, which was discovered in the Larsemann Hills in 1998 and named for its composition, *bo*ron, *al*uminium and *sili*con.

We found boralsilite at nine localities on Stornes during the 2003-04 field season. The colourless prismatic mineral can be seen with the naked eye and recognised in the field, and is distinguished under the microscope by its striped appearance (Figure 2). Outside the Larsemann Hills, boralsilite is known only from Rogaland, Norway.

The distinctive borosilicate mineral assemblage in the Larsemann Hills is attributed to a variety of factors, including the high boron content of the source rocks and their relatively low water content, which caused an unusual enrichment of boron, but not of other elements normally concentrated in pegmatites, such as lithium and beryllium.

Apatite-associated minerals

Large brown nodules of apatite – which can be up to 10 cm across – are associated with boron-rich rocks and other rock types (Figure 3). Eight phosphate minerals have been found in apatite nodules, three of which are new and, to date, have only been found in the Larsemann Hills. The three new phosphate minerals – stornesite-(Y), chopinite and tassieite – are microscopic and very rare.

Stornesite-(Y) is a sodium-calcium-magnesium-rich phosphate, named for Stornes and for the element yttrium-(Y). Its closest relative is the yttrium-free phosphate 'chladniite' reported in two meteorites.

Chopinite is dominantly magnesium phosphate with *i*ron. It was named in honour of French mineralogist, Christian Chopin. Four sub-millimetre-sized grains were found in a single thin section of apatite.

Tassieite (Figure 3 insert) is a sodium-calcium-iron-magnesium phosphate, containing water lodged in its structure. It was named for Tassie

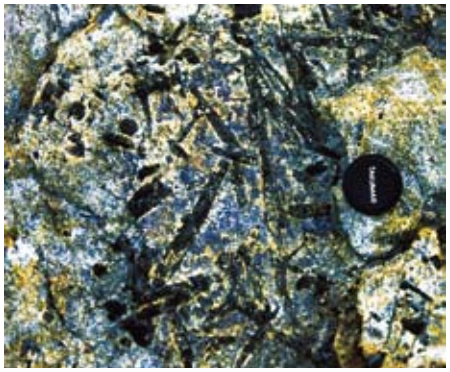


Figure 1. Prismatine (dark crystals) in cordierite (bluish matrix) near Prismatine Peak, Stornes.

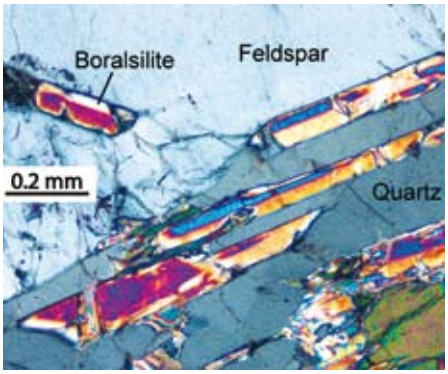


Figure 2. Photomicrograph of striped boralsilite prisms from southern Stornes, (taken with crossed polars).

vered in the Larsemann Hills

Tarn south of Johnston Fjord, which has an outline resembling that of Tasmania.

The Larsemann Hills is unique in its mineral diversity. Four new mineral species have been found, while three other minerals are known from only a handful of other locations worldwide. Several rare species are also found in unusual abundance in the Larsemann Hills. This unique mineralogy, as well as the region's other scientific, environmental, aesthetic and logistical values, has led to its recent designation as an Antarctic Specially Managed Area (see story below).

PROFESSOR EDWARD GREW
Department of Earth Sciences, University of Maine, USA

DR CHRIS CARSON
Geoscience Australia

Figure 3. Photograph of the apatite nodule (next to pen) from which the crystals of stornesite-(Y) and tassieite were extracted to determine the physical and chemical properties of the two minerals. Inset is a photomicrograph of 'type' tassieite crystals in apatite in plane-polarised light. These crystals were used to characterise tassieite as a new species. From southwest of Johnston Fjord and near Tassie Tarn, Stornes.

ANTARCTIC OASIS DESIGNATED AN 'ANTARCTIC SPECIALLY MANAGED AREA'

Antarctic coastal ice-free areas – such as the Larsemann Hills – are rare, making up less than 0.5% of the continent. The relatively favourable habitat and climate, proximity to the ocean, and availability of fresh water, mean that such 'oases' are hotspots of Antarctic biodiversity, and in demand for the conduct and support of human activities. These features create a potential for human activities to impact on the environmental qualities that make coastal ice-free areas special in their own right and valuable research sites.

Australia, China and the Russian Federation set up facilities in the Larsemann Hills in the late 1980s. Romania entered the scene a couple of years ago through an arrangement to use Australia's existing facilities, and India has recently installed some temporary huts at the location of a planned new station. Now these, and other countries, have agreed on ways to minimise the impacts from their individual and collective activities in this 40 km² region of ice-free ground and unspoiled lakes.


EWAN MCIVOR

Following its designation as Antarctic Specially Managed Area No.6, international activities in the Larsemann Hills will be formally managed to safeguard the environmental and scientific values of this coastal 'oasis'.

Over several years, Australia led work with these partner countries to prepare the required management plan to make the Larsemann Hills an Antarctic Specially Managed Area (ASMA). The ASMA designation aims to protect the Larsemann Hills environment by establishing a formal framework for close collaboration and cooperation in science, operations and environmental protection. The management plan was considered and endorsed by the 10th meeting of the Antarctic Treaty's Committee for Environmental Protection (CEP) in May 2007, in conjunction with the 30th Antarctic Treaty Consultative Meeting (page 20).

The focus has now shifted to working closely with the other countries active in the region to implement the management plan. Australian Antarctic Division representatives held productive discussions during a meeting of the Larsemann Hills ASMA Management Group in July. Priorities for future action include the collective development of comprehensive quarantine procedures, cooperation on logistics and facilities, collaborative research and monitoring, and effective exchange of information.

EWAN McIVOR
Antarctic Territories, Environment and Policy, AAD

CEP update

As well as endorsing the management plan for the Larsemann Hills, the 10th CEP meeting continued discussion of the future challenges facing Antarctica (see *Australian Antarctic Magazine* 11: 31), and endorsed a provisional five-year work plan. The plan places a high priority on actions to address the introduction of non-native species to Antarctica, possible impacts of non-governmental activities, the effects in Antarctica of global pressures, such as climate change and pollution, and development of an Antarctic marine protected areas system. Australia helped champion this new strategic approach to the Committee's work, and will remain closely involved in the efforts required to take the good ideas and goodwill from the meeting room to the ice.

ANTARCTIC DISCUSSION HOTS UP

While parts of Antarctica shivered through -40°C temperatures as winter approached last May, delegates at the 30th Antarctic Treaty Consultative Meeting (ATCM) in New Delhi sweltered in +40°C.


ANDREW JACKSON

The Australian delegation to the ATCM and CEP meeting comprised representatives of the Department of Foreign Affairs and Trade, Australian Antarctic Division, Tasmanian Government, WWF Australia and University of Tasmania.

Despite the heat, both the ATCM and the preceding meeting of the Committee for Environmental Protection (CEP) were productive. On Australia's agenda were further measures to protect the Antarctic environment, improvements in the management of Antarctic tourism, and actions to strengthen the Antarctic Treaty.

As a result of the CEP meeting – which included environmental impact assessments for India's proposed station in the Larsemann Hills – management plans were adopted by the Treaty Parties for Antarctic Specially Managed Areas in the Larsemann Hills (page 18) and at the South Pole.

Discussions on Antarctic tourism focused on passenger vessel safety, site guidelines and the potential impacts of tourism. The ATCM adopted a resolution recommending that Treaty Parties discourage tourism that may substantially contribute to long-term degradation of the Antarctic environment. Also adopted were site guidelines for another two frequently visited sites in the Antarctic Peninsula; and a resolution discouraging landings from vessels carrying more than 500 passengers, and restricting the numbers of passengers ashore at any one time.

The full report of the New Delhi meeting can be found at the Treaty website: www.ats.aq. It includes the report of the CEP and the text of the Measures, Resolutions and Decisions adopted. The next ATCM and CEP meeting will be hosted by Ukraine in Kiev in June 2008.

ANDREW JACKSON
Principal Policy Advisor, AAD

Australian tourists in Antarctica

Tourism offers an opportunity for people other than scientists and support workers to see Antarctica.


STEPHEN POWELL

Antarctic tourists can now choose from a range of non-traditional tourism experiences.

It is now a regular and substantial activity in Antarctica, with a wide diversity of experiences on offer. The Australian Government, Australian companies and Australian travellers are prominent in the tourism industry and its management.

Australians are particularly keen to visit Antarctica. Of the 37 552 visitors to Antarctica in the 2006-07 season, some 2950 (8%) were Australian – a figure out of all proportion to our population, and an indication of the appeal of Antarctica to the Australian imagination.

Some Australian companies operate tours direct from Australia to Antarctica, while others visit from ports in other nations. Compared to the Antarctic Peninsula, which is close to South America, the Australian Antarctic Territory (AAT) is still a challenging place for tourist visits, due to the long distances and sometimes stormy seas that must be traversed.

One place in the AAT visited regularly is Mawson's Hut Historic Site at Commonwealth Bay – the 'home of the blizzard', and the first base for Australians embarking on scientific and geographical discovery in Antarctica. The importance of this site to Australia's heritage is acknowledged in its place on the National Heritage List. The AAT can also be viewed from above, with overflights of passenger aircraft providing a unique perspective on the icy continent. Voyages from Australia visit the Ross Sea region too – a place with many links to the heroic era of polar exploration and the quest to reach the South Pole.

Antarctic tourism has traditionally involved ship travel, with small boat excursions for wildlife viewing. Australian companies have, however, been active in offering visitors non-traditional experiences, including diving, sea kayaking, climbing, photography and camping; while yachts offer passengers longer and more adventurous trips, or support expeditions for science, mountaineering, and even film crews.

For more information see www.aad.gov.au, and follow the links to 'experience Antarctica' and 'tourism'.

PHIL TRACEY
Policy Advisor, AAD

Weather beaten hut given extra protection

A six-man conservation team spent Christmas 2006 finishing a major task in the ongoing restoration and conservation of Mawson's Huts at Cape Denison.

Overcladding the roof of Mawson's Main Hut with Baltic pine boards. SIMON MOSSMAN

The team over-clad the roof of the living section of the main hut with Baltic pine boards – the same material it was built from in 1912. Over-cladding the roof protects the original boards, which remain in place, while the new boards will stop snow and ice penetrating the roof and causing further damage.

The team – provided by the Mawson's Huts Foundation and supported by the Australian Antarctic Division and commercial sponsorship – completed around 90 percent of the task of preventing the snow from entering the building. The last conservation effort was in late 2005, when snow and ice were removed from inside the hut.

The team also brought back the original 1.6 m Oregon pine pole from the roof of the living quarters. The pole was used to hoist the British flag in honour of King George V during the Australasian Antarctic Expedition (AAE) of 1911-1914. Windborne ice had eroded the pole to about half its original thickness and it was in imminent danger of being snapped off and blown out to sea by the regular hurricane-force winds at Cape Denison. The flagpole was removed for conservation and replaced with a replica, which will stand in its place until the original can be safely returned.

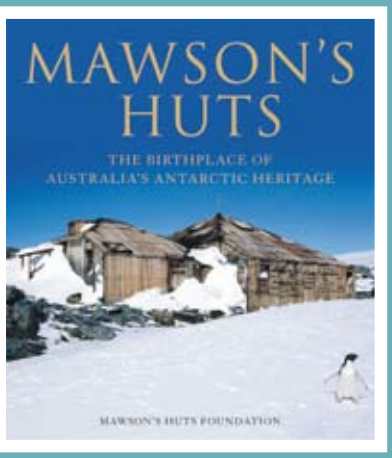
Plans are now underway for the next conservation phase – excavating and cataloguing thousands of artefacts left behind by the AAE, as well as maintenance on the buildings.

The shift in focus from urgent structural repairs to maintenance and archaeology is an opportune time for the Australian Antarctic Division to develop a new management plan for the site. Since the previous management plan, which guided on-site work from 2001 to 2006, the site has been listed as a National Heritage place and a Commonwealth Heritage place, and included in an Antarctic Specially Protected Area and an Antarctic Specially Managed Area, under the Antarctic Treaty. The new plan meets the requirements of these recent designations, extends the conservation principles that underpin on-site work, and sets up key phases of work in the lead-up to the site's centenary in 2012.

A draft management plan was available for public comment in July and August 2007, and will be launched before the next conservation expedition in December 2007.

Conservation of Mawson's Huts is expected to continue through public-private partnerships (as was Douglas Mawson's own expedition nearly a century ago). In May 2007, the Australian Government announced that the public purse will continue to fund on-site conservation through a $1.3 million grant to the Mawson's Huts Foundation. The Foundation, in turn, will raise additional funds.

STEPHEN POWELL
Antarctic Territories, Environment and Policy, AAD



Historic book

A photographic history of Sir Douglas Mawson's Australasian Antarctic Expedition (AAE), and the historic huts used by the men at Cape Denison, will be published in May 2008 to raise funds for the conservation of the Cape Denison site.

The 192-page coffee table book, *Mawsons's Huts: The birthplace of Australia's Antarctic heritage*, contains over 200 images, including the largest published collection of photographs taken by the expedition's official photographer, Frank Hurley, and other members of the AAE. The book also contains a brief history of Mawson's expedition, biographical details of the men, and never before seen letters. The book is produced by the Mawson's Huts Foundation in partnership with the Australian Antarctic Division.

A limited leather-bound edition signed by Mawson's seven grand children can be ordered for AUS$400, plus freight, and will include a limited edition print of a painting by either Alasdair McGregor or Angus McDonald – artists and members of previous conservation expeditions. Standard editions of the book are available for AUS$95. Copies can be ordered through www.mawsons-huts.org.au.

Is snowfall in Antarctica linked to rainfall in Australia?

Research into snowfall variability at Law Dome, just inland from Casey station, suggests that it may be linked to climate in the Australian sector of the Southern Ocean and south-west Western Australia.

Law Dome is directly south of Western Australia and is the most northerly continental point in East Antarctica. This location gives Law Dome a strong maritime climate and a very high snow accumulation rate – equivalent to around 64 cm of water per year. Ice cores drilled at Law Dome provide a record of annual variations in snowfall that can presently be extended back over seven centuries. This record can be compared with meteorological data in the recent past.

Early results show that the snowfall at Law Dome is significantly inversely correlated with the climate at mid-latitudes, extending as far as southern Australia. These results may shed light on recent changes in southern Australian climate, such as the declining rainfall in south-west Western Australia. Further work is underway to explore these connections and understand the reasons behind them.

TAS VAN OMMEN
Ice, Ocean, Atmosphere and Climate programme, AAD


GRANT DIXON

Snowfall variability at Law Dome may be linked to climate in south-west Western Australia.

NEW REGULATIONS FOR AN EXPANDING KRILL FISHERY

The October meeting of the Commission for the Conservation of Antarctic Living Resources (CCAMLR), resulted in a new regulatory regime for the rapidly expanding Southern Ocean krill fishery.

With the world's fish stocks dwindling, attention has turned to the largest underexploited fishery – the Antarctic krill fishery – which is predicted to become one of the world's largest fisheries. To deal with this increasing pressure, CCAMLR Members agreed that krill vessels fishing in CCAMLR waters must participate in the CCAMLR vessel monitoring system (*Australian Antarctic Magazine* 7: 32), and that vessels operating in waters off eastern Antarctica must have observers aboard.

New measures will also require:

- more rigorous notifications to participate in the krill fishery, to ensure that CCAMLR can implement management measures appropriate for the level of fishing effort;
- more frequent reporting of krill catches so that the fishery can be closed before the new trigger level is reached; and
- introduction of additional management tools to ensure the sustainability of the Southern Ocean ecosystem prior to the fishery reaching its full potential.

The annual precautionary catch limit for the CCAMLR fishery off the coast of eastern Antarctica has been increased from 450 000 tonnes to 2.645 million tonnes, based on scientific advice from a 2006 Australian survey of krill in the area. The survey obtained an estimated biomass of 28.75 million tonnes, which could sustain a 2.645 million tonne krill fishery and still allow for the feeding requirements of penguins, seals and whales.

GILL SLOCUM,
Antarctic Territories, Environment and Policy, AAD

SO KAWAGUCHI,
Southern Ocean Ecosystems programme, AAD


GAVIN JOHNSTONE

Krill vessels fishing in CCAMLR waters must participate in the CCAMLR vessel monitoring system.

Pesticides found in penguin colonies

New research has found that Adélie penguin colonies in Antarctica magnify the contamination of surrounding soil with toxic pollutants originating from other parts of the world.

These 'persistent organic pollutants' include pesticides such as DDT and chlordane, and cooling and insulating fluids like PCBs (polychlorinated biphenyls). These chemicals are manufactured and used in warmer regions of the world, where they evaporate, get transported through the atmosphere, and then condense over cooler regions, including Antarctica.

Now an international team of scientists, including Dr Martin Riddle from the Australian Antarctic Division, has found that Adélie penguins, which spend all their life in Antarctica, also contribute to the 'concentration' of persistent organic pollutants in their local environment. The pollutants are concentrated in the bodies of animals through a process known as 'biomagnification' – where the levels of chemicals, present at low concentrations in the environment, gradually increase as they are passed up the food chain – and are then excreted.

The scientists analysed soil samples from around three Adélie penguin colonies at Hop Island, near Davis, and three Antarctic reference sites away from any penguin activities. They found the concentrations of persistent organic pollutants to be 10-120 times greater in samples from the penguin colonies, compared to the reference sites. The concentrations of DDT and chlordane, for example, were 70 and 120 times greater, respectively, in the penguin colony samples. The scientists also found high concentrations of the pollutants in penguin eggs.

'Because the penguins do not travel outside the Antarctic region, it is clear that they are concentrating pollutants that have already been transported into the region, through water or atmospheric deposition, and then further concentrating them when they come together in large numbers at their breeding sites,' Dr Riddle says.

'By concentrating these chemicals they are creating local "hot spots" of contamination.'

A comparison of Antarctic soil samples with Arctic soil samples, however, has shown that overall levels of the pollutants are lower in Antarctic soils.

Global transport by evaporation and condensation is a one-way means of transferring persistent organic pollutants to the cold parts of the planet. Dr Riddle says this new information significantly adds to the overall picture of where in the global environment these persistent contaminants will eventually end up.

WENDY PYPER
Information Services, AAD


MATT LOW

Persistent organic pollutants are concentrated in the soil around Adélie penguin nests and in the birds' eggs.

More information

L. Roosens, N. Van Den Brink, M. Riddle *et al* (2007). Penguin colonies as secondary sources of contamination with persistent organic pollutants. *J. Environ. Monit.*, 9: 822-825.

Pesticides found in penguin colonies: www.aad.gov.au/default.asp?casid=33775


Hop Island in Antarctica, where the scientific study was conducted.
JUDY CHAPPELL

NEW AUSTRALIAN MARINE MAMMAL PROJECTS

Technology development is a feature of many of the new marine mammal projects to be undertaken in 2008 through the Australian Centre for Applied Marine Mammal Science (ACAMMS) – based at the Australian Antarctic Division. Eleven projects, worth $790 000, were approved by the Australian Government in late 2007. They follow on the heels of 15 projects undertaken during the Centre's first year of operation (*Australian Antarctic Magazine* 12: 29-31).

All projects have to address at least one of four priority research areas, one of which is the development of powerful, new, non-lethal technologies and methodologies to support marine mammal conservation and management. The following articles on pages 24-26 highlight three such technology-driven projects.

Other projects to be conducted in 2008 include:

- A census of Australian fur seal pups;
- Investigating the movement patterns and population size of Western Australian pygmy blue whales;
- Using aerial and land-based surveys to determine the population status of Western Australian humpback whales; and
- Determining the diet of Australian fur seals through DNA analysis of faeces.

The ACAMMS supports research that focuses on understanding, protecting and conserving marine mammals from tropical, temperate and Antarctic waters. The work is critical to the Australian Antarctic Division's broader research and advisory role within the Department of the Environment and Water Resources. More information about ACAMMS research can be found at www.aad.gov.au/acamms.

AMANDA HODGSON, UQ

Humpback whale identi-kit more than a fluke

Just as humans can be identified by their facial features, humpback whales have identifying features on their tails or 'flukes'.

Captured on film, these features can be used by biologists to estimate the abundance of whales and to monitor individuals in a population year after year. Tens of thousands of photos of the flukes of Southern Hemisphere humpback whales have been taken over the years, providing an incredible database of information. But as the number of photos increases, so does the difficulty of manually comparing images to find a match.

Through the Australian Centre for Applied Marine Mammal Science, Dr Eric Kniest, of the University of Newcastle, and Professor Peter Harrison and Mr Daniel Burns, of the Southern Cross University Whale Research Centre, will complete development of the first computerised fluke matching system for humpback whales in Australia and the South Pacific region.

The system will standardise each fluke image for computer matching – scaling and rotating images onto a common reference system. This means that photos taken from different angles, at different distances, or with water obscuring parts of the fluke, will all fit a standard template. The database will also record visual and measurable elements of each fluke, such as the pattern of black and white patches, the distance between the fluke tips, and the shape of the fluke tips. When a new photo needs to be matched against those in the database, researchers will simply need to enter information on some of these common visual or measurable points.

'There will also be scope to include additional features in the database, such as scratches, to improve the matching process,' Dr Kniest says.

In a database of 1000 flukes, the photo-identification matching system will take only a few minutes, compared to up to an hour for an experienced operator comparing photos manually.

A working version of the system has already been developed through a previous pilot study in 2004, but will now be refined for more efficient searching of larger fluke catalogues. In the future, Dr Kniest says the system could be adapted for Northern Hemisphere humpback populations and other whale species.

WENDY PYPER
Information Services, AAD

JOSHUA SMITH AND MICHAEL NOAD

A computerised fluke matching system will reduce the time needed to match fluke photos in large databases from hours to minutes.

POPULATION SURVEY PILOTS UNMANNED AIRCRAFT

Robotic aircraft or 'Unmanned Aerial Vehicles' (UAVs) could soon take to the skies in the name of marine mammal research, if a pilot project to test the technology succeeds.

JOSHUA SMITH AND MICHAEL NOAD

Through the Australian Centre for Applied Marine Mammal Science, Dr Amanda Hodgson and Dr Michael Noad, of the University of Queensland, will conduct and compare traditional manned and UAV surveys of dugongs and humpback whales, to test whether UAVs can improve the safety, cost-effectiveness and accuracy of marine mammal population surveys.

'Aircraft hire and personnel costs mean that traditional manned aerial surveys are expensive, and eight people have died over the past 20 years after aircraft crashed during aerial surveys,' Dr Hodgson says.

'So we want to determine whether UAVs offer a better way of monitoring marine mammal populations, by reducing the cost and the risk, and by increasing the accuracy of species detection, location and identification using on-board imaging technology.'

UAVs have been around since the 1950s and developed for a range of applications including defence, weather research, and search and rescue. They are largely untested in wildlife research, but they have the potential to be used at night – with infrared cameras attached – or in extreme environments. Their lower cost would also enable more aerial surveys to be conducted, improving population estimates.

The research team will use a large (5 m wingspan), commercially available UAV, supplied by Aerocam Australia and equipped with video and still cameras.

'A larger UAV can carry more equipment and a lot more fuel – allowing us to cover the greater distances necessary for whale surveys,' Dr Noad says.

The first phase of the project will test the basic capabilities of the UAV for viewing and surveying marine mammals. It will ask a range of questions, including: does the UAV provide video and still images that can be easily analysed by researchers or image analysis programs; what is the optimal camera height and system for different species; can images be viewed in real time to enable operators on the ground to alter the flight path when animals are sighted; and how much post-flight analysis of images is required?

Dugongs and humpback whales are being targeted as they live in different environments, are sighted using different cues from the air, and have very different movement habits and aggregation patterns.

'Dugongs sometimes congregate in large herds of up to 300 individuals, and need to be circled to be counted,' Dr Noad says.

AEROCAM AUSTRALIA

Aerocam's UAV 'Shadow'

Aerocam's 'Shadow' specs

Wingspan:	5.2 m
Length:	2.9 m
Max weight:	90 kg
Fuel load:	12-24 l
Max range:	1500 km
Endurance:	3-8 hr
Speed:	160-200 km/hr
Max payload:	25 kg

'Migrating humpback whales usually travel singly or in pairs, and often you just see their blows before they submerge again. They're spread out on a long migratory path, so you have to cover quite a bit of ocean to find them.'

For dugongs, the UAV will fly transects over Moreton Bay and Hervey Bay, in south-east Queensland, and when a herd is sighted - through the live video link – researchers will take over the controls and circle the herd to get an accurate count.

Humpback whales will be located during their winter migration past North Stradbroke Island, and the UAV will again be tested at varying heights above the animals. Still and video images will then be compared to see if there is any advantage of one over the other.

'Still images will likely have a better resolution than video images, but it may be easier to detect whales from movement in the video,' Dr Noad says.

If this first phase of the project proves successful, the researchers will move on to the second phase – to directly compare the results of UAV surveys with manned surveys.

The scientists admit this is a high-risk project. But even if the technology does not prove adequate today, with the pace of development, it may be in just a few years' time.

'In the medium to long term, smaller UAVs could reduce the cost of flights to just a few dollars an hour, while better imaging software could negate the need for human analysis at all,' Dr Noad says.

WENDY PYPER
Information Services, AAD

GETTING A FAST LOCK ON DUGONG LOCATIONS

New generation satellite tag technology that can locate and record the position of tagged animals faster and more efficiently than previous instrumentation, promises to vastly improve scientific understanding of dugong movement and habitat use.

Through the Australian Centre for Applied Marine Mammal Science, Dr Ivan Lawler of James Cook University, and Mr Dave Holley of Edith Cowan University, will test the ability of new 'Fastloc®' GPS (Global Positioning System) technology (developed by Wildtrack Telemetry Systems Ltd, UK) to track the fine scale movements of dugongs in deep water and sub-tidal seagrass meadows.

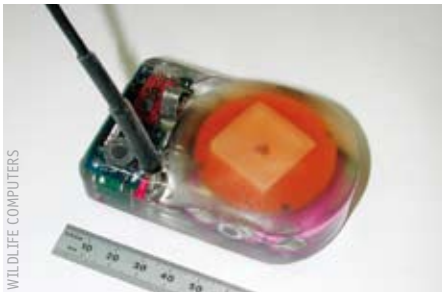
Dugongs have traditionally been tracked with standard GPS tags, which need to remain above the water's surface long enough to download 'ephemeris' data relating to the positions of the passing GPS satellites. The longer a tag is submerged between one position fix and the next, and the further the animal travels before resurfacing, the longer it takes to record the next position. In practice, this often means that the dugong (and tag) re-submerges before a location is calculated, leaving significant gaps in the data. Fastloc® tags, in contrast, do not download ephemeris data and need only 0.02 seconds at the surface to record data that can be processed to provide an animal's position.

'When dugongs are in deep water and/or moving quickly, we get fewer location fixes using standard GPS technology, because the tags do not breach the surface for long enough,' Dr Lawler says.

'This introduces a serious bias that can interfere with modelling of dugong habitat use and our ability to detect migratory corridors.

'If we don't know what routes dugongs take when they move between areas, we don't know what threats – such as nets – they could potentially be exposed to, and we can't assess the importance of deep water seagrass beds to the animals. This has implications for the conservation and management of both dugongs and their habitat.'

The research team will test the effectiveness of Fastloc® tags in two very different habitats – Shoalwater Bay in central Queensland and Shark Bay in Western Australia. Both areas are important for dugong conservation. However, Shoalwater Bay has a high tidal range of 7-8 m while Shark Bay has a tidal range of 1.7 m.



A Fastloc® tag, similar to this one produced by Wildlife Computers in the US, but with a dugong-specific housing that allows the tag to be tethered to dugongs' tails, will be used to track the fine scale movements of dugongs in deep water and sub-tidal seagrass meadows.

'The habitat use of dugongs within inshore seagrass meadows is poorly understood at low tide because the animals are in deeper water than at high tides when they move up into the intertidal shallows,' Dr Lawler says.

'So fewer locations are received from dugongs at low tides than at high tides. We'll compare the frequency of location fixes between these two areas and if similar numbers of locations are received in both habitats it will demonstrate that the Fastloc® system can acquire position fixes from animals in deep water.'

The tags will also be tested for their ability to acquire location fixes from dugongs moving rapidly between seagrass habitats in different bays.

The tag units will be deployed on five dugongs in each region for 2-3 months, along with time-depth recorders to measure the animals' dive profiles. Tags will be attached to the tail of the dugong via a harness with a remotely triggered release. The Argos satellite system will then be used to locate the tag and to decode the dugong location information recorded by it.

WENDY PYPER
Information Services, AAD

A dugong is restrained during attachment of a tag to its tail.

A dugong is released with its tag (a traditional GPS unit) attached.

Dr Phil Tucak monitors a Weddell seal anaesthetised using the sled-based anaesthetic machine.

JOHN VAN DEN HOFF

ALL CREATURES GREAT, SMALL AND ANTARCTIC

Veterinarian, Dr Phil Tucak, leapt at the chance to extend his skills with domestic and farm animals to Weddell seals.

PHIL TUCAK

I've had a long-held fascination with the vast white southern continent, and have been keen to get to Antarctica for many years. I grew up near the coast and, apart from regularly heading down to the beach for a swim or surf, I was intrigued by marine mammals such as dolphins, whales and seals. After graduating as a veterinary surgeon from Murdoch University in Perth in 1999, I worked in both farm animal practice and small animal practice in Western Australia. I then spent two years in the United Kingdom, before returning to work in a variety of practices in Western Australia, the Northern Territory and Tasmania.

In 2006 the opportunity to work as a veterinarian in Antarctica arrived in the form of a research project counting Weddell seals and assessing their body condition. The multi-year project is run by Dr Mark Hindell, from the University of Tasmania's Wildlife Research Unit, and Dr Nick Gales, from the Australian Antarctic Division. The scientists expect that data gathered during the project will allow them to assess the Weddell seals' foraging success over several years, providing an indication of the impact of fisheries activities and climate change.

Weddell seals breed amongst the ice covered fjords of the Vestfold Hills, several kilometres north of Davis station. The female Weddell seals usually start breeding after the age of six. They give birth around October and will care for their pups until they are weaned, about six weeks later.

Antarctica presented unique challenges to our research team (seal biologists Judy Horsburgh, John van den Hoff, and field project leader, Kathryn Wheatley), as we worked in often sub-zero temperatures to study the seals and catch the mother and pup pairs that would form part of the body condition assessment study. We travelled on the ice using quad bikes and undertook an aerial survey of seal numbers in the fjords via helicopter. Flying above Antarctica also allowed us to pinpoint where the mother-pup seal pairs were located amongst the fjords.

To measure and weigh the adult female Weddell seals we first had to net them. As Weddell seals are relatively placid, we were able to get close enough to place a hoop net over their heads, which they would then wriggle into. Very quickly they would relax, allowing me to administer an intravenous sedative injection and then anaesthetise them using a portable isoflurane anaesthetic machine (transported on a sled).

The anaesthetic machine was specially adapted by scientists and technicians at the Australian Antarctica Division for use in the extreme cold of Antarctica, and included an insulated housing and a battery-operated heating system. We also used heat packs and hot water bottles to keep the anaesthetic machine warm, and an esky to store the sedative and anaesthetic drugs in.

Each anaesthetic would last for approximately 17 to 20 minutes, during which time the seal was weighed – using a portable tripod and scales – and several girth and length measurements were collected. A small identifying flipper tag was also attached, and the seal's mouth was photographed for evidence of tooth-wear or infection.

During the anaesthesia, I would monitor the seal's respiration and heart-rate, and record these measurements. Once the anaesthetic wore off, I continued to monitor the seal until it recovered, usually within a few minutes. The seal pups could be safely caught and weighed without the need for any anaesthetic.

The opportunity to work in Antarctica was an incredible experience, and working so closely with such beautiful animals was extremely rewarding and an invaluable learning opportunity. I think Antarctica somehow gets into your blood, and I would love to get back there again soon…all I have to do now is work out how!

PHIL TUCAK (BSc, BVMS, CMAVA)

Dr Tucak works as a vet in Perth and as a television producer with ABC TV.

After returning from Antarctica he promoted the work of wildlife veterinarians through his role as the Murdoch University Veterinary Trust's BJ Lawrence Veterinarian in Residence (2006).

A YEAR AT WILKES

When Don Butling applied to be a plumber in Antarctica, he never expected to have his teeth removed. Almost 50 years on, he recalls the trip of a lifetime.

Butling was 34 years old when he left Australia for Wilkes station in January 1960, on the *Magga Dan*.

'I had to have my top teeth taken out first,' he recalls. 'I had a tooth knocked out playing football so I had a plate with one tooth on it and wires around it. They told me I wouldn't get the job because there was no dentist in Antarctica and the wire could wear my teeth out and give me toothache. Would I be prepared to have my teeth extracted?'

During the six-week journey to Wilkes (via Dumont D'Urville and Mawson) all the expeditioners were seasick except Butling and one other. Wilkes station was home to 13 Australians and five Americans, including several scientists. Butling says one American biologist always walked around with a pistol in a holster on his hip 'just in case he came across a leopard seal inside the mess hut'.

Butling's job was to maintain all of the plumbing on the station, repairing the occasional breakages and blockages as well as some carpentry work. But his first day at work came as a shock.

'They hadn't told me there had been a fire through the plumber's shop and they had done nothing about it. I wasn't too happy,' he says.

The charred structure of the pre-fabricated building was still there so he set to work and cleaned it up.

Although the toilets were primitive, Butling says there was never any smell as it was too cold, there were no flies, and everything froze.

For entertainment, the men enjoyed weekly nights at the movies. *Gun Fight at the O.K. Corral* was a particular favourite, which they could recite word for word. Fishing, however, proved more challenging.

'Once you put on all your heavy clothes and went out carrying a pick, shovel and crow bar, and dug a hole through two-foot thick ice, you didn't feel like fishing,' Butling says.

The inhabitants of Wilkes were rarely sick, but when a box of new trousers and overalls was opened, everyone came down with colds from germs in the material.

Conditions at Wilkes were harsh. When Butling arrived in February the weather was beautiful, but cold. 'When we first went down there it was shocking. We'd say we were going to die, but after a while we gradually took off layers of clothing as we acclimatized,' he recalls.

The wind was a different matter. 'Every time you got a strong wind blowing there was a howling noise with the wind blowing through the posts and wires. When it was really blowing – about 70 or 80 miles an hour (130 kph) – it was like screaming; you never got used to it,' he says.

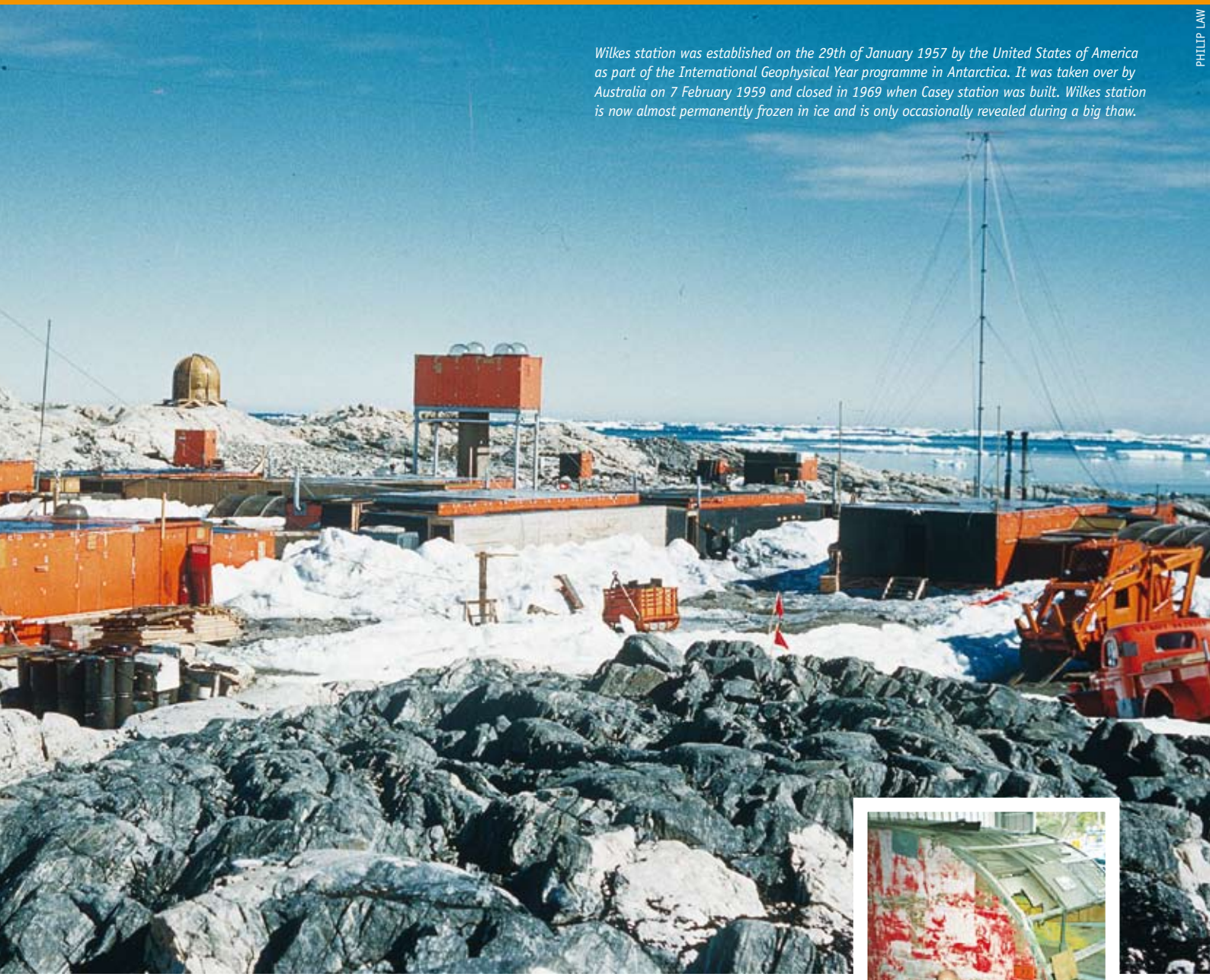
The regular routine was often broken up with week-long field trips to S2, a camp 80 km inland, on Law Dome. It consisted of a hut, generator, storage and snow laboratory dug into the snow, joined with a roofed trench – which was then covered over with snow – and a shaft dug 36 m down into the ice.

Butling remembers a three-month, 400 mile (640 km) return trip inland, towards the Russian base at Vostok. A caravan was required and it was his job to make one from ply wood, heavy cardboard and Oregon planks. (The caravan, called 'ANEATA' after his wife, later became a field hut used by the Australian Antarctic Division until the mid-1990s.)

Travelling in a sno-cat and two weasels in single file, with about half a mile between each vehicle,

H. WEYCK

Don (centre) during an inland traverse in 1960.



PHILIP LAW

Wilkes station was established on the 29th of January 1957 by the United States of America as part of the International Geophysical Year programme in Antarctica. It was taken over by Australia on 7 February 1959 and closed in 1969 when Casey station was built. Wilkes station is now almost permanently frozen in ice and is only occasionally revealed during a big thaw.

DAVID MCCORMACK

the men kept in contact to ensure they maintained their direction. Every mile, large poles of Oregon, which Butling had sawn and painted himself, were placed into the ground as reference points.

Danger was ever-present in Antarctica and this trip was not without its heart-stopping moments. Once, while using a manual post-hole digger, the men found that the ice was only 15 cm thick. 'When we broke through and looked down all we could see was the blue expanse of a huge crevasse underneath us, and we had three vehicles sitting on top,' he says. 'We had to quietly pack everything up and leave very gently, one vehicle at a time, hoping we got across the area.'

Snow storms were another hazard. When a snow storm blew up during the trip, the five men made camp as fast as they could. 'We just sat it out for seven days, sitting in the caravan playing cards,' Butling says with a smile. 'I think I won about 50 million dollars playing poker!'

HELEN BISHOP
Freelance writer

Don with the caravan he built and named 'ANEATA' after his wife, during the traverse towards Vostok. Inset: Don with the caravan in 2005.

HARRY BLACK

MAD ABOUT MOSSES

Rod Seppelt bumps into a lot of branches and spider webs when he goes walking in the Australian bush. As a passionate bryologist, Rod isn't looking at the trees and the views; he's searching the ground for tiny mosses, liverworts and lichens.

'Most people just see gravel and rocks,' he says, 'but I see bryophytes and lichens.'

Some of Rod's subjects are only half a millimetre in size, so good eyesight is essential. But if you think that sounds like hard work, consider Rod's other passion – botanical illustration.

For the past 40 years, Rod – a principal research scientist with the Australian Antarctic Division and a curator of the Division's herbarium – has been drawing scientifically accurate illustrations of Antarctic, sub-Antarctic, Arctic and Australasian mosses. His subjects might only be millimetres in size, but it can take Rod up to 20 hours to complete one drawing. His completed work usually includes an illustration of the whole plant, leaves, the spore capsule (if there is one), cellular detail and cross-sections of the leaves and stem.


AAD

Rod at work.

Rod uses both dissecting and compound research microscopes with drawing attachments, which effectively allows him to trace the shape of the plants and cells. He then transfers the rough pencil drawing to transparent drafting film, and uses a fine inked nib to complete the art work. The illustrations can then be scanned or photocopied.

Rod's interest in botanical illustration began during his undergraduate studies in the Department of Botany at the University of Adelaide, and some of his first moss drawings still hang on the Department's walls. He then transferred to Melbourne University to do a PhD on Australian native violets. After two and a half years, however, he realised the research was going no-where and he changed research topics to the moss flora of Macquarie Island – a subject that continues to fascinate him, 36 years later, and which he has researched extensively during his subsequent work with the Australian Antarctic Division.

Rod reckons he's covered about half of Antarctica and much of the sub-Antarctic in his search for mosses. He has also worked in Arctic Alaska and Scandinavia. His drawings help others to identify specimens from written descriptions, which can be very similar. They are also an important visual record of the biodiversity of a region, which can be used to monitor or detect changes as a consequence of climate change or human interference.

Rod's illustration of the moss Sanionia uncinata, *found on Macquarie Island and in Antarctica, was displayed at the Hobart Botanical Gardens during Living Artists' Week.*

Some of Rod's drawings were recently displayed at the Hobart Botanical Gardens for Living Artists' Week, and are also in an exhibition touring Australian art galleries until 2009, called *Hidden in Plain View: the forgotten flora*.

WENDY PYPER
Information Services, AAD

Heroic era moss discovered

A rare specimen of a 'fruiting' Antarctic moss, collected during Douglas Mawson's 1911-13 Australasian Antarctic Expedition, has been discovered in the Tasmanian Herbarium in Hobart.

Dr Rod Seppelt found the specimen of *Dryptodon fuscoluteus*, which was collected by Tasmanian biologist Charles Harrisson, amongst miscellaneous collections held in the Herbarium.

'This lone moss specimen is the first and only record of the species for continental Antarctica,' Rod says.

'Even more exciting is that the specimen has both immature and mature spore capsules. Records of fruiting mosses in Antarctica are very rare.'

Another 13 moss specimens from the expedition, representing five species, are housed at the National Herbarium of New South Wales. Duplicates of this material were sent to the British Museum of Natural History and some of these have been located in the Dixon Herbarium there.

According to Harrisson's notes on the expedition, he collected a number of fruiting moss specimens from several outcrops on or near David Island, near the Shackleton Ice Shelf in East Antarctica. His notes observe: '…some fine lichens and, what pleased me most, a little moss in seed'.

Rod has illustrated the moss and, together with his colleague, Ryszard Ochyra, from the Polish Academy of Science, is preparing a detailed article on the moss for publication.

'Historical information like this is vital to understand the baseline biodiversity of Antarctica,' Rod says. 'It appears that the area around David Island and Haswell Island (an Antarctic Specially Protected Area) may be a plant biodiversity hot spot and the area needs a careful re-examination.'


AAD

Hobart biologist, Charles Harrisson, collected the first record of fruiting moss in Antarctica during the Australasian Antarctic Expedition of 1911-13.

FIRST ANTARCTIC FLIGHT FOR THE AIRBUS A319


US NATIONAL SCIENCE FOUNDATION

A319 parking at McMurdo.

After a 5.2 hour flight from Christchurch, New Zealand, the Australian Antarctic Division's Airbus A319 touched down in Antarctica – at America's McMurdo base – for the first time, on the 19 November 2007.

On arrival, passengers and crew were greeted by the US National Science Foundation representative at McMurdo, Mr Mike Scheuermann, and representatives of the New Zealand Antarctic Program, from Scott Base. In keeping with the tradition of not arriving empty handed on a first flight to Antarctica, the A319 delivered 1500 kilograms of mail and parcels to McMurdo.

While in Antarctica the aircraft undertook further take offs and landings to give the aircrew additional experience of the local conditions, before departing on the 4.5 hour return flight to New Zealand. On 22 November the A319 flew to McMurdo again, and returned directly to Hobart. Both flights were conducted without incident and demonstrated the capability of a modern, commercial, twin engine jet to provide an effective air service to Antarctica. All objectives of the flights were met and the performance and handling of the aircraft on the McMurdo ice runway exceeded the expectations of the aircrew.

The A319 flight to McMurdo was planned 12 months in advance and was an important part of preparations leading up to the first landing on Australia's new Wilkins Runway, expected in December. The ability of the aircraft to conduct two return trips to Antarctica in a period of four days highlights the flexibility and efficiency that intercontinental air travel can provide to operations in Antarctica.

Many thanks must go to Skytraders, the US Antarctic Program and Antarctic New Zealand, for the conduct and support of such a significant operation. Congratulations must also go the aircrew, consisting of Captain Garry Studd and Captain Rex Booth of Skytraders and Captain John Quinnell of Airbus. Lt Colonel Jim McGann, the US Airforce Antarctic C-17 Commander, also participated as an observer on the flight.

CHARLTON CLARK
Manager, Antarctic Airlink Project

Women wired for Antarctic experience

In a first for the Australian Antarctic Division, Mawson station will have an all-women telecommunications team in 2008, and three of the four communications operators working in Antarctica this summer are women. With their diverse backgrounds, the five women bring a wealth of experience to the Australian Antarctic programme.

Supervising Telecommunications Technical Officer, Jodi Wruck, is a skilled radio frequency technician. Jodi joined the Australian Army in 1994, training and later working in radio communications and equipment testing. In 2006 she spent 12 months on Macquarie Island as the Communications Technical Officer – an experience which inspired her to leave the Army earlier this year and head south again for Mawson.

Jodi will be working with Communications Technical Officer, Roselin Bali, from Sydney. After training as an electrical engineer, Roselin specialised in network engineering with Cisco Systems, where she gained experience working with routers and switches.

Over summer, Narelle Rawnsley, Jane Leggate and Clare Ainsworth, will support the season's air and field operations programmes. Their work will involve providing a safety radio net for helicopters, C212 aircraft, the new A319 Airbus, and scientific research parties living and working in the field.


ANNIE RUSHTON

The communications team (from left): Roselin Bali, Narelle Rawnsley, Clare Ainsworth, Jane Leggate and Jodi Wruck.

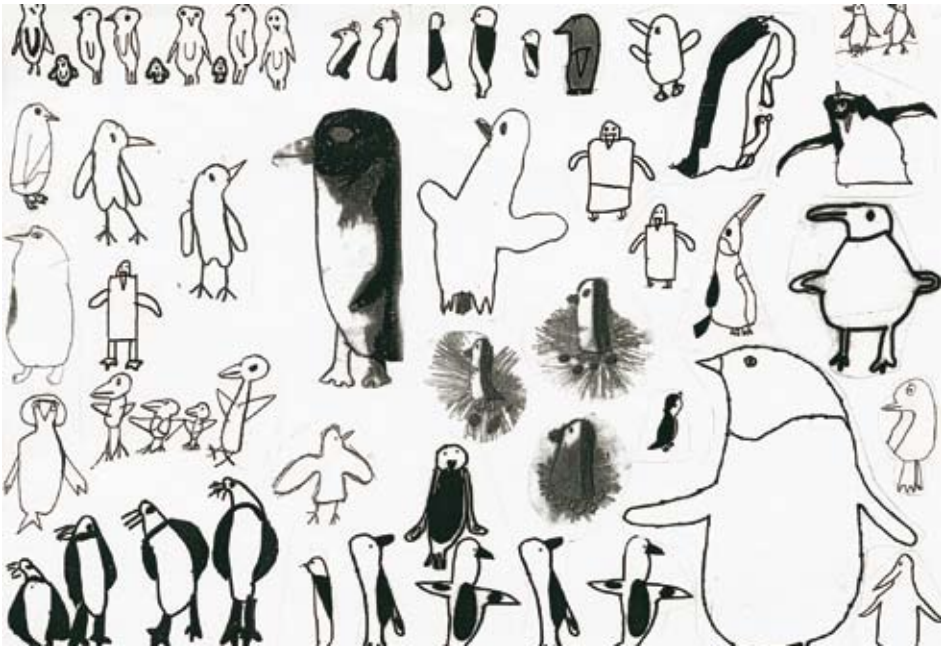
Narelle is an operational planning officer with the Country Fire Service in South Australia. Operationally responsible for 87 fire stations, Narelle has specialised in incident preparedness and management, and risk planning. She will be based primarily at Casey, but will also work at Davis and briefly at Mawson.

Jane is an air traffic controller with Airservices Australia. Based in Melbourne, she first became interested in Antarctica several years ago during preliminary discussions between the Australian Antarctic Division and Airservices Australia about an Australian-Antarctic air link, as planes destined for Antarctica fly through Australian airspace. Jane will be based at Casey.

Clare moved to Western Australia three years ago from the United Kingdom, where she worked as a search and rescue officer with HM Coastguard. She was responsible for coordinating all civil maritime search and rescue operations for boats, people and aircraft. Clare has also crewed a sailing ship around Cape Horn and into the Southern Ocean. She will spend most of her time at Davis.

ANNIE RUSHTON
Operations Branch, AAD

KIDS' ANTARCTIC ART



In 2005 I travelled south on the *Aurora Australis* as an Australian Antarctic Arts Fellow. My aim was to be the eyes and ears of children around Australia and to produce a series of collaborative paintings, based on the children's drawings, for an exhibition called *Kids' Antarctic Art* (*Australian Antarctic Magazine* 10: 35).

Every night of the six-week voyage I posted an email, detailing my experiences, and encouraged my readers to draw what they saw through my descriptions. When I arrived home a huge pile of fat envelopes and packages was waiting for me.

It took me days to sort through the drawings. Some were so striking I could see immediately what I wanted to do with them. Others I sorted into piles; whales, seals, birds, icebergs and so on, so I could use them to construct collages.

The pictures came from all over the place. Ryo Nakagawa from the British School in Tokyo sent a beautiful, vigorous, wax crayon drawing of a leaping orca. I remembered seeing the orcas early one morning, when the sunrise was reflecting gold on the sea, and planned a yellow background with swirls of gold.

Pearl Nabegeyo, from Gunbalanya in Arnhem Land, drew an emperor penguin and chick, the parent tenderly bending over the young one, which sat within it. I liked the sense Pearl conveyed of the chick being surrounded and protected by the parent.

The image was spoiled by the long, duck-like bill of the chick (like that of an Arnhem Land water bird), but as art director of the project I thought it was okay to alter this digitally. Images of emperor penguins huddling together in swirling snow under dark skies combined in my imagination with the concentric dot patterns that appear in much indigenous art to produce 'Arnhem Land Penguin'.

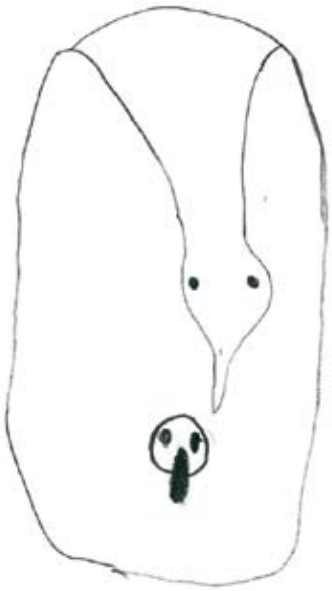
'Crazy Penguins' is the work of many children. The penguins they drew were most unusual, some with long necks and others with their black and white reversed. I kept the background crisp, with blue spots to create the feeling of cold.

To produce the single-image artworks, I scanned the originals into my computer, then manipulated them digitally; cleaning up smudges and removing writing and sometimes colouring the lines. I then printed the results on to A3 watercolour paper with an inkjet printer. To make the multi-image pictures I photocopied the original drawings, then cut and pasted them on to an A3 sheet before scanning. Some of the pictures were finished at this stage, but most images were worked on with watercolour paint and crayon, pencil, wax crayon and gouache.

I made 40 pictures, but could have made many more. The hardest decisions were choosing the images. Even now, if I flip through the drawings, I'll see one and wonder why I didn't use it.

'Crazy Penguins' collage – photocopied images glued on cartridge paper (top left).

'Crazy Penguins' (numerous children with Alison Lester) – inkjet printed image on watercolour paper, hand-coloured with watercolour, 2007 (bottom left).



'Arnhem Land Penguin' original (Pearl Nabegeyo) – pencil drawing on cartridge paper (left). 'Arnhem Land Penguin' (Pearl Nabegeyo with Alison Lester) – inkjet printed image on watercolour paper, hand-coloured with watercolour and gauche, 2007 (right).

Kids' Antarctic Art had its first showing at the Tasmanian Museum and Art Gallery during the 2007 Mid-winter Festival. For three days school groups came to see the pictures and I explained to them how the images were made and demonstrated how to make Antarctic effects with various art materials. Many of the images used were drawn by children from Tasmania and I got a huge kick out of one small girl recognising her drawing within a picture.

Since then the exhibition has been shown at Gasworks Park in Melbourne, and is currently at Dromkeen at Riddell's Creek. A digital version is also being shown at the Victorian State Library. The originals and the slide show will tour Australia over the next 12 months and a book of the images is planned. Two images have been produced as limited edition prints and a set of eight postcards, with all artists' profits going to the Royal Children's Hospital in Melbourne.

The *Kids' Antarctic Art* project reached children in schools all over the world. Teachers said they loved turning on the computer in the morning and finding the next Antarctic email there. It was such a personal and immediate connection that the students become instantly involved, not only drawing Antarctica, but researching and discussing it as well. Their participation in the project has given them an ownership and concern for Antarctic that will stay with them always.

Alison Lester talks to school children about Antarctic art at a workshop in Hobart in mid-2007

For further information visit www.alisonlester.citymax.com

ALISON LESTER
AAD Arts Fellow, 2005

Two picture books have originated from Alison's Antarctic Arts Fellowship. **Snoopy Sparks Goes South** *is the journal of a young detective who travels south with her bryologist aunt.* **One Small Island, the Destruction and Regeneration of Macquarie Island** *is a co-production between Alison and Coral Tulloch – another former Arts Fellow. The pair are sharing the writing and illustration and plan to have the book finished next year.*

Antarctic outreach

Three Australian Antarctic Arts Fellows have been selected for 2007-08.


SHARON DING

Dr Craig Cormick will undertake a four-part project during his trip to Antarctica: holding writing workshops for expeditioners and editing a collection of their writing for publication; writing non-fiction articles about Antarctica for publication in various media; writing a work of fiction exploring the interactions between Antarctic expeditioners and their societies; and developing an educational resource for Biotechnology Online on biodiversity and biodiscovery in Antarctica. Craig is an award-winning journalist and author, a popular writing tutor and a science communicator and educator. He has won several book awards including ACT Book of the Year in 1999 and a Queensland Premier's Literary Award in 2006. He has lived in Iceland and Finland and in October 2007 he was the Australian delegate to the APEC Workshop on Agricultural Biotechnology Communications in Peru. His Antarctic projects aim to increase awareness and appreciation of human societies in Antarctica – past, present and future.


NATALIE FAULKNER

Nicholas Hutcheson will use his Antarctic experience to build up a body of drawings from observation, which he will use to create large scale art works in his studio. He will also establish a web site for online discussion during and after the trip to give the arts and education communities an insight into the vastness of the continent and the reality of Antarctic life. The final art works will be displayed at the Dickerson Gallery, Melbourne, and a CD or digital book will be available on his web site. Nicholas will also engage a range of audiences through presentations, studio and school visits and online discussion groups. Nicholas studied illustration and print making in London and has exhibited his work at both group and solo exhibitions (www.nicholashutcheson.com).


VICKI SLINKO

Lynette Finch is writing a biography of Syd Kirkby, a surveyor from Western Australia who first wintered in Antarctica in 1956 and who, over the next 20 years, explored and surveyed more of the Australian Antarctic Territory than any other person. Lynette is a historian and Senior Lecturer in Australian and Cultural Studies at the University of the Sunshine Coast in Queensland. Lynette's trip to Antarctica will enable her to better recreate the setting and feel of the continent in her book. She has previously written books, papers and articles on such topics as war history and propaganda, and histories of health, and food and nutrition.

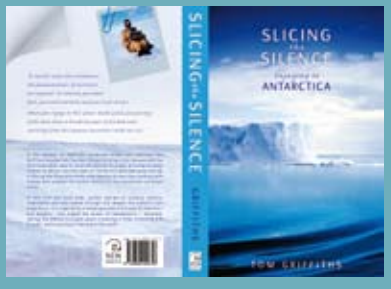
For more information about Australian Antarctic Arts Fellowships visit: www.aad.gov.au/default.asp?casid=13637

Arts Fellows out and about


JENNY WHITTAKER

Midwinter exhibition

An exhibition of community and connection to place, *Antarctica – A Place in the Wilderness*, by Judith Parrott, was displayed during the Midwinter Festival in Hobart in June. The exhibition was the product of an Arts Fellowship with the Australian Antarctic Division and a two month residency at Casey station in 2005-06. It included silver gelatin photographs, data projection of coloured images, text, local sounds, music, and words spoken by members of the Antarctic community. The exhibition covered aspects of life on the research vessel *Aurora Australis*, science, the environment, station community life, an Antarctic Christmas and visits to Mawson and Davis stations.



Slicing the Silence

The latest book by Tom Griffiths, Professor of History in the Research School of Social Sciences at the Australian National University, and a former Antarctic Arts Fellow (2002-03) has been widely acclaimed. *Slicing the Silence: Voyaging to Antarctica*, published by UNSW Press and Harvard University Press, was launched by Sir Guy Green in Hobart on 23 May, with the support of the Tasmanian Museum and Art Gallery and the Australian Antarctic Division. In the book, Tom reflects on the history of human experiences in Antarctica, taking the reader on a journey of discovery, exploration, and adventure.

IN BRIEF

Antarctic Station Leaders 2007-2008

JESSICA FITZPATRICK

CASEY – **Jeremy Smith** has spent 26 years in academia as a Lecturer, and later, Associate Professor at the University of New England in Armidale, NSW, where he specialised in biogeography and taught environmental studies. He has undertaken field research in Papua New Guinea, Sabah and Venezuela, as well as in eastern Australia, from Tasmania to Torres Strait. He is the author of more than 100 scientific publications in biogeography, particularly the ecology and origins of equatorial high mountain floras, dispersal of seeds by marine currents and the invasion of Australian habitats by exotic shrub species. This season at Casey station will mark Jeremy's fifth year as a Station Leader in Antarctica. He has previously occupied the position at Macquarie Island in 1996, Davis in 2001 and 2003 and Casey in 2005.

JESSICA FITZPATRICK

DAVIS – **Peter Pedersen** comes from a 17-year career with the Australian Quarantine Service, based in Cairns. As a Remote Area Operations Coordinator he was responsible for remote field activity in Cape York, and exercises in the Northern Territory and Western Australia. Much of his work involved providing logistical support to scientific staff undertaking exotic pest and disease surveys, border enforcement along the northern Australian coast, and community engagement work, especially in remote Aboriginal communities. Peter was posted to Torres Strait for two years and was involved with quarantine border issues between Papua New Guinea and Australia. He then spent a year in East Timor leading a project to establish the newly independent country's first quarantine service. Peter is a keen hiker and fisherman, and enjoys spending time on his doorstep – the Great Barrier Reef!

JESSICA FITZPATRICK

MAWSON – **Narelle Campbell**, born and raised in Wingham and Taree (NSW), has 23 years experience in print media, covering logistics, sales and marketing in senior management roles. She began her career at Rural Press Limited before moving to Fairfax Media where she was National Circulation Manager for Fairfax Business Media for seven years. Here she was responsible for overseeing print orders, distribution, sales, marketing, subscriptions and audits. In 2005 she took on her current role as National Manager, Income Development, for Mission Australia. Narelle has degrees in social science and counselling and has worked as a volunteer for Missionbeat in Sydney – providing support to homeless people. When not at home in Coogee, Narelle can be found out climbing, sailing, kayaking or walking. She has walked the Kokoda Track and completed high altitude climbs in Nepal, India, Africa and Chile.

Antarctic Medal

AAD

Sharon Labudda, an Aircraft Ground Support Officer (AGSO) with Australia's Antarctic programme, was awarded this year's Antarctic Medal. Sharon was the first AGSO employed by the Australian Antarctic Division with the introduction of fixed-wing aircraft operations within Antarctica in 2004. Since that time she has helped develop and refine the position, and those of others who have followed in her footsteps, to the highest degree of efficiency and safety. AGSOs work closely with all fixed-wing and helicopter flight crews, ensuring the smooth operation of air services between Australia's Antarctic stations and field locations.

The Australian Antarctic Medal is an award in the Meritorious Service Awards category of the Australian Honours System. The Medal replaced the (British) Imperial Polar Medal and its variations, which date back to 1857 for service in the Arctic and Antarctic regions.

Director's Awards

The 2007 recipients of the Director's Award for Excellence were:

AAD

Tania Ashworth – for her drive, enthusiasm and professionalism in running the Airlink Taskforce, and especially for her project management and facilitation of the Airlink workshops over the past two years.

AAD

David Sumner – for his exemplary attitude, work ethic and willingness to lead and adapt to a changing work environment. David undertakes his warehousing services role with an agreeable and customer focused manner and has also played a significant part in the implementation of the Head Office Logistics Centre.

AAD

Don Hudspeth and Brett Quinton – for outstanding leadership during the resupply and change-over voyage to Macquarie Island in the 2006-07 Antarctic season. As the voyage involved many high profile round trip projects, a highly detailed and flexible plan was required. The team went to extraordinary lengths to make sure participants knew what was going on at every stage, they balanced task completion with risk mitigation appropriately; and they demonstrated good judgement at every stage.

AAD

Rob King, Andrew Mceldowney, David Zeven and Paul Camp – for the exemplary work they undertake in maintaining the krill culturing and aquarium facilities at the Antarctic Division.

AAD

Wendy Pyper – for exemplary dedication to ensuring excellence in the production of the *Australian Antarctic Magazine*.

Departmental Secretary's Award

GLENN JACOBSON

Renata Robertson

Australian Antarctic Division staff, Renata Robertson and Andrew Jackson, received this year's Departmental Secretary's Awards. Renata's award recognises her consistent contribution to the Department's goals through her dedicated and efficient work in the Science Branch, and her tireless efforts supporting staff in the running of the Division's social club.

MATHEW OAKES

Andrew Jackson

Andrew's award recognises his role as a mentor and role model. As Acting General Manager, Policy Coordination, from 2005 to 2006, Andrew inspired staff with his positive leadership and provided an excellent role model when he championed and a made a significant personal contribution to the Branch Improvement Plan. Most recently Andrew has managed and led the Antarctic Future's Project.

Parliament House Exhibition

An exhibition of 60 photographs from recent Australian Antarctic expeditions drew crowds at Parliament House, Canberra, from August to September. The exhibition included a series of 40 black and white photographs by 2005-06 Arts Fellow, Judith Parrott, and 20 colour photographs taken by scientists and support personnel.

FREDERIQUE OLIVIER

One of the photographs in the Parliament House Exhibtion.

National Science Week

The Australian Antarctic Division celebrated National Science Week in August with displays of various Antarctic research activities at the Tasmanian Museum and Art Gallery. Live displays of the two most important organisms in the food chain – phytoplankton and krill – were a hit with school students and the public.

WENDY PYPER

Phytoplankton display.

The Division's research diving team showed off the latest in polar dive-wear and equipment, and the research they support. Climate scientists produced a genuine 500-year old ice core to illustrate how ice cores contribute to our understanding of past climate and detect and monitor changes in today's climate. Biologist, Dr Graham Hosie, also gave a demonstration of the ancient Japanese art of fish printing or 'Gyotaku' – a technique he learnt from internationally acclaimed Japanese artist, Boshu Nagase, who has donated a number of prints to the Antarctic Division.

Antarctic heritage assessment

JOHN CLAYDON

The Australian Antarctic Division recently conducted an assessment of its historical artefact collection with the help of professional curators and knowledgeable staff members. The assessment will enable the Division to make informed decisions about the storage, conservation, display, lending and disposal of items. Many of the items have heritage significance, including a ski stock, ice axe and a man-hauling harness belonging to geologist, Dr Frank Stillwell, who formed part of Mawson's Australasian Antarctic Expedition of 1911-14. Other objects of interest included artefacts from Mawson's Huts, medical equipment, an old wooden wind turbine generator from Mawson station, a 1943 Weasel tractor and various de Havilland Beaver aircraft parts. Several of the aircraft parts were later shipped to New Zealand for use in a display aircraft at the Air Force Museum, Christchurch (above).

Teachers at sea

AAD

Jane Dobson, Caroline Lapworth and Voyage Leader, Tony Worby, before the voyage.

Two Tasmanian teachers joined scientists on board the *Aurora Australis* for a 42-day voyage to the sea ice zone around Antarctica in September, to study sea ice physics, biology and the open ocean food web. Jane Dobson from Claremont College and Caroline Lapworth from Geeveston District Hight School got involved in a range of research projects and posted daily reports on the voyage website – www.acecrc.sipex.aq. Teachers and students around the world were able to follow the pair's adventures, learn more about the different aspects of scientific research being conducted, email questions, and try various experiments that demonstrated the principles behind the science. Jane and Caroline were also joined by a toy polar bear, Polar Knutsen, who provided a different perspective on the voyage with his own web blog. The next issue of the *Australian Antarctic Magazine* will contain stories about the voyage.

Aleks Terauds' image of an 'Adélie penguin flying' won the Animal Behaviour category of the 2007 Australia, New Zealand, Antarctica and New Guinea (ANZANG) photography competition (www.anzangnature.com). Aleks describes how he captured the winning shot: "We had spent three days waiting on the ship for the weather to clear so we could get ashore at Commonwealth Bay. When the weather finally broke we had 12 hours of bright sunshine and calm waters. One of my jobs was to ferry passengers to and from the ship, so in between trips I lay in the Naiid *on the water, photographing the penguins coming and going. Photographing porpoising penguins requires luck and anticipation, and it was a combination of the two that eventually (after many near misses) allowed me to photograph this Adélie".*

FREEZE FRAME

Biologist and photographer, Aleks Terauds, has spent more than a decade working with marine wildlife in southern Australia. He aims to capture images that can help preserve wild places and the animals that inhabit them. Aleks's work, as well as photographs by other Australian Antarctic Division expeditioners, regularly appears in Images of Antarctica calendars - www.imagesofantarctica.com.

ANTARCTICA valued, protected and understood

Australian Government
Department of the Environment and Water Resources
Australian Antarctic Division

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