Australian ANTARCTIC MAGAZINE

HEARD ISLAND in focus

7 Spring 2004

Australian ANTARCTIC MAGAZINE

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SIMON GOLDSWORTHY

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

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- To protect the Antarctic environment
- To understand the role of Antarctica in the global climate system
- To undertake scientific work of practical, economic and national significance

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FRONT COVER: At 2745 m Mawson Peak dominates Heard Island. The peak marks the summit of Big Ben, an active volcano covered in a thick mantle of snow and glacial ice and surrounded by black volcanic rocks. A smoke plume and fresh lava flowing down the Gotley Glacier are visible. ERIC WOEHLER

BACK COVER: Young male southern elephant seal (*Mirounga leonina*), Heard Island. ERIC WOEHLER

INSIDE COVER: Ascending Big Ben. SIMON GOLDSWORTHY

FEATURE

Heard Island in focus

Rising majestically out of nowhere, Heard Island, wild and wind-battered and surrounded by the tumultuous waters of the Southern Ocean, recently became the centre of an ambitious and successful scientific research program to find out how Antarctic ecosystems tick. This issue of *Australian Antarctic Magazine* celebrates the efforts and achievements of the scientists, expeditioners and crew, who combined their talents to uncover the secrets of one of the world's wildest and most undisturbed places.

After its discovery in 1853, Heard Island attracted sealers who rapidly set about exploiting the abundant wildlife on the island. Sealing finished around the 1890s and the island was infrequently visited by seafarers, adventurers and eventually by scientists. In 1947 Australia mounted the first ANARE (Australian National Antarctic Research Expedition) to Heard Island and established a station in 1948, which was abandoned in 1955. Australian scientists continued to visit Heard Island irregularly through the late 20th century. In spite of, or because of the sporadic nature of these activities, Heard Island is as close to pristine as anywhere on Earth.

In 1997 Heard Island and the McDonald Islands were inscribed on the World Heritage List for their outstanding natural values, beautiful landforms, geology and geomorphology, and their importance in demonstrating significant ongoing ecological and biological processes. In 2003 the 65 000 square kilometre Heard Island and McDonald Islands (HIMI) marine reserve was declared, encompassing the islands and an area of ocean stretching to the edge of Australia's Exclusive Economic Zone.

With its unmodified, interrelated terrestrial, freshwater, coastal and marine ecosystems – in which the evolution of plants and animals has occurred in a natural state – and its location south of the Antarctic Polar Front, Heard Island provides a unique laboratory. There are opportunities for scientists to study the effects of geographic isolation and climate change on the evolution of species; the effects of climate change on glacial retreat, biodiversity and the functioning of subantarctic terrestrial and lake ecosystems; and the interrelationships between the terrestrial and marine environments. Understanding these interactions will help us to conserve this remarkable place and provide us with advance warning of impending changes in Antarctica.

SIMON GOLDSWORTHY

The waters around Heard Island also support two important fisheries for Patagonian toothfish and mackerel icefish. Understanding how the ecosystem works and the relationships between the fish and the species that depend on them, is important for the ecologically sustainable management of the fishery. To ensure these fisheries are sustainable, we must understand the effects of fishing on the target species, their predators and their prey. Heard Island is the breeding ground for large colonies of seals, penguins and albatrosses and it is therefore an ideal place on which to study these complex food webs.

In the summer of 2003–04, the Australian Antarctic Division (AAD) mounted a ground-breaking research program with 28 expeditioners journeying to Heard Island. Another team of scientists and crew aboard the *Aurora Australis*, remained in the Southern Ocean to study the prey and foraging patterns of Heard Island predators and support various land-based activities.

One project, led by AAD marine mammal scientist Nick Gales, involved satellite tracking penguins, seals and albatrosses as they foraged out to sea; logging thousands of individual dives by fur seals, macaroni and king penguins; and collecting samples for dietary analysis. Despite advances in satellite technology that enable us to see things from a great distance, there is still no substitute for the human hand or eye when it comes to collecting samples or – as Barbara Wienecke discovered – spotting an elusive penguin in a crowd.

Heard Island's geology is dominated by the active volcano Big Ben and, as Doug Thost and his colleagues discovered, fast-flowing glaciers that have retreated dramatically in recent decades as a result of climate change. This glacial retreat has opened up new ice-free areas on the island for colonisation by plants and animals.

Long-term monitoring of such changes will now be easier thanks to the success of terrestrial ecologists in mapping the vegetation on Heard Island. These maps will provide a starting point upon which to map future vegetation change.

Protecting the natural values of Heard Island is an important part of the AAD's responsibilities, as was evident in the precautions expeditioners took in maintaining strict quarantine measures and in ongoing efforts to clean up pollutants at the old Atlas Cove Station. A new management plan for the HIMI region is currently being developed and reflects our obligations to ensure best practice management of this nationally and internationally significant area.

While Heard Island was a focus of 2003–04, Antarctica-related activities continued apace. This issue of the magazine features highlights from the Antarctic Treaty Consultative Meeting, and meetings of the Committee for Environmental Protection and the International Whaling Commission.

Heard Island expeditioners 2003–04 aboard the *Southern Supporter.*
FRONT ROW L-R: Karen Evans, Robb Clifton, Shavawn Donoghue, Justine Shaw, Perpetua Turner. SECOND ROW (kneeling): Graeme Denny, Heather Kirkpatrick, Jenny Scott.
MIDDLE ROW: Denna Kingdom, Kate Kiefer, Simon Goldsworthy, Ruth Casper, Kieran Lawton, Barbara Wienecke, Iain Staniland, Karl Rollings, Rowan Trabilco, Johanna Turnbul, Bruce Deagle.
BACK ROW: Simon Jarman (far left), Nick Gales, Chris Stevenson, Roger Kirkwood, Martin Truffer, Marcus Schortemeyer, Peter Dann, Doug Thost. ABSENT: Eric Woehler.

AAD

Through these meetings Australia plays a vital role in ensuring Antarctica and its flora and fauna are 'valued, protected and understood'.

As I write, we are entering an exciting new era in Australia's Antarctic air transport history. Our new CASA 212–400 aircraft will shortly touch down for the first time on one of the world's most remote runways – the new ice runway about 60 km from Casey station. The new aircraft will bring increased flexibility and responsiveness to our Antarctic program and open up exciting new opportunities for science and international collaboration on the frozen continent.

In another exciting initiative we have set a course for a new direction in Antarctic science. Better prediction of future global climate change and protecting the Antarctic environment is the focus of the Science Strategy for Australia's Antarctic Science Program 2004/05 – 2008/09.

As this magazine goes to press, teams of expeditioners – a mixture of new faces and some more experienced hands – are heading south for the summer, continuing our tradition of undertaking world class science. Regular readers will also notice that this magazine is a mix of the old and the new. As we continually strive for excellence in all that we do, we've made some changes to the format which I hope you enjoy.

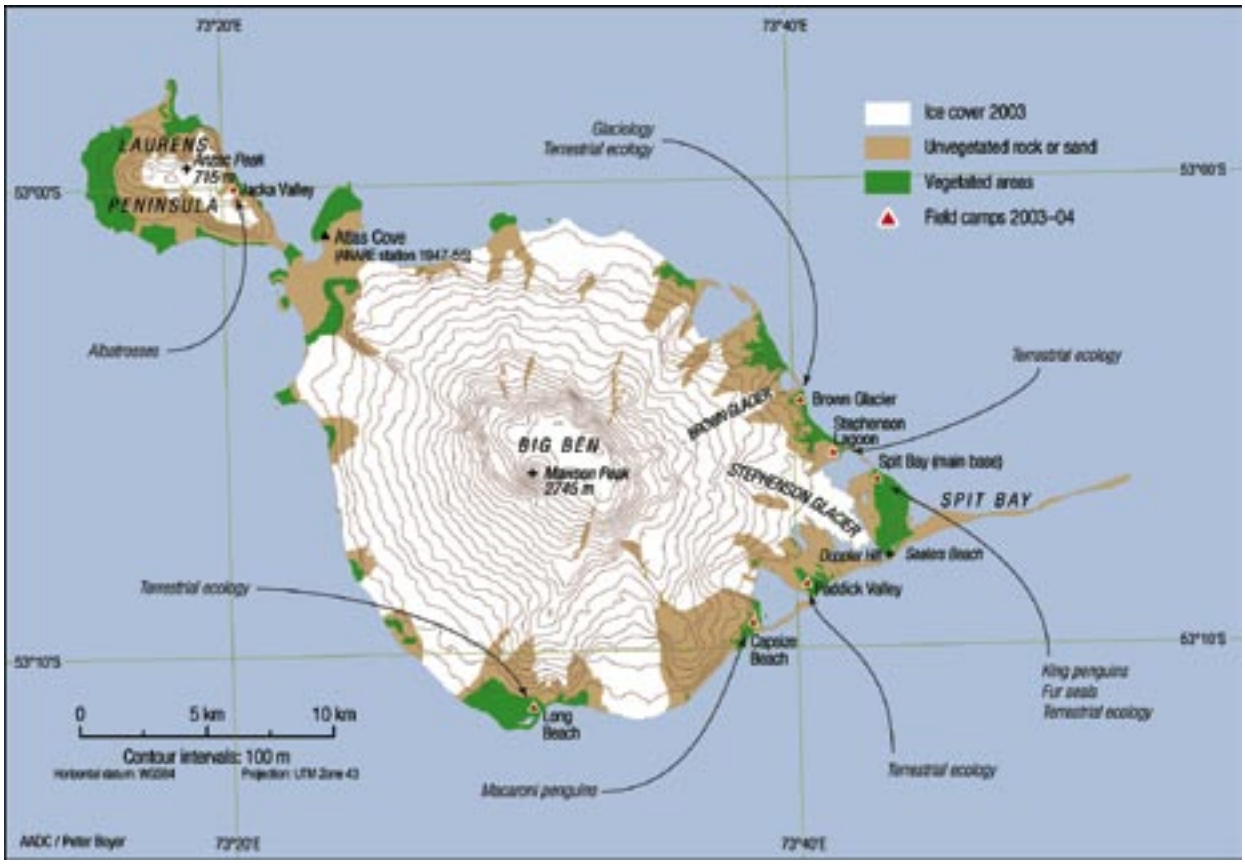
Tony Press

—TONY PRESS
Director, AAD

Heard Island's geology is dominated by the active volcano, Big Ben, and fast flowing glaciers.

SIMON GOLDSWORTHY

Heard Island research sites 2003–04



'What do we do if the beach isn't there anymore? It'll all go to custard.'
'We'll just have to sort it out when we see it!'

Planning for contingencies

Going to Heard Island must surely be like travelling to another planet. The sheer dynamic nature of the physical environment means that where there was once beach, cliffs now loom against crashing surf, glaciers become lagoons and previously walkable beaches are cut by racing streams. Nothing is certain and everything can change.

Plan too rigidly for operations on Heard Island and you will undoubtedly end up planning it all again and again, as the island and weather unfolds. In fact, the key to the success of the 2003–04 expedition to Heard was our detailed contingency planning. Luckily, we could draw on the expertise of seasoned Heard Island expeditioners and some innovative minds, in both the planning and operational teams.

Before we left we spent hours poring over aerial and satellite images looking for suitable camp sites, water sources, landing beaches and, most importantly, study sites for the array of research projects we were to undertake. We quizzed those with local knowledge, although in the intervening years we knew much could have changed.

The coast of Heard Island is where the glaciers meet the sea. Often the glaciers end in wide lagoons that are separated from the ocean by a spit of land that can be traversed by foot. But this is not always the case. As the lagoons fill with melt water or rain they tend to break out and the ensuing torrent or large gap in the spit makes foot travel impossible. We evolved two contingencies to meet this potential challenge.

The first was to learn how to safely cross rivers flowing from the lagoons. To do this we undertook a day of river crossing training in Tasmania. We learnt how to assess river flows, to 'buddy up' when crossing and to rescue each other with throw bags of floating rope if things didn't work out. This training enabled expeditioners to travel to their study sites safely.

For the bigger and more difficult crossings our second idea came into play – using zodiac inflatable boats to cross the lagoons. On the southern side of the island we took small boats that we could carry into position, if a beach landing was impossible at the desired site. These nine-foot boats with eight-horsepower motors proved effective in getting people across Winston Lagoon to the macaroni penguin study camp at Capsize Beach, or in venturing further to Long Beach.

We used 18 foot boats on the northern side, to establish camps at Stephenson Lagoon and along the north-east coast. Trips were even made to Brown and Compton Lagoons for bathymetry work for the glaciologists. The bigger boats were also used by a reconnaissance and beach-marking team to help land our amphibious LARCS on unknown beaches and get expeditioners from the *Southern Supporter* ashore.

We had worked hard to ensure the boats would operate safely, meet our needs and survive the conditions. They held up well despite being used as a lounge suite by the elephant seals and the propensity for rocks to find the propellers from time to time.

We had also put a lot of thought into our shelter needs – a critical part of any expedition. We took converted water tanks to use as laboratories and living accommodation along with heavyweight and lightweight tents. We also hoped to use existing huts if they had survived the three years since the last visit; the very condition and existence of these huts was another unknown.

Our heavyweight polar pyramid tents had been redesigned for the wet and windy subantarctic (see Expedition Kit page 14). The final result was fantastic and with ongoing design, as a result of our experience, things will only get better.

SIMON GOLDSWORTHY

HEATHER KIRKPATRICK

LEFT: The nine foot zodiacs proved popular with the elephant seals.
RIGHT: River crossing techniques.
BELOW: The ever changing Heard Island landscape.

ROBB CLIFTON

Lightweight tents were used around the island as overflow accommodation at camps and backup shelter for parties travelling further afield. The apple hut that had been at Paddick Valley three years earlier was now widely scattered debris, so a cache of lightweight dome tents was carried over for use by scientists throughout the summer. When travelling as far afield as Long Beach – an 11 hour walk from Capsize Beach – the lightweight tents provided shelter enroute if rivers were not crossable or an emergency occurred. Importantly, they acted as backup should the Long Beach apple have disappeared in the 'freight train' of wind that wraps around the island. To our relief, the apple was intact, warm and comfortable.

As well as transport and accommodation on the island, we needed a flexible source of power for the radios, computers and array of scientific equipment. The engineering team came up with a field camp power system that used solar panels, wind generators and small petrol generators to provide more than enough power for our needs in a variety of environmental conditions.

Our clothing had also been selected to provide flexibility while affording protection from the elements. We took mostly new clothing and used no velcro, to minimise the chance of introducing alien species to the island. Heard Island is rare in being a relatively pristine environment and we wanted to do all we could to maintain this.

Even our food was 'environmentally friendly' with nothing that could escape and grow, or introduce disease into plant or animal colonies. This meant no eggs, fresh fruit and vegetables or seeds that could take root and propagate. Even so we enjoyed many options with our food. From lightweight freeze-dried and dehydrated meals for those travelling long distances, to flour, pasta, cheeses and meats for camp-bound cooking. No-one went hungry.

Our 'flexible toolbox' of transport, accommodation, power generation, clothing and food allowed us to meet the challenges of operating on Heard Island with confidence. Getting ashore, completing our work and returning home with minimal environmental impact was a credit to the planners and expeditioners alike. In the end not too much 'went to custard' and when it did we sorted it out.

—ROBB CLIFTON
Expedition Field Leader, Heard Island 2003–04

ROBB CLIFTON

Nick Gales, Simon Goldsworthy, Iain Staniland and Ruth Casper attach a satellite tracker and VHF radio tag to a male Antarctic fur seal. A gas anaesthetic is delivered to the animal via a specially designed machine for use in cold climates. The anaesthetic lasts about 15 minutes, during which time the scientists attach their trackers, take samples and weigh and measure the animal.

Who eats whom around Heard Island

Australia oversees two important commercial fisheries – for Patagonian toothfish and mackerel icefish – in the waters around the Heard Island and McDonald Islands (HIMI) region. To manage these fisheries sustainably we need to understand the effects of harvesting on the target species, predators of those species and on the prey and competitors of the target species. This food web information will allow us to more accurately model the effects of fishing on all species and manage our fishing activities accordingly.

To acquire this information, in 2003-04 the Australian Antarctic Division (AAD) conducted an innovative and ambitious ecosystem study of the predators that breed on Heard Island; their prey; and the regional ocean environment. We called it the 'Heard Island Predator-Prey Investigation and Ecosystem Study' or 'HIPPIES'. The study gave us an insight into who eats whom, and where and when the predators of Heard Island feed.

It was a study on a grand scale. Twelve of us joined our terrestrial ecology, glaciology and operations colleagues on the *Southern Supporter* for the 4000 km journey to Heard Island. Once established in our three field camps (Jacka Valley, Spit Bay and Capsize Beach), our marine science colleagues on the *Aurora Australis* arrived. They spent the next 40 days rolling and pitching around Heard Island in a carefully constructed pattern, to study the many animals we equipped with satellite trackers on the island. The overall HIPPIES study was led by Andrew Constable, while Dick Williams was voyage leader on the *Aurora Australis* and Nick Gales led the animal tracking group on Heard Island.

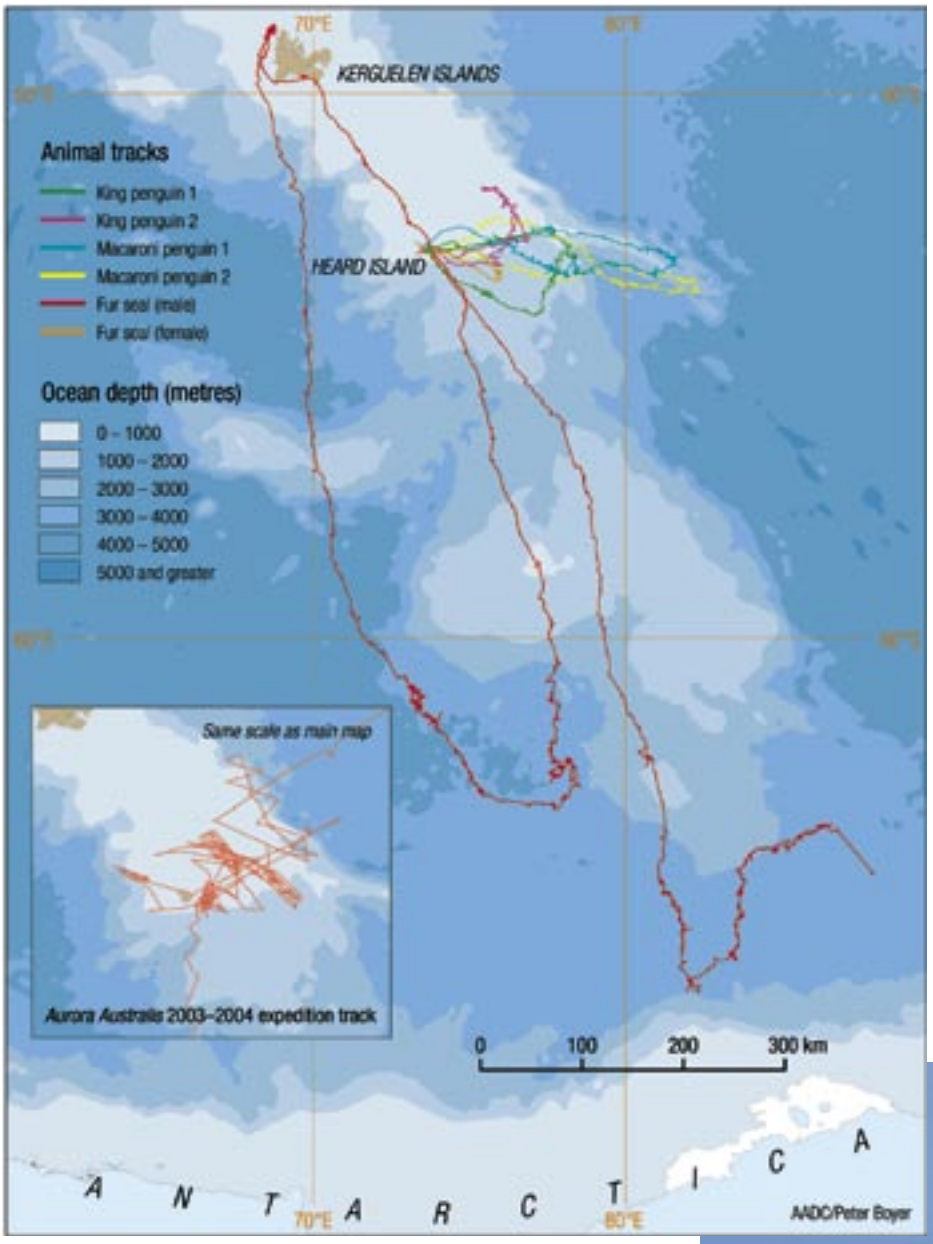
The basic approach of the study was to choose the predator species that, by virtue of their numbers, consume the most food from the waters immediately around Heard Island. These, in order of abundance, were the macaroni penguins (numbering in the millions), the king penguins (numbering in the tens of thousands) and the Antarctic fur seals (numbering in the thousands). Our experiment coincided with the busy summer breeding season on the island, during which the penguins and female fur seals were alternating their time on shore caring for their offspring and offshore consuming food for themselves and their young.

Before an animal headed off to sea, we would catch it and carefully – following ethics committee guidelines – attach a satellite radio tag (which gave us regular locations) and a dive data logger (which gave us data on all the animal's diving and swimming behaviour). Trips to sea varied from a few hours to a few weeks. When the animal returned to Heard Island we captured it again, removed the equipment and collected samples – scats and milk from fur seals and stomach contents from penguins – to identify what they had been eating.

Male fur seals were included in the work, but as they take no parental responsibility and we were unable to recapture them, we only placed satellite tags on them so that we could record where they went to feed. Some of these tags also sent back summaries of diving behaviour through the satellite. We also placed satellite tags on some black-browed albatross and light-mantled sooty albatross. We need to understand where these birds forage so we can assess the degree to which they overlap with the areas fished by longline vessels, which represent a risk to the birds if they attempt to take baits from the hooks.

At any one time almost 100 animals were being tracked around Heard Island via the French Argos satellite tracking system, and gigabytes of data were being collected on diving behaviour. To make sense of all these interlocking tracks we developed some specific software (HeardMap), which generated maps of each animal's whereabouts, and mathematically derived grids showing overall animal foraging intensity. The development of these maps was co-ordinated between the *Aurora Australis* and the Spit Bay camp by transferring data via the satellite phone. We also co-ordinated the ship's movements with that of the predators by discussing the day's observations and results (via high frequency radio) with the *Aurora Australis* crew each evening.

To collect the suite of data necessary to give us a complete enough picture of the physical and biological processes that influence the relationships between predators and prey, specialised ship-based trawls, acoustic echo sounders and regular measurements of the water column, were combined with remote data (of sea surface temperature and water colour for example) derived from space sensors.



Foraging tracks of fur seals, king penguins and macaroni penguins around Heard Island between December 2003 and February 2004. Female fur seals foraged close to the island while caring for their young and were observed to eat mostly icefish and myctophids (small schooling fish). Male fur seals have no parental responsibility and forage further afield – to Iles Kerguelen, down the Kerguelen plateau and along the continental shelf near Antarctica, where it is possible that they feed on krill. King penguins and macaroni penguins foraged for myctophids and squid in similar areas, although macaroni penguins travelled further – up to 1000 km in one case. Not bad for a small bird. Earlier in the breeding season, however, when their chicks are young, macaroni penguins tend to forage significantly closer to the island.

In the eight months since we returned home, samples and data collected on the island and the *Aurora Australis* have been, and continue to be, analysed. The different components of this complex, dynamic food web are being assembled into a model that will help us determine what level of fishing in this region can be conducted, while ensuring that dependant predators are not affected.

We only visit this remote and operationally challenging region sporadically, but each time we learn a little more about what is there and how best to manage it. HIPPIES has taken us a big step towards a sustainable, ecosystem-based fisheries model that we hope can give us confidence in fisheries management of this Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) region. The experiment has also taught us many scientific lessons to help us conduct similar experiments elsewhere in Antarctica.

—NICK GALES and ANDREW CONSTABLE
Southern Ocean Ecosystems Program, AAD

Iain Staniland searches for homeward-bound female fur seals using a directional antenna to pick up signals from the VHF tags attached to the animals.

NICK GALES

Operation King Penguin

ERIC WOEHLER

Sealers virtually exterminated king penguins from Heard Island between 1855 and 1880. Fortunately, over the last few decades, these beautiful birds have made a remarkable come-back. In the summer of 2003–04, three of us set out to study the birds, to find out where they foraged and what they did while at sea.

The original plan was to camp near Doppler Hill, at the island's eastern end, and find a few volunteers, among the thousands of penguins there, on which to attach a satellite tracker and dive recorder. But the colony had expanded so much that there was no space to catch individuals without placing ourselves amongst the breeding and incubating birds. It was imperative to keep our distance as eggs and chicks may be abandoned permanently, if the adult caring for them is disturbed.

We quit the camp site and moved to 'tent city' at Spit Bay, close to a colony of about 1800 pairs of king penguins. Here we were able to watch the penguins, chose our candidates and deploy the instruments when the birds left their breeding grounds and headed for the sea.

It sounds easy, but king penguins have a rather unusual life cycle. It takes them up to 14 months to rear a chick and because of this extended breeding season, the time a pair attempts to breed varies each year. When we started our project in December, everything appeared to be happening at once. There were penguins still feeding chicks from the previous season; penguins incubating eggs; penguins engaged in courtship; penguins moulting; and others just hanging around.

We wanted to study genuine breeders and the challenge was to distinguish them from non-breeding penguins. The only way to do that was by watching the colony for penguins that returned to their partners and then intercept the partner, now relieved of its incubation duties, as it was leaving the island. This changeover could take up to four hours, so we had to wait until a potential volunteer made up its mind to leave.

At first we wondered whether we would ever get all 21 tracking and recording units out. On our best day we deployed four sets of instruments (all animal handling and deployment procedures were in accordance with approved animal ethic guidelines). Throughout the season we managed to track penguins during incubation and after the chicks had hatched. At the end of our stint on Heard Island we had information on 50 individuals who were tracked over 307 days – a pleasing result.

Sending out the units was one thing; trying to get them back was another. From our daily data downloads we could see whether the birds were still at sea or returning to the island. As we needed to redeploy the instruments we had to catch the returning penguins before they reached the colony. To our surprise we found that many of our penguins returned to the sand flats at the Spit (some even went to the Doppler colony) and walked several kilometres back to the colony along a pebbly beach. So we had to go walking too.

Equipped with receivers and binoculars, we spent hours looking for penguins sporting big, painted numbers on their chests and carrying the latest in electronic fashion on their backs. Wind, rain and tens of thousands of moulting penguins made this task challenging and on a few occasions we returned to Spit Camp unsuccessful. A number of penguins also managed to sneak past us and enter the colony before we could retrieve the equipment. We then had to wait for their partners to return and recapture the instrument-bearers on their way back to sea.

We received data on the whereabouts of the penguins sometimes several times a day and it was exciting to see how far the birds ventured out to sea. On average they swam about 100 km a day, reached distances of 166–466 km from the island and travelled up to 2550 km on a single foraging trip that lasted from 6–23 days. The penguins travelled in many directions but there was one area (about 74–76°S) where they concentrated their efforts. It will be fascinating to link our data to the marine science data collected on the *Aurora Australis*. This information will improve our understanding of the complex Southern Ocean ecosystem and help us to secure a future for these magnificent birds.

—BARBARA WIENECKE
Southern Ocean Ecosystems Program, AAD

King penguin number 34 is home.

BARBARA WIENECKE

Glacial retreat heralds climate change in Antarctica

A study of Brown Glacier on Heard Island has shown that the glacier is rapidly retreating, suggesting that local climatic conditions are continuing to change rather than stabilise.

The study, which commenced in November 2000, involved measuring the basic physical characteristics of Brown Glacier. During the 2003–04 Antarctic season the Heard Island glaciology team repeated these measurements to see what changes had occurred.

Our results showed that compared with 1950 (the earliest record from which physical boundaries of the glacier can be defined), the glacier has lost 38% of its volume and retreated 1.17 km at an average rate of 21 m per year. This retreat is attributed to an increase in average annual temperatures of about one degree Celsius. While this may sound trivial, a one degree change is a significant temperature increase considered as a yearly average.

Since 2000, Brown Glacier has retreated 60 m. But the greatest changes were noted using Global Positioning System surveying techniques to measure the ice surface elevation. The lower slopes of the glacier have lost as much as 11 m in thickness, while higher up (where it is colder and changes were expected to be minor), the surface has dropped by up to four metres. This translates to a loss of about 8 million cubic metres of ice a year, compared with the 50 year average of 3 million cubic metres a year.

Brown Glacier has been changing for the last 50 years, and the changes appear to be ongoing at an accelerated rate. This implies that climatic conditions are continuing to change, rather than stabilise. To understand these changes our team installed markers to measure the mass balance of the glacier over the summer season, and over the next few seasons. Three weather stations were temporarily installed at different altitudes to monitor the glacier's immediate response to temperature. Ice samples were collected from deep within crevasses to help determine the amount of annual ice accumulation, which is still the biggest unknown.

Because Heard Island is difficult to get to, and we can't always be there to measure how much ice is melting, we aim to predict melt rates based on data from a remotely operating weather station near the glacier, combined with energy balance models. The field measurements we made last summer will allow us to fine tune the equations that are used to make these calculations.

Other glaciers on the island also display marked changes with time. A comparison of the ice front of Stephenson Glacier (which terminates in a 113 m deep lagoon) using a high resolution satellite image taken in January 2003, showed a retreat of nearly 200 m; a dramatic change for a one year period.

The majority of glaciers are retreating worldwide, and Heard Island fills a gap in an otherwise vast expanse of ocean by providing a point where change in the climate of the Southern Ocean can be monitored. The lonely outpost of Heard Island is like a sentry, giving us advanced warning. And while the loss of glaciers on Heard Island would make a trivial contribution to world sea level rise, it heralds the progression of climate change south, towards the ice-covered Antarctic continent.

—DOUG THOST
Ice, Oceans, Atmosphere and Climate Program, AAD and ACE CRC

The Heard Island glaciology team had an international flavour with Dr Martin Truffer (right), a Swiss national based in Alaska, and Ms Shavawn Donoghue (second from right), a Canadian PhD student based at the University of Tasmania. Aussies were Dr Doug Thost (left) co-ordinating the field program, field training officer Ms Heather Kirkpatrick (second from left) and expedition field leader Mr Robb Clifton (centre).

DOUG THOST

DOUG THOST

Teaching an ancient discipline new methods
vegetation mapping

JENNY SCOTT

Paddick Valley looking inland. The lake with island can be seen in the aerial photo and vegetation map.

Over the last two years we have been successfully resurrecting old Heard Island field mapping vegetation data with the aid of new mapping technologies. It has been a great example of collaboration between Henk Brolsma, mapping officer at the Australian Antarctic Data Centre (AADC), a Geographic Information Systems (GIS) consultant, DataVision GIS P/L, and Jenny Scott, the scientist who originally collected the data. The key to the project was the set of ground control points surveyed by Jenny in the summer of 2000–01, which allowed the mapping to proceed with some confidence. We tell the story here in the hope it might inspire other successful collaborations.

During the 1986–87 and 1987–88 Australian National Antarctic Research Expeditions (ANARE) to Heard Island, Jenny mapped most of the island's vegetation in the field using 1980 and 1986–87 colour aerial photography. Vegetation boundaries were traced from aerial photos onto transparent overlays and ground-truthed where possible. A series of 35 mm slides (oblique aerial photos from a helicopter, and also ground-based photos) were taken to aid later interpretation. However, there was a problem afterwards with how best to display and map the information from the aerial photos, as the aerial camera and photography were not designed for mapping. At the time there was no accurate base map of the island, or a Digital Elevation Model (DEM), so the data sat waiting for a solution.

Since this time, satellite imagery of Heard Island and the technology for translating the imagery to map form have become increasingly sophisticated and the AADC has produced a number of increasingly accurate maps of the island. Over the same period, documenting and measuring vegetation change on Heard Island has become a topic of great interest and relevance to subantarctic terrestrial biologists, as the island presents an unusually sensitive and pristine environment for detecting and measuring the effects of regional climate change. The 1987 vegetation mapping data had the potential to become an invaluable baseline tool for assessing changes in vegetation distribution and the nature of communities on the island.

With this in mind, we were keen to see if we could make the 1987 mapping data come to life. During the 2000–01 summer expedition to Heard Island, Jenny collected a series of ground control points around the east and west coasts using a small hand-held Global Positioning System (GPS) unit. These ground control points, although not ideal due to their spatial inaccuracy (±10 metres), together with a relatively coarse DEM of the island, enabled the first digital 'ortho-rectification' (correcting for the effects of camera lens tilt and displacement of objects due to ground relief) of the 1980 and 1987 aerial photographs. It also showed that it was possible to use ground control points collected by personnel other than surveyors.

Jenny's old transparent vegetation mapping data overlays were also rectified, although it was decided, after a few tests, that greater accuracy would result if the vegetation boundaries were mapped directly from the rectified aerial images on the screen, while using the overlays for 'ground-checking'. Consequently Jenny spent several months mapping by 'screen-digitising' at DataVision, where she learnt to use ArcView GIS software and benefited from the expertise and advice of the DataVision personnel. Jenny's series of oblique aerial 35mm slides taken in 1987 were invaluable for interpreting the vertical aerial photos during this process.

We have now produced a vegetation map for eastern Heard Island, which can be used as 1987 baseline information

by researchers. Several hundred of Jenny's 35mm oblique aerial and ground-based slides from 1987 and 1988 have been incorporated as part of the final data set ('hot-linked' to the digital vegetation map). Jenny undertook some field checking of the map during the 2003–04 Heard Island expedition and made some minor adjustments to vegetation category descriptions. A report describing the methodology and vegetation mapping categories is available through the AADC's metadata records. The vegetation data can be downloaded from the same record. The final phase of this 1987 baseline project will be to map the remaining vegetated areas of the island (the west and north-west ice-free areas) using similar methods, by July 2005.

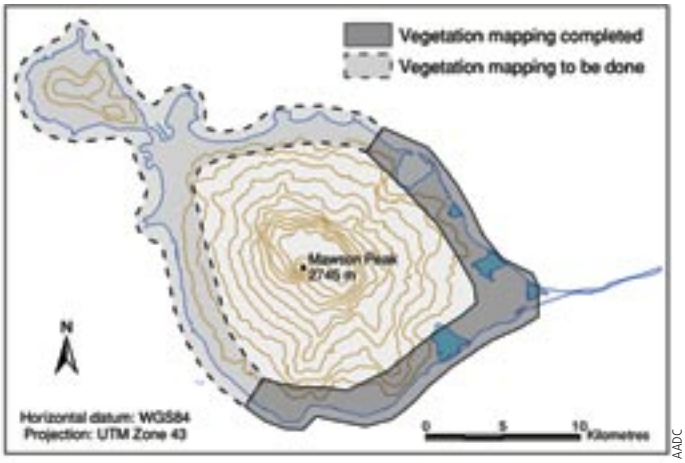
In January 2003 a high resolution satellite image of eastern Heard Island was obtained by the AADC. This was ortho-rectified using a Radarsat DEM and the hand-held GPS control points captured during the summer of 2000-01. On request from the terrestrial biologists participating in the 2003-04 Heard Island expedition, the image was enhanced to highlight vegetation features. The AADC supplied the biologists with several series of prints at 1:5000 and 1:7500 scales for field use. Jenny found these invaluable for assessing the extent and nature of vegetation change on the ground, with similar scale prints of the 1987 aerial imagery and mapping data used for comparison. Together with an extensive series of fixed photo-points of vegetation features on the ground (taken by Jenny in 1987 and 2003–04), the 1987 and 2003 aerial imagery provides an unequalled data set for analysing vegetation change on Heard Island over the 16 year period.

Following the successful collection of usable ground control points in the summer of 2000–01, the AADC equipped the 2003–04 Heard Island expedition with a base station and several differential GPS units. The aim was to collect a series of more accurate ground control points and provide a more efficient and accurate method of data collection for various research programs. In addition to their own programs, three expeditioners (Jenny Scott, Robb Clifton and Justine Shaw) surveyed several hundred new ground control points around eastern Heard Island using the differential GPS system, and re-surveyed the ground control points acquired in the 2000–01 summer to sub-metre accuracy. This will assist the AADC in its endeavours to refine the mapping of Heard Island.

In the island's north, two other expeditioners (Kieran Lawton and Roger Kirkwood) collected a series of hand-held GPS ground control points which, together with the Radarsat DEM, will allow ortho-rectification of the Laurens Peninsula high resolution satellite imagery and aerial photography. Jenny will use these in the next phase of the vegetation mapping project.

—JENNY SCOTT
School of Geography and Environmental Studies, University of Tasmania

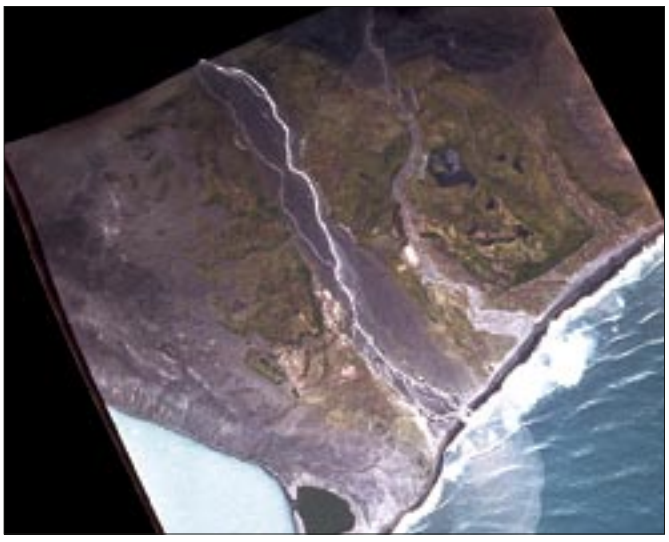
—HENK BROLSMA
Australian Antarctic Data Centre, AAD

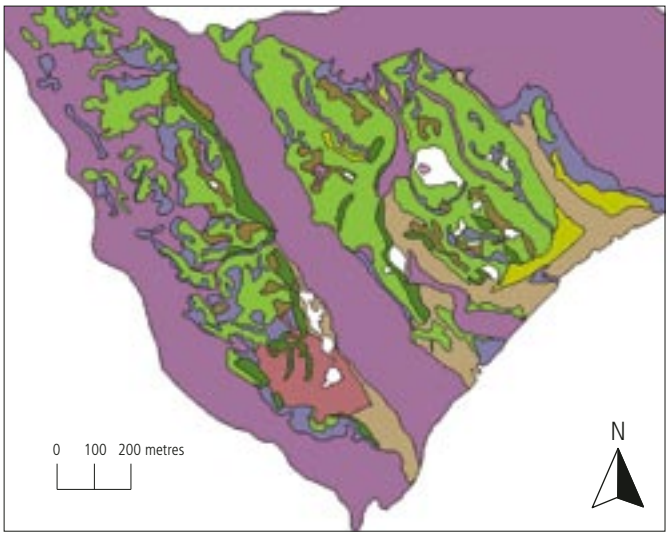


AADC

Vegetation mapping completed and to be done.

A 1987 oblique aerial photo after orthorectification and the resulting vegetation map produced by screen-digitising. This vegetation map is a valuable baseline tool for assessing future changes in vegetation distribution and plant communities.


AADC



JENNY SCOTT, AADC

A new plant on Heard Island

JENNY SCOTT

The first daisy (*Leptinella plumosa*) found on Heard Island.

Written on Heard Island, February 2004, for the weekly newsletter.

'One wet and windy afternoon recently, I went for a walk along the gravelly river terrace of the main glacial stream running through Paddick Valley. Big areas of new vegetation had appeared on the terrace since 1987. I knew this from comparing air photos taken back then, with a satellite image of eastern Heard Island taken in January 2003. A big part of my project is to look at vegetation change on the island since 1987, based on these aerial images and a mass of photos and other data that I had collected during two field seasons in 1987 and 1988.

As I expected, the new vegetation on the river terrace was mainly the bright green cushion plant *Azorella selago*, which is expanding its range nearly everywhere on the island. This may be partly due to climate conditions becoming milder.

I wasn't expecting to find anything unusual, although this was potentially a good place. I wandered along, eyes to the ground, and suddenly saw something that made me think I was dreaming! It was a new type of plant; a small feathery-leaved member of the daisy family, *Leptinella plumosa* (formerly *Cotula plumosa)*. I stared at it, not believing my eyes. It was nestled at the edge of an *Azorella* cushion and a rock and was only about 10 x 15 cm in diameter, with four or five small, yellow, bud-like flowers. (Daisies in the subantarctic have no petals to attract insects, as there are no flying insects to pollinate them. The wind spreads their pollen instead.)

There are only 11 species of flowering plants on Heard Island, but this made it 12. Were there any other *Leptinella* plants here, or was this the only one? When I told Pep, who was working nearby, she was as excited as I was, and we walked around the whole river terrace area covering every likely spot.

We didn't find any other *Leptinella* plants, although of course that doesn't mean there aren't others. And other species of plants could be arriving. In a rapidly changing environment like Heard Island's, we expect that other species of plants will arrive; including unwanted, weedy, invasive ones (hence the strict quarantine regulations for the island).

So where did this *Leptinella* plant come from and how did it get here? It is likely that it originated from the French subantarctic islands to the west of Heard Island – Iles Kerguelen and Iles Crozet – where it is abundant. It is a common species in the subantarctic and is found in coastal areas at Macquarie Island.

How it got here is a harder question to answer…possibly a coastal scavenging bird, such as a skua, unknowingly transporting and then depositing the seed on this spot. A tiny sample from the plant will be enough for DNA analysis back in Australia, which may indicate where it originated from.

We will monitor the fate of this little plant with great interest in the future, and hope that it survives the winter and escapes trampling by the fur seals and moulting elephant seals which are all around it on the river terrace. We also hope that additional plant arrivals on the island are also 'friendly subantarctic natives' and not invasive weeds.'

—JENNY SCOTT
School of Geography and Environmental Studies, University of Tasmania

MARCUS SCHORTEMEYER

Postscript

Preventing the human introduction of non-native species and disease to Heard Island is a key goal of the new management plan being prepared by the Australian Antarctic Division (see HIMI Management plan opposite), which will include comprehensive quarantine measures (see Ecological risks to Heard Island assessed, page 14). The management plan will also include provisions for investigating and responding to new species recorded on the island, and the Australian Antarctic Division is currently undertaking an investigation to determine the probable origin of the *Leptinella* plant. It is hoped that genetic analyses and expert advice will indicate the plant to be a 'friendly native' that has arrived by natural means, rather than an unwanted hitchhiker from a previous expedition.

—EWAN McIVOR
Environmental Policy and Protection Section, AAD

ROGER KIRKWOOD

HIMI Management Plan update

The HIMI Management Plan aims to maintain the conservation values of Heard Island, which are recognised on a national and international scale.

The Australian Antarctic Division (AAD) administers and manages the Heard Island and McDonald Islands (HIMI) Marine Reserve, located in the Southern Ocean some 4000 km south west of Western Australia (see *Australian Antarctic Magazine* 5, page 40). The AAD has prepared a draft management plan for the Reserve which has been considered by the Commonwealth Marine Protected Areas Committee – an interdepartmental body responsible for considering draft management plans for Commonwealth marine protected areas – and by the key stakeholders involved in the process to declare the Reserve. The draft plan will be released for public comment shortly, with announcements to be made via the AAD website, the *Australian* newspaper, the *Government Notices Gazette* and environmental newsletters. The draft plan includes comprehensive measures to prevent the human introduction of new species and diseases (see Ecological risks to Heard Island assessed, page 14), to communicate the Reserve to the Australian and global community (see Bringing Heard Island to the world, page 22), and to ensure that wastes, facilities, access and human activities in general are managed to maintain conservation values recognised on a national and international scale.

Readers interested in the management of HIMI are welcome to comment on the draft plan. The draft plan will be revised where necessary to address issues raised during the public comment period and will then be presented to Parliament by the Minister for the Environment and Heritage for formal adoption.

—EWAN McIVOR
Environmental Policy and Protection Section, AAD

Heard Island online

The Heard Island expeditioners shared the daily ups and downs of life and work on Heard Island and aboard the *Aurora Australis* through an online newsletter on the Australian Antarctic Division (AAD) web site <http://www.aad.gov.au/default.asp?casid=12881>.

The newsletter was a popular source of information for expeditioners' families and friends and the general public, and detailed the preparations for departure, progress to and from the Island, set-up of camp sites, Christmas celebrations and scientific activities and discoveries.

You can visit the AAD web site to read about these adventures, find information on the plants, animals and glaciology of Heard Island and, thanks to satellite technology, follow the tracks of penguins, seals and albatrosses as they travelled from Heard Island to their feeding grounds in the Southern Ocean.

ROBB CLIFTON

KATE KIEFER

Scientific activity could challenge the near-pristine status of Heard Island.

Ecological risks to Heard Island assessed

The islands of the Territory of Heard and McDonald Islands (HIMI) are amongst the world's most biologically pristine. Recognising the need to extend the stringent quarantine measures applied to Australian Antarctic Program activities to all HIMI visitors, in 2003 the Australian Antarctic Division (AAD) commissioned an independent assessment of the risk of introduction, by human means, of organisms that may pose a threat to the region's plant and animal life. Professor Stephen Chown, in his report, *The probability of introduction of non-indigenous species to Heard and McDonald Islands: Taxa risks, and mitigation*, notes that although HIMI is isolated and infrequently visited, its 'pristine' status is likely to be challenged.

Already some 240 shore-based visits have been made to Heard Island and the level of activity is expected to rise as interest in the Territory increases for science, tourism and fisheries. Scientific activity in the region has broadened its scope in recent years, as demonstrated by the duration of expeditions, the number of field camps and sites occupied, and the volume of stores and equipment landed – some 340 m^3 of cargo was landed for the 28 expeditioners of 2003–04. The risk assessment identified equipment and stores, clothing, containers, wood and vehicles as critical pathways for terrestrial introductions; and the more cargo landed, the greater the risk of introducing non-native species.

Professor Chown concluded that, 'A wide variety of terrestrial and freshwater taxa, capable of substantially altering ecosystem functioning and causing the local extirpation of many different species, could potentially be introduced to Heard and McDonald Islands'.

With ballast water exchange already prohibited in HIMI, he noted that the primary routes for introduction of marine species are, 'by fouling of hulls and gear that is routinely left in the water and possibly by accidental waste-water discharge'.

Undoubtedly the best strategy for maintaining the islands' World Heritage-listed ecosystem is the application of preventative measures. Accordingly, fresh fruit and vegetables – identified in the assessment as high risk vectors for the transport of hitch-hiking species – were not taken ashore by the 2003–04 expedition.

Other controls applied last season and to be formalised via a new management plan for the region include: mandatory inspections for rodents on the day of departure for HIMI (regardless of vessels holding valid de-rat certificates); vessel hull and equipment cleaning; a ban on the landing of viable seed and fungal products; controls on yeasts handling; and the phytosanitary treatment of timber to be taken ashore.

—SANDRA POTTER
Environmental Policy and Protection, AAD

Expedition kit

Out with the old clothes, the velcro and open weave fabrics! That was the message of Australian Antarctic Division (AAD) clothing and equipment co-ordinator Damian Flynn, to the 2003–04 Heard Island expeditioners. Instead, expeditioners were equipped with a range of new, lightweight, purpose-designed clothing that provided warmth and comfort while minimising the risk of introducing seeds, soil and insects to the island.

Two of the new design features were light-weight Gore-Tex jackets with waterproof zippers, draw-string cuffs and rounded, capacious pockets for easy vacuuming; and gaiters made of cordura and canvas and fastened with buckles (zips and press studs are hard to manipulate in muddy, icy conditions).

A new tent, designed by One Planet in consultation with AAD staff, was also trialled by expeditioners. Based on the pyramid tents used since the earliest days of Antarctic exploration, the new tents were constructed of strong aluminium poles and waterproof, reinforced fabric that could withstand Heard Island's strong winds (of up to 250 km/hr) and driving rain. The aerodynamic design minimised the noise of flapping fabric and the apex of the tents were constructed of radiator hose to increase flexibility and strength.

DOUG THOST

Expeditioners erect a polar pyramid tent.

Protecting Heard Island's environment

Botanist, Dana Bergstrom, removes excess packaging.

ANNIE RUSHTON

A range of environmental mitigation strategies and actions were employed to protect Heard Island's environment during the 2003-04 expedition. In particular, a detailed environmental assessment was prepared prior to the expedition, pursuant to the Heard Island Wilderness Reserve Management Plan. The assessment identified a number of possible environmental impacts:

- the introduction of alien species to the island;
- disruption to wildlife populations;
- trampling of vegetation and disturbance to soil;
- pollution from chemicals and wastes;
- effect of human activity on cultural heritage; and
- temporary loss of wilderness and aesthetic values from the establishment of base camps.

Specific actions to mitigate these environmental impacts included:

- strict quarantine measures such as the purchase of new equipment, non supply of fresh fruit and vegetables, and rigorous cleaning and inspection regimes on all cargo;
- presence of restricted areas and controls on vehicle movements, field camp locations and wildlife approach distances;
- deployment of Unusual Animal Mortality Response Kits in the event of a disease outbreak;
- deployment of field fuel spill kits to prevent and clean up fuel spills;
- reduced packaging on all cargo to minimise waste prior to departure;
- removal of solid waste from current and previous expeditions, and proper disposal of liquid waste;
- preparation of an Environmental Code of Conduct
- a comprehensive environmental training programme for all participants; and
- an environmental reporting regime while on the island and upon return.

For more information contact the Operations environment advisor at opsenviro@aad.gov.au.

—SHAUN WALSH
Environment Advisor – Operations Branch, AAD

Weathering the furious fifties

Life in a tent on Heard Island can be challenging. But the most vulnerable to the weather in this zone of strong and persistent westerly winds – the 'furious 50s' – are those working the decks and laboratories on the *Aurora Australis*. We had budgeted for a loss of at least one-third of the ship days to poor weather, but, by being adaptable in the survey design, managed to collect usable data on most days. *Aurora Australis* voyage leader, Dick Williams, describes the difficulty of conducting marine science in the Southern Ocean:

' January 19–24, 2004. As always in the Heard Island region the weather is the dominant factor affecting plans. Trying to finesse the weather, taking calculated risks on what the wind and sea will do in the ensuing couple of days so that something productive can be done during bad or marginal conditions, is a constant feature of trying to do marine science in this area and getting the maximum value out of the always limited time available...

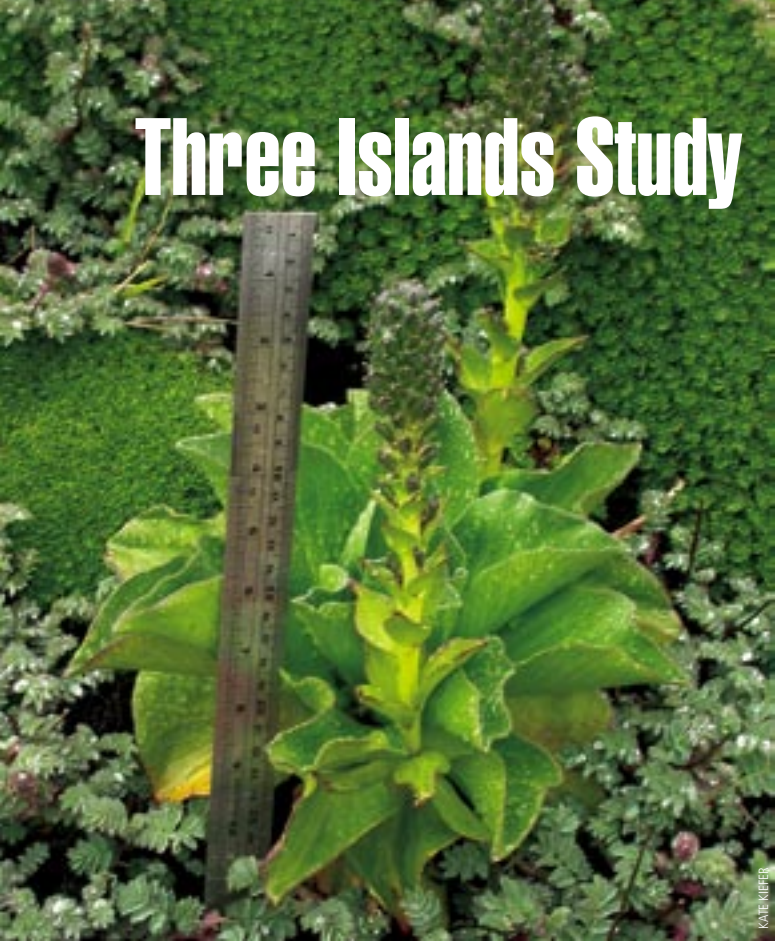
As it happened, we had our most extensive period of bad weather for the whole voyage. Although the wind was not always in the extreme range (although we did experience periods of wind over 45 knots), the constant westerly or north westerly winds over 30 knots, since leaving the king penguin box, built up very large swells which precluded any work. This meant that after completing two of the 10 CTD (conductivity, temperature and depth) casts on the western oceanographic transect, we were dodging west and east during Friday and Saturday, trying to stay near the transect line and waiting for the weather to abate...

By Saturday afternoon we knew we would not be able to complete either the western oceanographic transect or the juvenile icefish survey because the forecast was for continuing strong westerly winds. We headed for Heard Island to give us some respite from the heavy rolling that the ship was experiencing and to put us in a position to start the southern oceanographic transect as soon as the weather allowed. '

The ups and downs of the marine science group can be followed in the Heard Island online newsletter at <http://www.aad.gov.au/default.asp?casid=13133>.

DENNIS CRAWFORD

Three Islands Study


KATE KIEFER


KATE KIEFER


KATE KIEFER

A multinational study spanning three subantarctic islands, has given us an insight into the effects of climate change on subantarctic plant species.

The three islands in the study – Marion Island, Iles Kerguelen and Heard Island – lie north, within and south of the Antarctic Polar Frontal Zone (APFZ), respectively. This zone, on the edge of the Antarctic region, is both an oceanic and climatic boundary, with warmer seas and air temperatures to the north and colder temperatures to the south. The three islands therefore provide a latitudinal temperature gradient and a fabulous suite of natural laboratories to explore the impact of temperature on species' performance and ecosystem structure.

There is about a 2°C jump in average air temperature between each island, starting with Heard in the south at about 1.5°C; 3.5°C on Kerguelen; and 5.5 °C on Marion. This natural temperature gradient provides a useful analogy for the impact of climate change, with the warmer islands being models of what the cooler islands will be like in the future.

To overcome problems with year-to-year variations in seasonal temperatures – a hot summer one year and a cold summer the next, for example – we deployed teams on the three islands simultaneously over the 2003–04 summer. Logistical support was provided by Australia, France and South Africa, while scientists from eight nations were involved, either in the field or patiently awaiting samples.

There were many components to the three islands study, but one of the main ones involved examining the differences in the progression of flowering and seed development in four important plant species that occur on all three islands. These were the Kerguelen cabbage, *Pringlea antiscorbutica*, which is endemic to these islands as well as Iles Crozet; the cushion plant, *Azorella selago*; a subantarctic tussock grass, *Poa cookii*; and a creeping, wiry subantarctic herb from the rose family, *Acaena magellanica*. We had sites established along altitudinal gradients on all islands and these sites were visited every five days, weather permitting. Plants, identified by temporary markers, were monitored throughout the summer.

Our preliminary analysis has shown that not all species perform in the same way across the temperature gradient between the islands. This is important because it give us clues as to whether or not there will be winners and losers in a climate change scenario. Although we expected a lag in flowering development on the colder islands, compared to the warmer islands, in the case of *Acaena magellanica*, development differed by more than one month between Kerguelen and Heard islands. Such a lag time was surprising. Furthermore, coastal *Acaena* on Kerguelen had three flushes of flowers, compared to only one on Heard. The end result of this behaviour was substantially more seed production on Iles Kerguelen compared with Heard Island by the end of summer, so that *Acaena* may be more competitive under warmer conditions.

The three islands study was part of an international Scientific Committee on Antarctic Research program called RiSCC (Regional Sensitivity to Climate change in Antarctica) and took advantage of the opportunity that co-operation between nations in the Antarctic offers. Support for the visit to Kerguelen came from both the French Antarctic program and the French Embassy in Australia.

—DANA BERGSTROM
Adaptation to Environmental Change Program, AAD

KATE KIEFER

Far left: Three of the four target plant species: The Kerguelen cabbage, *Pringlea antiscorbutica* (centre), the green-grey foliage of the subantarctic herb *Acaena magellanica* or buzzy (bottom) and the cushion forming species *Azorella selago* (top).

Top left: Dr Dana Bergstrom downloads data from an automatic weather station on Iles Kerguelen using a satellite telephone and laptop computer.

Left: Aerial shot of Marion Island, showing the lush coastal vegetation typical of this warmer island. The persistent ice cap, which covers only one percent of the island, can be seen on the higher peaks in the background.

Above: The higher snow covered peaks of Mt Ross, Iles Kerguelen's highest peak, dominate the skyline. Low herbaceous vegetation, typical of Iles Kerguelen can be seen in the foreground.

Measuring the response of Heard Island plants to global warming

As the effects of global warming intensify, plants that have evolved in the cool environment of Heard Island must cope with rising temperatures. The amount of carbon plants acquire from the air by photosynthesis, or lose to the atmosphere by respiration, strongly affects their growth. Both processes are temperature-dependent and their balance is likely to change in a warming environment.

We can measure the response to an instantaneous change in temperature, but this does not tell us whether and how organisms might acclimate to a long-term, sustained temperature change. If you live in Darwin, for example, you will likely perceive and physiologically react to a cold day differently than someone living in Hobart. If you move from Darwin to Hobart and still freeze after 20 years, it's probably because there are limits to how well you can acclimate. These limits vary between people, and vary between plant species.

On Heard Island, we need to know whether plants in a future, warmer environment will have an altered physiology compared to those growing today. But how do we compare the plants of today and tomorrow? Over the 2003-04 summer on Heard Island, our approach was to treat the island as a natural laboratory, and to study the amount of carbon gained and lost by plants grown at different altitudes.

The theory is that plants growing at an altitude of say 200 m, currently experience temperatures that coastal plants would have experienced 50 years ago. In our natural laboratory, we worked on a transect from sea level, at Skua Beach, to the escarpment of Scarlet Hill, at an altitude of more than 200 m. Our 'guinea pig' was the Kerguelen cabbage, *Pringlea antiscorbutica*. By measuring the amount of carbon gained and lost through photo-synthesis and respiration, we now know that acclimation to warmer temperatures does occur, but that the delicate balance between carbon gain and loss in *Pringlea* is upset on days warmer than 10-12°C. This likely results in slower growth.

Pringlea and other 'guinea pigs' are currently under close observation in Canberra, where they are being treated with cool and warm days in different walk-in growth chambers.

Below: Marcus Schortemeyer measures photosynthesis in Kerguelen cabbage (*Pringlea antiscorbutica*) on Scarlet Hill, Heard Island, using a LiCor 6400 Portable Photosynthesis System. His research will help him understand how plants on the island respond to rising temperatures.

CHRIS STEVENSON

—MARCUS SCHORTEMEYER
Australian National University

Heard Island: a history of exploration

Despite considerable sealing activity at the Iles Kerguelen from the 1770s, Heard Island – approximately 300 km to the south-east – remained undiscovered until 1853. On 25 November of that year, Captain John Heard, aboard the merchant vessel *Oriental*, sighted land. His wife provides the first recorded description of the island:

> *'At 10 o'clock the Captain was walking on deck and saw what he supposed to be an immense iceberg. … the atmosphere was hazy, and then a heavy snow squall came up which shut it out entirely from our view. Not long after the sun shone again, and I went up again and with the glass, tried to get an outline of it to sketch its form. The sun seemed so dazzling on the water, and the tops of the apparent icebergs covered with snow; the outline was very indistinct. We were all the time nearing the object and on looking again the Captain pronounced it to be land. The Island is not laid down on the chart, neither is it in the Epitome, so we are perhaps the discoverers, … I think it must be a twin to Desolation Island, it is certainly a frigid looking place.'*

In the five years following Heard Island's discovery and reporting in newspapers around the world, more than 50 visits were made to kill elephant seals and render their oil. Oil production peaked in 1857-58 and continued until 1877, despite the near-destruction of seals on the island by 1859. The poor weather conditions at Heard Island and the lack of sheltered harbours along its coast meant that many vessels ran aground, occasionally sinking in view of the sealing gangs that awaited their return.

Early scientific visits to Heard Island

The Australian National Antarctic Research Expeditions (ANARE) station at Atlas Cove was established in December 1947. Before then, five known scientific visits to Heard Island occurred between 1874 and 1929. The first was by the *Challenger* in 1874, when a landing was made at Atlas Cove and a few scientific samples were collected. Poor weather limited the visit to three hours. Later that year, the *Arcona* brought a German expedition to Heard Island looking for suitable sites for observing a transit of Venus. It is likely that poor weather discouraged their interest in the island. Three visits were made in the early 20th century. The first was in February 1902 by the German Antarctic Expedition, when a small team landed at Atlas Cove to make observations and collect samples. The second was an eight-day visit to the Atlas Cove region in January 1928 by two French geologists and the third was in November 1929 by the British Australian New Zealand Antarctic Research Expedition, led by Douglas Mawson. As with previous visits, poor weather limited the scientific investigations by the field party.

Australian research expeditions

In December 1947, Australia established a research station at Atlas Cove. The station was occupied by the ANARE for seven years until March 1955 by between nine and 15 men. The station was originally planned for Spit Bay in the east, but poor weather prevented landing operations there. The station was abandoned in March 1955 at the time of the establishment of Mawson station on the Antarctic continent. The next visit was for six weeks in 1963, when scientists and a small climbing party were landed on the island. Poor weather prevented the climbers from reaching the summit of Big Ben.

In 1979–80 a National Mapping expedition visited Heard Island for two weeks. During this visit, the second landing was made on the nearby McDonald Islands (discovered by Captain William McDonald on 4 January 1854) by amphibious vehicle, and a small team spent five days conducting the first scientific surveys of the islands. Between 1985 and 1988, three extended visits were made to Heard Island over three summers. A month-long mid-winter visit was made in 1990 by a team of four at Spit Bay and five expeditioners wintered on Heard Island between January 1992 and March 1993. Further expeditions occurred in 2000–01 (42 expeditioners) and 2003–04 (28 expeditioners).

Foreign national and private expeditions

Between March 1969 and April 1970, the ANARE station at Atlas Cove was occupied by American scientists involved in the US Coast & Geodetic Survey. The scientists' objective was to photograph a satellite in orbit, for use in triangulation calculations to determine the shape and size of the Earth and the relative locations of the photographic stations. Unfortunately, poor weather limited the number of photographic opportunities. Early in 1971 a joint French-Australian expedition visited Heard Island for six weeks. During this expedition the first landing was made on the McDonald Islands – a helicopter landed two scientists for 45 minutes.

There have been five private expeditions to Heard Island between 1965 and 2000. The first, the Southern Indian Ocean Expedition, visited in 1964–65 with the aim of climbing Big Ben. The climbers landed at Capsize Beach – so named as the surf overturned their boats on landing – and successfully reached the summit on 25 January 1965. A second mountaineering expedition visited Heard Island in early 1983 and successfully ascended Big Ben, reaching the summit on two occasions. Another expedition, present on Heard Island at the same time, was primarily a ham-radio visit, but a small mountaineer team was also landed in another (unsuccessful) attempt to climb Big Ben. A ham-radio expedition spent less than three weeks at Atlas Cove in January 1997. They established their own camp and made more than 80,000 contacts with other ham-radio operators around the world. The third ascent of Big Ben was made in 1999-00 by four climbers from the Australian Army. Several small yachts have visited Heard Island since the early 1970s.

—ERIC WOEHLER
IASOS and AAD

Reconstructing the lives of Heard Island's sealers

A survey of relics is helping to reconstruct the lives of 19th century sealers on Heard Island.

The survey, conducted in 2003-04, was confined to the coastal ice-free areas between Fairchild Beach, in the northeast, to Long Beach in the south, where intensive sealing operations occurred between 1855 and 1877. The survey complemented similar efforts at Atlas Cove in 2000-01.

Several hundred sealing relics were located using historical photographs from 1947-87 (when Australian National Antarctic Research Expeditions documented the state of relics around the island), earlier archaeological surveys from the mid 1980s, and published and unpublished field notes from previous expeditions. The relics ranged in size from shards of pottery to the foundations of cobble stone houses. Their locations were recorded using a Global Positioning System (GPS), and photographs were taken *in situ*, to supplement the GPS data and field notes.

One of the more significant findings was the rediscovery of the sealers' cemetery on the vegetated slopes overlooking Doppler Hill and the seal processing facility on the beach. The cemetery was discovered by Max Downes, a historian and early expeditioner at Heard, during a visit in 1987-88 and consisted of four relatively prominent headboards. However, it was not mapped accurately at the time. In 2003-04, after two days of searching, three headboards were discovered, barely protruding from the surrounding vegetation. In some cases there was less than two centimetres of wood exposed.

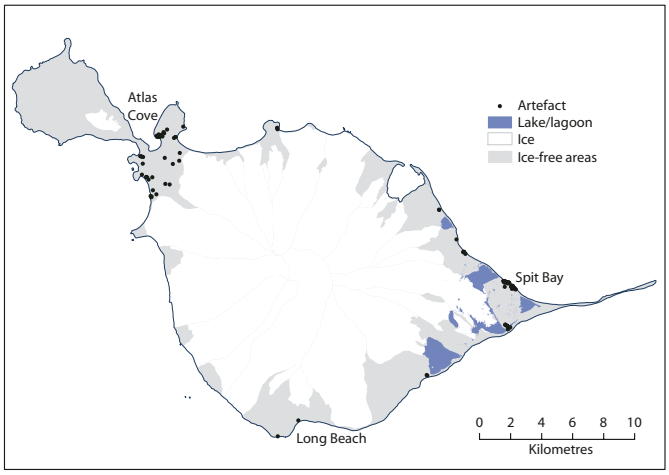
Ruins of two sealers' huts at Capsize Beach, on the southeast coast, were reported by a private expedition in 1965, but were overlooked by subsequent visits. These ruins were relocated and numerous relics and fragments were found, including parts of machinery and tools associated with the sealers' work. Fragments of cast iron were also discovered at Fairchild Beach, providing the first evidence of sealing activity in the area.

A database has been established to manage all of the GPS data and associated pictorial records. Future surveys will add further information to the database in ongoing efforts to reconstruct the lives of 19th century sealers and to manage the cultural heritage of Heard Island.

—ERIC WOEHLER
IASOS and AAD

ERIC WOEHLER

Vegetation growth has almost concealed the wooden headboards of sealers' graves on Heard Island.



AADC

Following Heard Island's discovery, sealers almost extirpated the population of elephant seals. Large trypots for rendering oil still remain around the island.

ERIC WOEHLER

CONTAMINATION at Atlas Cove Station

ROGER KIRKWOOD

The benefits of a remediation scheme at Atlas Cove need to be weighed against any negative effects on plant and animal life.

Atlas Cove, at the northwest end of Heard Island, was the site of the first permanently occupied Australian National Antarctic Research Expeditions (ANARE) station from 1947–55; a precursor to the establishment of bases on the Antarctic continent. Constructed close to the sea on a low-lying area of basaltic lava flows and sand, the station comprised a range of buildings including living quarters, a hospital, stores for food and equipment, workshops, a powerhouse with a diesel generator, fuel caches, and several refuse or tip sites. After its closure, Atlas Cove Station was abandoned to the mercy of the harsh natural forces, visited only occasionally by ANARE.

Between January and February 2000, a major cleanup of the site was initiated by the Australian Antarctic Division (AAD). Most of the remaining structures were demolished and material collected and sorted for disposal in Australia. This was completed the following summer. To determine the extent and intensity of residual chemical contamination within the station area, soil and water samples were collected during the cleanup and analysed in Australia for total petroleum hydrocarbons (TPH) and metallic elements like cadmium, copper, iron, lead, and zinc - derived from batteries, paints, solder, welding materials, machinery, and spilt or burnt fuel.

Chemical concentrations were compared to background levels measured for Atlas Cove and also Australian and New Zealand guidelines for the assessment of contaminated sites and the protection of aquatic and terrestrial ecosystems. Metal contamination was found throughout the station area and there was evidence for its dispersal from the site by water. However, the concentrations of these contaminants are assessed as unlikely to have a toxic impact on local ecosystems. In contrast, contamination by TPH (mainly residues of kerosene and diesel fuel, with small amounts of heavy lubricating oils and greases) was found to be both extensive and at a level that could potentially exert an impact on the environment. In the most contaminated areas, surrounding the locations of the old powerhouse and fuel caches, TPH concentrations were greater than the environmental investigation guideline set for contaminated urban sites in Australia.

While remediation of metal contaminants at Atlas Cove is not warranted, contamination by TPH requires further investigation, with remedial action assigned high priority should impacts on the biota – the plants, penguins, petrels and seals – be demonstrated. However, the benefits of any proposed remediation scheme at Atlas Cove would need to be weighed against the negative effects this might have on the plant and animal wildlife that have recolonised the old station site since it was abandoned nearly 50 years ago.

One of the applied research goals of the Human Impacts Program at the AAD is to understand and facilitate the *in situ* (on site) remediation of contaminated sites in Antarctica and the subantarctic. Given the logistical difficulties and expense of excavating soil and transporting it to Australia for treatment and disposal, *in situ* remediation is a more practicable, cost-effective and less intrusive option for the cleanup of contaminated sites in these remote regions, especially when petroleum hydrocarbons are the problem. This might involve bioremediation, for example, where natural microbial decomposition is promoted by application of fertilisers or heat. For Atlas Cove, with an estimated 200–600 tonnes of contaminated soil present in an area inhabited by abundant wildlife, *in situ* remediation is a preferable cleanup method.

—SCOTT STARK
Impact of Human Activities in Antarctica Program, AAD

Heard Island seabird survey

A census of breeding seabirds conducted at eastern Heard Island in 2003-04 has confirmed long-term increases in the breeding population of king penguins and black-browed albatrosses.

The census was conducted in the ice free areas between Fairchild Beach in the northeast and Long Beach in the southwest. Seabird breeding colonies and nests were also mapped using the Global Positioning System (GPS). The census and GPS survey aimed to provide current information on the distribution and abundance of breeding seabirds on Heard Island and followed similar studies conducted in 2000-01. Census data were also available for several species, from the 1940s to the present, allowing long-term trends in the breeding populations of these species to be assessed.

Since the late 1940s, breeding populations of king penguins have increased exponentially, doubling every five or so years. The current breeding population estimate is 60 000 pairs, with at least another 45 000 non-breeding birds present on the island during the 2003-04 summer. Similarly, the black-browed albatross population has trebled since the late 1940s. This increase is thought to be due to either improved breeding success resulting from regional warming, or the adults feeding at trawlers working within their foraging range, or both.

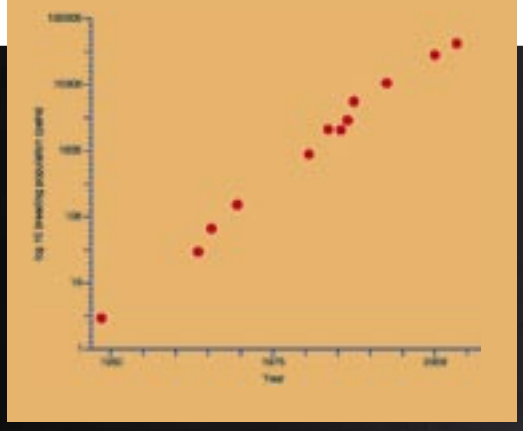
The Heard Island black-browed albatross population is less than one percent of the global population, but its increase is counter to almost all other populations, which are decreasing because of interactions with longline fisheries.

While the king penguin and black-browed albatross populations on Heard Island are increasing, historical images and early surveys suggest that there are fewer colonies and reduced breeding populations of macaroni, rockhopper and gentoo penguins, than in the past. The reason for this is unknown and further surveys are required to confirm the trend.

Heard Island's seabirds have not suffered the devastating impacts of human activities or introduced predators, such as cats and rats, suffered by similar populations on other subantarctic islands. These undisturbed seabird populations provide a valuable baseline and comparative data with breeding populations on other islands. Information collected during the 2000–01 and 2003–04 surveys will be used in the management of the Heard Island and McDonald Islands Marine Reserve and will allow status updates of these species, as required under legislation and national and international conservation agreements.

—ERIC WOEHLER
IASOS and AAD

Breeding populations of king penguins have doubled every five years or so since the 1940s. It is estimated that some 60 000 breeding pairs and 45 000 non-breeding birds were present on Heard Island in 2003–04.



While king penguin numbers have increased on Heard Island, early work suggests that populations of macaroni (below), gentoo and rockhopper penguins have decreased. Further research is needed to confirm this trend.

Bringing Heard Island to the world

SIMON GOLDSWORTHY

Many tourists (and some Australians) are amazed to learn of a distant Australian outpost in the Southern Ocean called the Territory of Heard Island and McDonald Islands; where penguins and seals number in the millions and the landscape is dominated by a 2750 m high glacier-covered active volcano.

Heard Island was added to the World Heritage list in 1997, joining a significant group of natural and human-made places with characteristics considered to be of outstanding value to humankind. The Australian Antarctic Division (AAD) manages the Territory of Heard Island and McDonald Islands and is responsible for fulfilling the requirements of the World Heritage Convention, which includes presenting the territory's natural values to the rest of the world.

But how do you show off a place that can only be reached via a two-week shipping voyage, through some of the roughest seas in the world? Well, if Mahomet cannot go to the mountain, you must bring the mountain (and the albatross, fur seals…) to Mahomet.

Wade Fairly, a professional film-maker with extensive experience in high latitude and extreme locations, was asked to infuse his cinematic knowledge into members of the 2003–04 Australian Antarctic Program expedition to Heard Island. Expeditioners were supplied with enough slide film, digital cameras and digital video cameras to (almost) sink a ship, and given a wish list of World Heritage values to capture on film.

The resulting images will be used for public exhibitions, such as the Hobart Antarctic Midwinter Festival, publications such as this magazine, and a new Heard Island website <http://www.heardisland.aq>. Wade has also turned his director's eye to creating a DVD of the 2003–04 expedition, which shows how expeditioners live and work.

So now you've heard of it, take a look at it. Check out the Image Bank on the Heard Island website and be thankful you didn't need to spend big dollars and four weeks throwing up over the side of a ship for the experience!

—EWAN McIVOR
Environmental Policy and Protection, AAD

Heard Island: a distant Australian outpost, dominated by Big Ben and home to an abundance of wildlife.

Ukraine comes to the Party

ANDREW JACKSON

Professor Vasil Kremen (left) from Ukraine addresses the Antarctic Treaty meeting.

Ukraine achieved recognition as a Consultative Party to the Antarctic Treaty at the 27th Antarctic Treaty meeting in Cape Town in May, bringing the number of Consultative Parties to 28.

Recognition of the achievement of Consultative Party (ATCP) status is done is accordance with the provisions of Article IX.2 of the Antarctic Treaty and is made by a decision of the existing ATCPs. The decision recognises Ukraine's long term commitment to the Antarctic Treaty and the standard of its Antarctic science program.

At the meeting, Professor Vasil Kremen, Minister of Education and Science, responded to concerns about Ukraine's involvement in the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) and the actions of some of its fishing vessels. The Minister noted that Ukraine meets all of the current CCAMLR conservation measures, but apologised for the behaviour of some Ukrainian flagged vessels engaged in fishing for toothfish in the CCAMLR area. He reassured the meeting that the allegations about these vessels would be fully investigated and that the vessels involved would likely lose their licences.

Ukraine operates one permanent station in the Antarctic Treaty area – Vernadsky station – where it conducts studies in atmospheric physics, geophysics, climate, biology and glaciology.

For more information about the Antarctic Treaty visit the AAD web site: <http://www.aad.gov.au/default.asp?casid=78>

—ANDREW JACKSON
Manager, Antarctic and International Policy, AAD

Treaty Secretariat open for business

ANDREW JACKSON

Chris Moraitis (left), Head of the Australian delegation at the 27th ATCM congratulates Jan Huber on his appointment as Executive Secretary.

The Secretariat of the Antarctic Treaty has been established following agreement on outstanding organisational issues at the 27th Antarctic Treaty Consultative Meeting (ATCM) last May.

A key step in establishing the Secretariat was the selection of Mr Johannes (Jan) Huber as the inaugural Executive Secretary. His appointment commenced on 1 September 2004, when the Secretariat opened for business in Buenos Aires.

Jan was Chairman of the Netherlands Polar Affairs Committee and has been the Netherlands Representative at the last five Antarctic Treaty meetings. He was largely responsible for the organisation and conduct of the 12th Antarctic Treaty Special Consultative Meeting held in The Hague in 2002, and has played a significant role in negotiating the legal and operational instruments for the Secretariat in his role as Chair of ATCM's Legal and Institutional Working Group.

The operation of the Treaty Secretariat successfully concludes a sustained effort by Australia and other Parties to modernise the Antarctic Treaty system, by establishing a permanent headquarters to provide essential administrative support.

—WARREN PAPWORTH
Antarctic and International Policy, AAD

Meeting of Antarctic environmental interests

Wildlife conservation, waste removal, and enhanced protection for parts of the Antarctic environment, were among the issues discussed by the Committee for Environmental Protection (CEP), at its seventh annual meeting in Cape Town in May.

The CEP was established under the Protocol on Environmental Protection to the Antarctic Treaty, also known as the 'Madrid Protocol'. Recent ratification of the Madrid Protocol by Canada in November 2003 and the Czech Republic in September 2004 brings the number of CEP Members to 32.

The CEP reported its activities, findings and recommendations to the concurrent 27th Antarctic Treaty Consultative Meeting (ATCM) for further consideration. Report highlights included:

ENVIRONMENTAL IMPACT ASSESSMENT (ANNEX 1) – Four draft 'comprehensive environmental evaluations' were considered for:

- Installation of a neutrino telescope at South Pole station – Project IceCube (USA);
- Development and implementation of surface traverse capabilities in Antarctica (USA);
- Construction and operation of a scientific station on James Ross Island (Czech Republic);
- Upgrading the summer station at Troll in Dronning Maud Land to a permanent station (Norway).

CONSERVATION OF ANTARCTIC FAUNA AND FLORA (ANNEX II) – A revised Annex II text was agreed to; the legal implications of the CEP's proposed scientific and technical amendments to the Annex will be considered at the next ATCM. The Committee also discussed the need to provide environmental guidance to pilots operating in Antarctica and endorsed a set of 'Guidelines for the operation of aircraft near concentrations of birds in Antarctica'.

WASTE DISPOSAL AND WASTE MANAGEMENT (ANNEX III) – Information papers reporting on Antarctic cleanup activities were presented by Australia, the United States and the United Kingdom, following similar reports at previous meetings and indicating an encouraging trend in waste management efforts.

PREVENTION OF MARINE POLLUTION (ANNEX IV) – A draft set of Antarctic shipping guidelines, a draft proposal concerning controls on the disposal of ash into the sea, and minimum ice-strengthening standards for fishing vessels, were reviewed.

AREA PROTECTION AND MANAGEMENT (ANNEX V)

- Five management plans for Antarctic Specially Protected Areas (ASPAs) were approved, including a management plan submitted by Australia for a new ASPA surrounding Mawson's Huts at Cape Denison.
- Two management plans for Antarctic Specially Managed Areas (ASMAs) were adopted: the McMurdo Dry Valleys in Southern Victoria Land; and Cape Denison at Commonwealth Bay.
- New Historic Sites and Monuments at Cape Denison and at India Point in the Humbold Mountains, Dronning Maud Land, were approved.
- A series of 'intersessional contact groups' were established to consider nine other draft management plans. This work will be conducted using an online discussion forum developed by Australia.

State of the Antarctic environment and environmental monitoring

A progress report was given by Australia and New Zealand on the development of an interactive electronic framework for State of the Antarctic Environment Reporting. A prototype will be presented at the next CEP meeting.

Next year

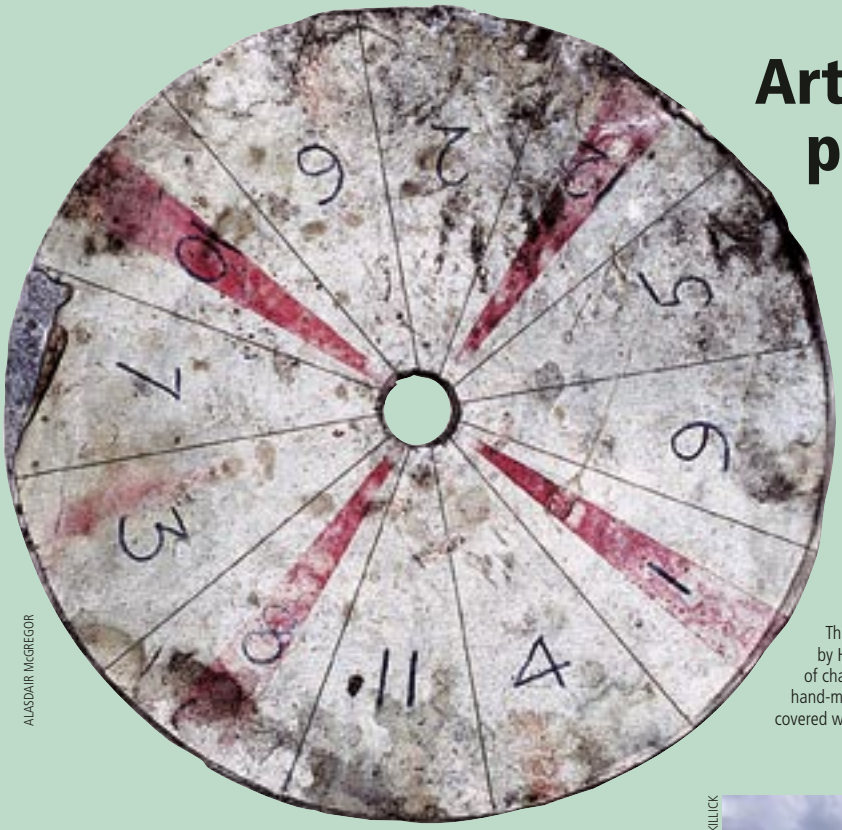
The next CEP meeting will be held in Stockholm in June 2005. It will again be chaired by Australian Antarctic Division Director Tony Press, who this year was re-elected to serve a second two-year term. Meeting papers are available from the publicly accessible document archive on the CEP website at <http://www.cep.aq>.

—EWAN McIVOR
Environmental Policy and Protection, AAD

The area surrounding Mawson's Huts at Cape Denison has been approved as an Antarctic Specially Protected Area.

DAVE KILLICK

Artefacts database provides public glimpse into private lives



ALASDAIR McGREGOR

This artefact is probably the infamous roulette wheel made by Hunter and Hurley that was used for 'Huntoylette', a game of chance which seemed to favour the bank over the players. The hand-made object has been fashioned from a piece of flat tin plate covered with paper on each side.

DAVE KILLICK

When Sir Douglas Mawson and his men departed Cape Denison after the Australasian Antarctic Expedition of 1911-1914, they left behind personal effects, rubbish and equipment, that today, provide us with an intimate glimpse into their lives. To preserve and protect this historic site, expeditioners from the Australian Antarctic Division (AAD) have painstakingly catalogued, photographed and mapped thousands of artefacts strewn across five huts and the small rocky promontory that Mawson's party roamed. Clothing, photographs, tin cans, scraps of wood, scientific equipment, and caches of seals and penguins, are just some of items discovered beneath a mobile blanket of snow.

Now a publicly accessible database of these artefacts is available, thanks to the work of archaeologist Dr Estelle Lazer, the Australian Antarctic Data Centre, and the AAD Environment Policy and Protection unit. The Cape Denison Artefacts database <http://aadc-maps.aad.gov.au/aadc/artefacts/index.cfm> is part of a larger Australian Antarctic Heritage database that includes artefacts and information on National and Commonwealth Heritage sites and places.

According to Dr Lazer the Cape Denison database has three functions: education, research, and as a management tool for the AAD.

'The AAD needs to know what's at the site, what condition the artefacts are in and where they are, so that they can track the movement or loss of items and make decisions on whether to remove items from the site for conservation work or for safety reasons,' she said.

The database can be searched using standard museum keywords or 'keyword types', such as 'expeditioner', which brings up a list of Mawson's party members and the artefacts associated with each. The database can also be searched using a map of Cape Denison, or a floor plan of the Main Hut, where many personal and photographic artefacts were found.

Each artefact has a catalogue number which links to detailed information about what it is; where it was found and when; its condition and significance; who it was associated with; who made it and the material it is made from. Pictures of most artefacts will be added to the database as it develops.

Each time an artefact is examined by an archaeologist or materials conservator, the 'event' will be logged in the database. This event will record the condition and location of the artefact and follow-up notes, to assist management.

In the future, the database will be linked to electronic databases from other institutions, including the Mawson Institute and the State Library of NSW, which house artefacts and photographs from Mawson's expedition. As all keywords in these databases will be standardised, one keyword search will cover all linked databases.

Better management of Antarctic tourism

Some 28 000 tourists visited Antarctica last year, almost five times the visitor numbers a decade ago. While this is negligible in global terms, there are now more tourists visiting Antarctica than national program personnel, although their time in the region is much shorter.

Antarctic tourists engage in a broad range of activities, including small boat cruising, flight-seeing, kayaking, mountain climbing, scuba diving, skiing, camping and marathon running. The individual and cumulative impacts of these activities need to be managed as they may result in environmental impacts (including disturbance of wildlife); may damage fragile cultural and historic sites; and may pose safety risks for those involved.

Together with our Antarctic Treaty partners, Australia is working to improve the management of Antarctic tourism. This work aims to ensure that tourism is sustainable; balancing the economic interests of the tour operators with the need to protect Antarctica's environment and ensuring that tourism does not disrupt other established uses of Antarctica.

Antarctic tourism was the focus of discussions at a Meeting of Experts held in Norway last March, and at the annual Antarctic Treaty Consultative Meeting (ATCM) held in Cape Town in May. Australia was represented at these meetings by government and industry and is taking an active role in the informal discussions between meetings.

A number of proposals aimed at managing potential impacts have emerged, with Australia taking the lead on several, including:

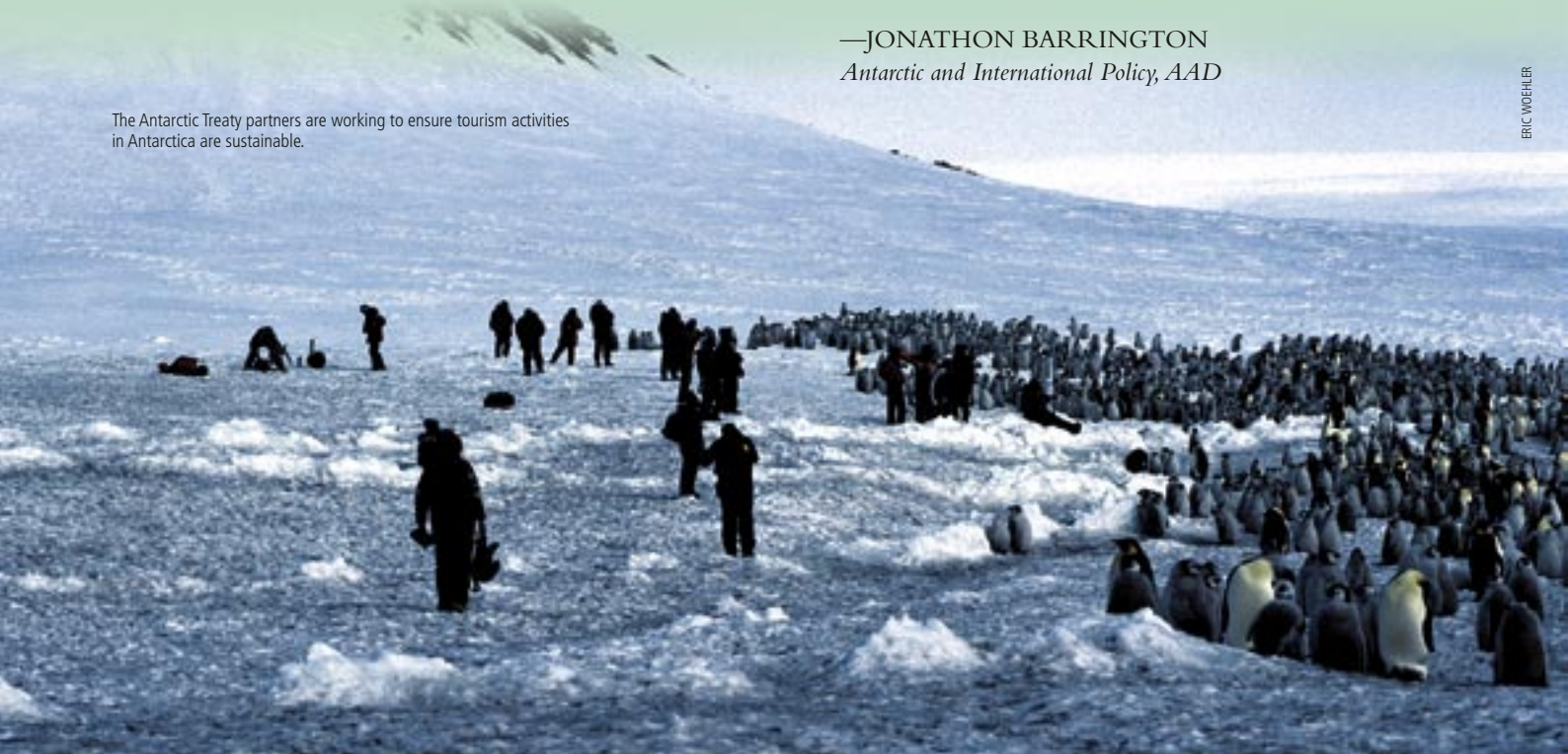
- **Database** – establishing a comprehensive database on Antarctic tourism and other non-government activities, to help inform management decisions.
- **Accreditation** – ensuring that Antarctic tour operators conduct their activities to a high standard.
- **Quarantine** – undertaking assessments of the potential risks to Antarctica, posed by tourism, of introducing alien species to Antarctica and translocation of species within Antarctica and adopting quarantine practices that minimise the risk.
- **Contingency planning** – ensuring that contingency plans and other arrangements for health and safety, search and rescue, and medical care and evacuation, have been drawn up and are in place for proposed tourism activities; and that adequate insurance or other arrangements are set up to cover costs associated with these.
- **Shipping guidelines** – developing in consultation with the International Maritime Organisation, voluntary guidelines for ships operating in Antarctic ice-covered waters that will improve the safety of tour vessels.
- **Cumulative impacts** – assessing the cumulative environmental impacts of Antarctic tour operators' activities at frequently visited or fragile sites.
- **Permanent infrastructure** – considering whether to limit Antarctic tourism to activities that have no more than a minor or transitory impact.

The 27th ATCM agreed on a number of new arrangements for managing Antarctic tourism arising from the above and initiated work on others.

ATCM adopted a Measure and a Resolution calling on all Parties to ensure that those involved in tourist or other non-government activities implement contingency plans and put in place adequate insurance arrangements. The ATCM also agreed to establish an intersessional contact group to develop further the basis for an accreditation scheme for Antarctic tour operators. Next year's ATCM will also examine the privacy and confidentiality of information proposed to be held on the tourism database, quarantine risk assessment, and the merits of limiting permanent tourist infrastructure.

Australia's positions on these issues are being informed through consultation with other governmental agencies, Australian Antarctic tour companies, the International Association of Antarctica Tour Operators and environmental interest groups. We anticipate working in close partnership with Australian Antarctic tour operators in an effort to continue to develop their international reputation as a socially responsible and sustainable industry.

—JONATHON BARRINGTON
Antarctic and International Policy, AAD



The Antarctic Treaty partners are working to ensure tourism activities in Antarctica are sustainable.

ERIC WOEHLER

Ensuring environmentally responsible Antarctic operations

ROB EASTHER

The operation of the Environmental Management System at Davis Station (above) and Mawson, will be reviewed this year.

To ensure Australia's activities in Antarctica are environmentally responsible, the Australian Antarctic Division (AAD) has developed an internationally certified (ISO 14001) Environmental Management System (EMS). In the 2004-05 Antarctic season the effectiveness of this system will be audited at Davis and Mawson stations by Phil Crosby of NCSI (NATA Certification Services International). Mr Crosby will be assisted by AAD operation's safety and environment advisor Shaun Walsh and EMS co-ordinator Leslie Frost.

The audit aims to review the operation of EMS in Antarctica and identify ways to improve the system. The team will meet with the station leaders at Davis and Mawson to review environmental management procedures, incident reporting, emergency preparedness and policies; codes and requirements for waste management, energy use and physical disturbance; hazardous materials management; and field activities.

Prior to departure, Mr Crosby will participate in expeditioner training and observe cargo operations at Macquarie Wharf. During the voyage he will observe shipping and transport operations; and at Davis, cargo handling, resupply and refuelling operations. His observations will help improve activities that are already performed conscientiously and to a high standard.

—LESLIE FROST
EMS Co-ordinator, AAD

Oceanic Viking to patrol Southern Ocean

AUSTRALIAN CUSTOMS

The 105 m *Oceanic Viking* and her crew will replace the polar ships, *Aurora Australis* and *Southern Supporter*, in the patrol of the Southern Ocean for illegal fishing.

The vessel, armed with twin .50 calibre machine guns, will help Customs and Fisheries officers conduct year-round armed patrols of Australian waters surrounding the remote Territory of Heard Island and McDonald Islands, where illegal fishing vessels regularly target Patagonian toothfish.

The ship was supplied by P&O Maritime Services after a successful tender to Customs, and is capable of operating throughout Australia's exclusive economic zone.

Its acquisition comes after the Government's commitment to a two-year armed patrol program in December 2003. Funding for the program of $47.8m in 2004–05 and $41.4m in 2005–06 was confirmed in the Federal Budget earlier this year.

Customs and Fisheries officers are now engaged in specialised training to operate the ship in the Southern Ocean.

The *Oceanic Viking* will patrol the Southern Ocean for illegal fishing.

A range of issues on the protection and hunting of whales were debated at the 56th annual meeting of the International Whaling Commission (IWC) in July 2004.

The meeting, held in Sorrento, Italy, was attended by a record high 57 member governments, including six new members since the last IWC meeting (Belgium, Côte d'Ivoire, Hungary, Mauritania, Suriname and Tuvalu). It was preceded by a Southern Ocean Sanctuary review workshop, the Scientific Committee and other sub-groups, including the new Conservation Committee. Australia was represented at all sessions, with Australian Antarctic Division (AAD) officers from policy and science branches playing integral roles.

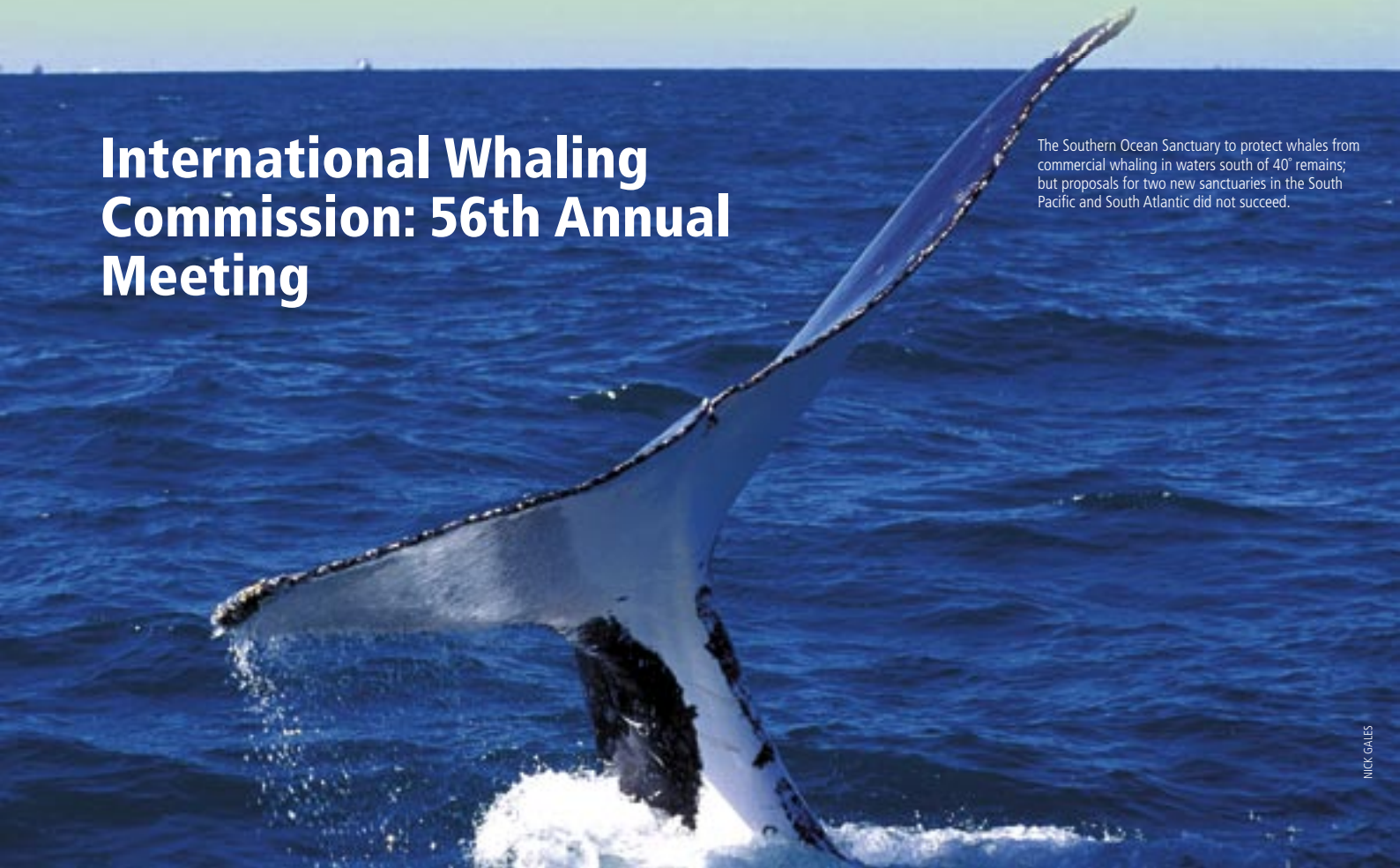
Key outcomes of meeting were:

- The global moratorium on commercial whaling (effective since 1985/86) remains in force. The meeting rejected two proposals to allow commercial whaling in Japanese waters: to take 100 minke whales and 150 Bryde's whales per year.
- The assembly agreed to hold a series of meetings over the coming year, on management and regulatory arrangements, should the IWC agree to allow commercial whaling to resume. Discussions will address the nature of a 'revised management scheme' for any future commercial whaling, and related policy and technical issues.
- The Southern Ocean Sanctuary (established in 1994, to protect whales from commercial whaling in waters south of 40°) was reviewed, and remains in force. Japan's proposal to abolish the Sanctuary and to allow an annual take of 2,914 minke whales from Antarctic waters was soundly defeated.
- Both proposals for new whale sanctuaries — in the South Pacific (proposed by Australia and New Zealand) and the South Atlantic (Argentina and Brazil) achieved majority support of a record 26 votes in favour. However, the proposals fell short of the required ¾ majority for the sanctuaries to come into effect.
- The inaugural meeting of the Conservation Committee (established 2003) outlined topics for future work: endangered species and populations; human impacts; habitat protection; whale watching; reporting systems for strandings, entanglements and bycatch; and conservation-related legal and regulatory arrangements.
- The rules governing aboriginal subsistence whaling (conducted in four Northern Hemisphere countries) were modified. These now require national legislation to govern all hunts, ban the take of calves and accompanying whales, and apply the restrictions on the use of products from such hunts equally in all cases.

The Australian Government's policy is to pursue a permanent international ban on commercial whaling and worldwide protection of all cetaceans. This opposition to whaling also applies to so-called 'scientific whaling'. The Government believes that whaling is not required to meet human needs and that whale killing methods involve unacceptable cruelty. The Government pursues its whale policy objectives through diplomatic means, including in international forums – primarily the IWC.

—STEPHEN POWELL
Antarctic and International Policy, AAD

International Whaling Commission: 56th Annual Meeting



The Southern Ocean Sanctuary to protect whales from commercial whaling in waters south of 40° remains; but proposals for two new sanctuaries in the South Pacific and South Atlantic did not succeed.

NICK GALES

Antarctic Operations meetings focus on the future

SKYTRADERS

The two new CASA 212-400 aircraft are about to commence operations in Antarctica after skis, avionics and radios are fitted.

The new CASA 212-400 at Bremerhaven airport, Germany, prior to being fitted with skis and other equipment necessary for Antarctic service.

CHARLTON CLARK

A new CASA 212-400 aircraft – destined for Antarctica – and a range of other polar aircraft, went on display at Bremerhaven airport in Germany earlier this year, during a series of operational meetings in Bremen.

Meetings included the 16th Council of Managers of National Antarctic Programs (COMNAP), the 11th Symposium of the Standing Committee on Antarctic Logistics and Operations (SCALOP) and its associated trade show, and the 28th Scientific Committee on Antarctic Research (SCAR) conference and meetings.

The air show and SCALOP trade show, hosted by the Alfred Wegener Institute (AWI), matched the theme of the SCALOP Symposium – *Towards the International Polar Year and Beyond* – which featured presentations and posters on new transportation technologies and applications; technology to enable science; technology to reduce environmental impact; and the latest developments in energy storage.

Hundreds of scientists and support staff from a range of countries attended the meetings, to share experiences and display equipment, services and ideas. The next COMNAP and SCALOP meetings will be hosted in Hobart, Australia, in 2006. A team is already working to prepare for this important event and we look forward to the opportunity to deliver as successful a set of meetings and displays as our colleagues and friends at AWI did.

After the meetings the CASA 212-400 flew to Australia, where it was joined by a second CASA 212-400. Both aircraft were fitted with avionics, radios and skis. They are expected in Antarctica before Christmas.

Aircraft usher in a new era in Antarctic support

There is a good deal of expectation about how the two CASA 212–400 aircraft will perform. A sense of excitement is building as the Australian Antarctic Division (AAD) prepares for its first season when mainstream fixed wing support will be provided using planes operating under an Australian issued Air Operations Certificate.

The CASA 212–400s are an important and integral part of the AAD operations and logistics support system for the 2004–05 season. There is much to look forward to and learn as we integrate the operation of ships and aircraft into a single system for the first time. It is clear that there will be great advantages and efficiencies once the system is fully operational.

Of course, in this first season we will be taking a cautious and risk averse approach to the planning and implementation of operations with CASA 212–400s. The objective is to provide the very best customer support possible, within the boundaries of safety, environmental excellence and efficient resource management.

—KIM PITT
General Manager, Operations, AAD

New Directions in Antarctic Science

ERIC WOEHLER

Research into atmosphere, climate and adaptation to environmental change forms part of the new strategic direction for Antarctic science.

Global climate change will inexorably affect Australia's climate and weather, its fringing oceans and its diverse natural ecosystems, in the coming decades. To meet these challenges, better predictions of future change are needed. However, the development of national policy – to realise the opportunities and minimise the risks of future environmental change – demands a high level of scientific understanding.

Antarctica and the high latitude Southern Ocean are especially relevant to Australia because of their proximity and influence on regional climate processes, and the importance of the Southern Ocean to our marine industries. Thus, Australia's Antarctic science program plays a significant role in advancing our understanding of how global climate processes arise, how they interact with the natural environment and what their consequences might be.

To support this understanding, a new Science Strategy has been proposed by the Antarctic Science Advisory Committee for the five-year period 2004/05-2008/09. Unlike the previous Strategic Plan, which was based on scientific disciplines (such as glaciology, biology and oceanography), the new Strategy is underpinned by multi-disciplinary research and focuses on four priority science programs:

- Ice, Ocean, Atmosphere and Climate;
- Southern Ocean Ecosystems;
- Adaptation to Environmental Change; and
- Impacts of Human Activities in the Antarctic.

Each of the priority programs has developed a set of strategic questions that it will address during the life of the Strategy. What is the role of the cryosphere in the global climate system and sea-level change? How are Southern Ocean ecosystems structured? What are the consequences of Antarctic environmental change and how do high latitude ecosystems, communities and species respond to change? Are Antarctic ecosystems more vulnerable to human activities than those of other regions? These are a few examples of what our scientists will be working on over the next five years. All proposals for research in the priority areas will be externally refereed and only the highest quality will be supported.

Fundamental or basic science will not be left out in the cold. The Australian Antarctic Program will continue to support research that does not fall into one of the priority programs, provided that it is of high quality and does not make enhanced demands on logistic and support facilities.

Further information on the Science Strategy and priority programs is available on the AAD website at <http://www.aad.gov.au/default.asp?casid=13949>. Copies of the Science Strategy are available from the Chief Scientist.

—MICHAEL STODDART
Chief Scientist, AAD

Australian Antarctic Science Grants

This year's $760 000 in grants for Australian Antarctic science was distributed amongst 54 projects that predominantly fall into the four priority science categories. Projects include:

- Understanding the role of ice shelves in the global climate system;
- Investigating the importance of sea ice as a major source of primary production for Antarctic food webs;
- Exploration of ocean water masses and their sensitivity to climate change;
- The impact of ozone depletion on marine microbes;
- The influence of El Niño on the Antarctic and subantarctic;
- Geological studies into the formation of the Earth's crust, climate change, sea level change and changes to the sea floor and oceanic circulation since the break-up of Gondwana; and
- Examining various aspects of Southern Ocean seabirds and seals that are needed to assist with their conservation.

Freshwater fauna of Antarctica – pre-glacial survivors or recent invaders from the north?

Most Antarctic freshwater lakes contain a range of invertebrate animals – including tardigrades, rotifers, nematodes and crustacea – that graze on bacteria, algae and other small organisms. However the origins of these fauna are unclear.

Some people argue that complete glaciation of the Antarctic continent at the last glacial maximum destroyed all freshwater habitats and that all the species currently present have colonised Antarctica from more temperate areas, such as South America, over the last 12 000 years. However, glaciation is now known not to have been complete. It is possible then that some freshwater habitats continued to exist through the ice ages, and that animals that survived in these refuges have spread in more recent times. If the latter process – termed 'vicariance' – occurred, some of the fauna present in Antarctic lakes may have been associated with Antarctica for a very long time.

Which of these two processes was responsible for the Antarctic fauna we see today? We are currently undertaking a project that aims to answer this question for animals in the lakes of East Antarctica and the Antarctic Peninsula.

A simple approach to the question is to look at current animal distributions. For example, the copepod *Boeckella poppei* occurs in Patagonia and along the western side of the Antarctic Peninsula. It is easy to conclude that it has colonised Antarctica from South America. However, a further, isolated, population of *Boeckella poppei* occurs in lakes in the Prince Charles Mountains, many thousands of kilometres from the Antarctic Peninsula. How did this population get there?

One suggestion is that human activity has resulted in the transfer. But a detailed study of the morphology (physical characteristics) of animals in the Prince Charles Mountains lakes showed that each population is slightly different from the others and from animals from the Antarctic Peninsula and South America. This indicates that they have been separated from each other long enough to evolve individual characteristics. These findings argue for the occurrence of *Boeckella poppei* on the Antarctic continent for a significant time span. It is possible that the current distribution is derived from both colonisation from South America and vicariance on the continent.

Another approach to the question is to study the distribution of animal remains in sediments from freshwater lakes. When an animal dies, hard parts of its body and other remains – such as eggs and spermatophores – may be preserved in the sediment. By taking a sediment core from a lake and systematically searching for these remains, we can build a picture of how the animal community in the lake has changed over time.

Through our study of sediment cores from lakes in three ice-free regions in East Antarctica, as well as from the Antarctic Peninsula, we are detecting several trends.

Firstly, many species currently found in the lakes are present in the oldest sediments (typically 5000–10 000 years old), suggesting that they reached the lakes soon after the lakes were formed. Secondly, biodiversity has in some cases decreased with time, indicating that an initial pulse of invasions has not continued. These results suggest a local source for the fauna, rather than an intercontinental invasion.

We have a particularly interesting sediment core from Lake Reid in the Larsemann Hills. Radiocarbon dating indicates that the oldest sediments in this lake were deposited prior to the last glacial maximum (15 000–18 000 years ago). Remains of the cladoceran *Daphniopsis studeri* occur in the oldest sediment in this lake and throughout the remainder of the core. This indicates that the animal is not a recent invader from subantarctic islands, where it also occurs. Rather, we may be getting a rare glimpse of the fauna of Antarctic freshwater lakes as they were prior to the last ice age.

—JOHN GIBSON[1,2]
KERRIE SWADLING[2]
LOUISE CROMER[2]
[1]IASOS and [2]School of Zoology, University of Tasmania

L CROMER & J NEWMAN

J. LAYBOURN-PARRY

Right: At 2 mm, the cladoceran (water-flea) *Daphniopsis studeri* is the largest known crustacean in the lakes of the Australian Antarctic Territory. This female is carrying an egg in her brood pouch (ephippium).

Far right: Louise Cromer (on the ice) and Jonothon Newman (on the tripod), preparing to core Lake Terrasovoje on the Amery Oasis, with the Loewe Massif in the background.

A smaller ozone hole for 2004

This year's Antarctic ozone hole was smaller than those of recent years. According to a preliminary analysis of data from NASA's Earth Probe satellite, the ozone hole reached a maximum area (on 21 September) of about 24 million square kilometres – similar in size to the North American continent. The largest holes on record occurred in 2000 and 2003 and were about 30 million square kilometres in size.

The growth of this year's ozone hole was more gradual than in 2003 and resembled behaviour seen in the mid-1990s. Unlike the cold conditions of 2003, winter temperatures in the Antarctic stratosphere were near the long-term average. Polar Stratospheric Clouds (PSCs), which precondition the atmosphere and allow the ozone hole to form, were also less extensive than in 2003.

At Davis, the lidar detected the first substantial PSC layer of the season in early June, about four weeks later than for the previous year. Cloud sightings were also made by Davis and Mawson expeditioners around this time.

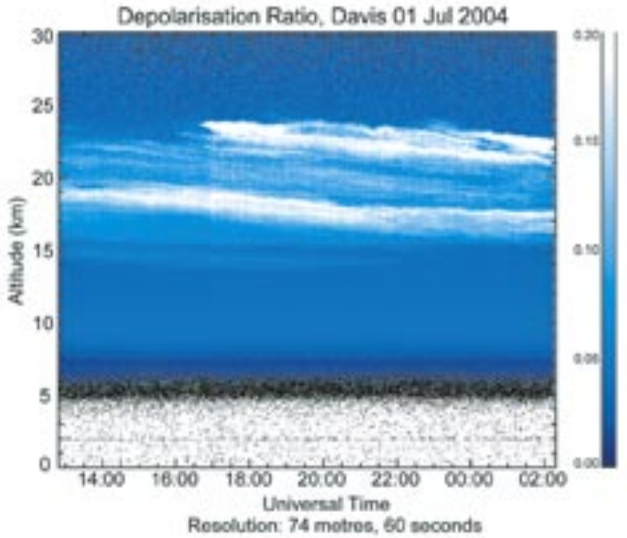
The first signs of ozone depletion over Antarctica began during late August. The lowest ozone values above Davis were reached during mid-September, when measurements by balloon-borne instruments showed a 40% reduction in total ozone compared with mean summer and autumn values.

Temperature disturbances in the upper stratosphere began to appear in early spring. This behaviour is an annual occurrence, although the disturbances were generally more pronounced than the long-term mean. As a result, PSCs quickly disappeared and the size of the ozone hole was in decline by the end of September.

—DR ANDREW KLEKOCIUK
Ice, Oceans, Atmosphere and Climate Program, AAD

ANDREW KLEKOCIUK, JOSEPH ZAGARI, AAD

Layers of Polar Stratospheric Clouds on 1 July 2004, measured by the Davis lidar. Special polarisation measurements reveal that the whitest clouds in this false-colour view consisted of water-ice crystals.



CCAMLR bites back: new rules to fight toothfish poaching

A satellite-based centralised vessel monitoring system (cVMS) to track fishing vessels seeking the valuable Patagonian toothfish in the Southern Ocean was adopted by the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) at its recent meeting in Hobart.

The cVMS, developed and promoted by Australia, New Zealand and the United States over the last three years, will be based at the CCAMLR Headquarters in Hobart and will help CCAMLR Members to conduct surveillance and inspections of fishing vessels in the Southern Ocean. The system is also designed to complement CCAMLR's catch documentation scheme (which tracks the taking, landing and trade of Patagonian toothfish) by allowing countries to verify that toothfish were caught where claimed.

In addition to the cVMS, CCAMLR Members agreed to improvements to the system for placing vessels on CCAMLR's illegal, unreported and unregulated (IUU) vessel list, and to provide detailed information for vessels seeking a license to fish in the CCAMLR area. Information on IUU vessels and licensed vessels will now also be made publicly available on the CCAMLR website, helping to ensure that those involved in IUU fishing do not slip through the net.

—Southern Ocean Conservation Unit, AAD

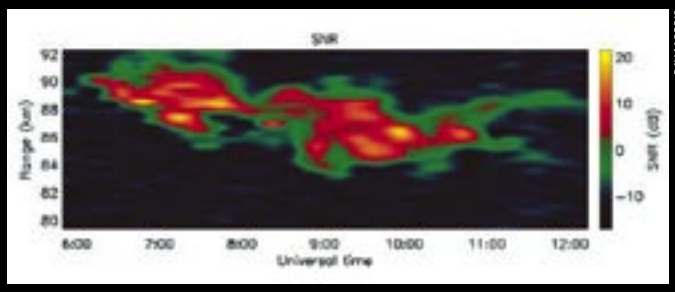
Polar Mesosphere Summer Echoes above Antarctica

In the summer of 2003–04, the first observations of Polar Mesosphere Summer Echoes (PMSE) above Antarctica were recorded using the Very High Frequency (VHF) radar at Davis.

PMSE are strong radar echoes associated with extremely cold temperatures – as low as -140°C – that occur in the 'mesosphere', some 50–92 km above the Earth, during summer. PMSE are also associated with the presence of increased water vapour content in the cold summer mesopause region. This water vapour originates from natural processes, such as the oxidation of methane, meteor ablations and volcanic eruptions, and anthropogenic emissions, such as rocket and space-shuttle exhaust gases. In fact, 'noctilucent' or night shining clouds, which are also associated with increased water vapour and lower temperatures in the mesosphere, were first observed in 1885, some two years after the spectacular eruption of Krakatoa and corresponding to the time needed to transport water vapour to the mesopause.

The seasonal occurrence of PMSE is dependent in part on a critical mesosphere temperature threshold (less than 150 K or -123°C). In 2004–05, observations of PMSE and noctilucent clouds will be undertaken at Davis using the VHF radar and lidar, to investigate the threshold temperature dependencies of each.

PMSE were first observed in 1979 using a VHF radar at Poker Flat, Alaska. The first observations of PMSE in the southern hemisphere were conducted at Machu Picchu base on King George Island during the summer of 1992–93. It has been suggested that southern hemisphere PMSE differ from their northern hemisphere counterparts, however, the first summer of PMSE observations at Davis revealed their intensity to be similar to those reported at equivalent northern hemisphere latitudes.



RAY MORRIS

Polar Mesosphere Summer Echoes (PMSE) observed at Davis on the VHF radar on 3 February 2004. PMSE manifest themselves as strong radar echo returns. The radar echo strength is often measured using signal-to-noise ratio. Over 27 days of observation, the Davis PMSE events occurred at an average peak height of 86 km and ranged from 81–92 km. The peak PMSE height was slightly below the summer mesopause temperature minimum at 88 km, and above the noctilucent cloud layer at 83–84 km. A complete season of observations and rigorous instrument calibration are now needed to substantiate these results.

Background image: A noctilucent (night shining) cloud above Davis station on 18 February 1998. These clouds are the visual indicator of cooling processes in the summer mesosphere.

International interest is now focussed on whether there is any measurable difference in summer mesopause temperatures between the northern and southern hemispheres. A proposed interhemispheric comparison of the properties of PMSE will contribute to this effort.

PMSE events provide a monitor of the background wind and a proxy for the temperature and water vapour content in the little-studied mesosphere. Research using the Davis VHF radar will make an important contribution to the long-term investigation of these phenomena and will add to the limited knowledge of polar mesosphere climatology; and thus to our capacity to detect climate change in the mesosphere.

— RAY MORRIS, DAMIAN MURPHY, ANDREW KLEKOCIUK and JOHN FRENCH
Ice, Oceans, Atmosphere and Climate Program, AAD

KAREN FRENCH & JOHN FRENCH

Arts Fellows breaking the ice

For most people, Antarctica is as accessible as the Moon, and they must rely on a virtual experience, dictated by others' impressions. Most visitors are scientists, trained to observe and interpret Antarctica according to their chosen discipline. Our Arts Fellows are chosen for, among other things, their ability to capture and communicate the experiences that inspire them. As communicators, their role is to help the community understand Antarctica's values and Australia's role in its research and protection.

In 1998, Jorg Schmeisser travelled to Antarctica on the *Aurora Australis*, visiting Mawson and Davis stations. From the resulting body of work, he selected pieces for an exhibition *Breaking the Ice*, the title of which is a reference to the trip as a significant life experience.

After spending years focussing on works that were almost all etchings and what Jorg calls 'culturally loaded material' he says of his Antarctic experience, 'The journey to Antarctica has opened an entirely different window, looking at one element only – water in all its different forms, textures and colours. The icebergs were particularly fascinating. Intriguing is not only what you see above the waterline, but imagining what the other six-sevenths under water is like, and wondering how the unbelievable shapes of many of them came into being.

'My other fascination there is the light, with the evening light being particularly beautiful. The white changes to a yellow-orange, and the shadows become purple and violet. Ice that is up to 4000 metre thick weighs on the continent with an eloquent silence.'

Breaking the Ice has travelled far and inspired rave reviews since its opening in May 2003 at the Tasmanian Museum and Art Gallery. Last year it visited the Australian Embassy in Washington and galleries in Kyoto, Tokyo and Yokohama and this year; San Francisco, Canberra, Sydney, Melbourne and Bonn in Germany.

For the 2004-05 Antarctic season, six people have been awarded Fellowships from a diverse international field of almost 30 applicants.

DAVID NEILSON, a photographer and publisher, left Hobart in November 2004 on board the Antarctic research and resupply vessel *Aurora Australis* to spend several weeks photographing at Australian stations Davis and Mawson.

The other Fellows will travel to Macquarie Island and Casey stations on the Australian Antarctic Division's final voyage south in March 2005.

MARGOT FOSTER, executive producer of the ABC's Bush Telegraph program, will record segments for radio broadcast and soundscapes for the Macquarie Island house at the Royal Tasmanian Botanical Gardens in Hobart.

FRANCES EVANS, freelance composer, multi-instrumentalist and music teacher will produce an audio-visual installation of sounds, images, photographs and new musical works.

ALISON LESTER, a children's author and illustrator with more than 25 books to her credit, will gather material for a book that will become part of a travelling educative project for school children throughout Australia.

JAMES AND JANET LUXTON, who own and run a small art gallery in Sydney, plan to produce etchings for exhibition from photographs and sketches of Southern Ocean and Antarctic wildlife, the Antarctic landscape, and shipboard and station resupply activities.

—CATHY BRUCE
Information Services, AAD

JORG SCHMEISSER

New Minister for the Antarctic


DEH

Senator Ian Campbell has been re-appointed as Minister for the Environment and Heritage after re-election of the Howard Government in October. Senator Campbell will take over responsibility for the Antarctic. In the Australian government's previous term, Antarctic affairs were the responsibility of Parliamentary Secretary, Dr Sharman Stone.

'Ginger' and 'Gadget' about to start work in Antarctica

Australia's first Antarctic-dedicated CASA 212-400 aircraft have been named 'Ginger' and 'Gadget' after Sir Douglas Mawson's sled dogs who accompanied him on his 1912 Antarctic expedition. The names were selected from some 300 entries by school children around Australia after a three-week competition in September. Seven-year-old **Luke Clifton** of St Monica School in Kurrajong NSW said 'Gadget' was the name of Mawson's favourite sled dog who, like the aircraft today, played an important role in helping scientists carrying out Antarctic science. Fourteen-year-old **Gracie Falkenmire** of Presbyterian Ladies College, Croydon NSW, said 'Ginger' was Mawson's last husky who, like others before her, helped carry explorers' equipment and shared their hardships.

The names were chosen by the Minister for the Environment and Heritage, Senator Ian Campbell, after recommendation by an independent panel. The panel consisted of Australian National University historian Dr Tom Griffiths, who is writing a history of Australia in Antarctica, Skytraders Chief Executive Officer Mr Norm Mackay, Australian Antarctic Division librarian Dr Andie Smithies, and Mawson Station Leader Ms Joan Russell.

A name for the new ice runway at Casey station has also been selected. 'Wilkins', proposed by **Joe Weiley** of St Finbars School, Byron Bay NSW, was recommended by the Antarctic Names and Medals Committee – responsible for geographical place names in Antarctica.

The new runway is over 3000 m long and is located approximately 60 km from Casey station and on flat glacial 'blue' ice. It is one of the world's most remote runways and Australia's first official runway in Antarctica.

Competition winners were announced on 18 November before departure of the planes for Antarctica. The three winners each received a notebook computer valued at $1600, and a certificate. Their schools received a multimedia Antarctic resource package consisting of books, DVDs, videos and CD ROMs, valued at $500.

Director's Award for Excellence


ANNA JOHNSTONE

The inaugural Director's Award for Excellent Performance was presented to **David Smith**, the **Casey Field Store Construction Team** and **Hospital Supplies of Australia**, last June. The award recognises their contribution to the success of the Australian Antarctic Division (AAD) and Australia's Antarctic program.

AAD Director, Dr Tony Press, said David Smith's ongoing contribution and support to science, management and operational programs, through the use of geographic information systems (GIS) and the creation of new maps, was outstanding. The inclusion of wildlife colonies on maps, for example, greatly assists environmental management efforts and has facilitated collaborative research with the Chilean Antarctic Institute and the 2002–03 Heard Island expedition.

Battling severe weather conditions and time constraints, the Casey Field Store Construction Team, consisting of Ken Smith, Dan Smith, Mick Keaveney, Rob Nixon and Ron Thomas, completed much of the essential building work on the new field store. Dr Press said their commitment to getting the job done reflected a strong level of teamwork, along with their individual commitment to the AAD Code of Conduct.

The Tasmanian manager of Hospital Supplies of Australia, Rod Hill, and his staff, received their award for streamlining important aspects of the AAD medical program.

Mawson exhibition well received in Norway

An exhibition celebrating the 50th anniversary of Australia's Mawson Station in Antarctica, and our co-operation and shared Antarctic history with Norway, has been well received by visitors to the Fram Museum in Oslo. The exhibition consists of 13 panels that describe and illustrate Australia's links with Norway and our Antarctic science efforts at Mawson – Australia's first permanent Antarctic station – since its establishment on February 13, 1954. Like Australia, Norway is an original signatory to the Antarctic Treaty. Norway's Antarctic territorial claim, Dronning Maud Land, abuts the Australian Antarctic Territory, and Australia has chartered a number of Norwegian ships including the *Polar Bird*.

The exhibit, prepared by **Elizabeth Haywood** of the Australian Antarctic Division, was originally displayed in Hobart during Tasmania's Midwinter Festival in July. It moved to Canberra in August and the Fram Museum in September. The exhibit will be displayed at the Norwegian Polar Institute in Tromso at the beginning of the European summer and will tour other venues in Norway for a further 12 months.

Moss flora of Macquarie Island

In the spirit of Australian explorer and botanist Sir Joseph Banks, **Rod Seppelt**'s book *The Moss Flora of Macquarie Island* brings together an extensive evaluation of subantarctic moss flora. The book is the culmination of 28 years of research by Dr Seppelt; a Principal Research Scientist with the Australian Antarctic Division (AAD) and curator of the AAD Herbarium.

Dr Seppelt has visited Antarctica and the subantarctic more than 36 times and is recognised as Australia's leading Antarctic bryologist. He is also one of Australia's most accomplished botanical illustrators.

AAD

The *Moss Flora of Macquarie Island* outlines the known flora of Macquarie Island though a combination of Dr Seppelt's beautiful illustrations and taxonomic information. As many of the species illustrated in the book exist throughout the southern hemisphere, it will provide a valuable reference for Tasmania and New Zealand.

Antarctic pioneer acknowledged

Antarctic pioneer, **Patricia Selkirk**, has been awarded the Australian Antarctic Medal. Presented by His Excellency the Governor General, Major General Michael Jeffery, in September, the award recognises Dr Selkirk's contribution to furthering community understanding of Antarctic flora through her numerous publications, media involvement and appointments on several national and international scientific committees.

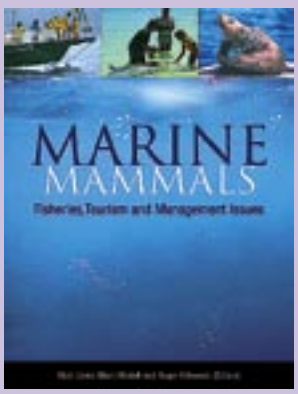
Since 1979 Dr Selkirk has been a member of 17 Australian National Antarctic Research Expeditions and Antarctica New Zealand Expeditions. She was also part of the team that discovered plant viruses in the subantarctic.

Dr Selkirk co-produced the first vegetation map of Macquarie Island and her research has formed much of the foundation for subantarctic plant biology. Her contribution to scientific literature includes over 67 publications on Antarctic terrestrial science and she has also completed a history of the achievements of geographer and geologist L.R. Blake, who was part of Douglas Mawson's expedition to Macquarie Island.

'It is thanks to people of Dr Selkirk's calibre, drive and determination that women today are able to play such an active role in Antarctic scientific research and station leadership,' said former Parliamentary Secretary for the Antarctic, Dr Sharman Stone.

Whitley Award for AAD scientist

Australian Antarctic Division biologist **Nick Gales** was honoured in the prestigious 'Whitley Awards for significant scientific publication' in September. Dr Gales was the senior editor of *Marine Mammals: Fisheries, Tourism and Management Issues*, working alongside Dr Mark Hindell from the Zoology Department at the University of Tasmania and Dr Roger Kirkwood of the Nature Park on Phillip Island in Victoria.



CSIRO PUBLISHING

The book explores the sometimes contentious issues that surround Southern Hemisphere fisheries, nature-based tourism and management. It contains valuable information on the interaction between marine mammals and fisheries; the ecological consequences of Southern Ocean harvesting; aquaculture and marine mammals; and the effects of marine-based tourism on whales. It also discusses practical suggestions for the development of ethical guidelines and standards in marine mammal management.

Literature Award for Antarctic Arts Fellow


GLEN JACOBSON

Tasmanian children's writer and illustrator, **Coral Tulloch**, has won the Wilderness Society's 2004 Environment Award for Children's Literature, for her book *Antarctica – Heart of the World*. The book was inspired by Coral's life-changing trip to Antarctica in 1999, as part of the Australian Antarctic Arts Fellowship program. Former Parliamentary Secretary for the Antarctic, Dr Sharman Stone, described the book as one that takes the reader on a fascinating and informative journey to the last great wilderness on Earth.

Antarctic Station Leaders for 2004–05

Antarctic continent station leaders for 2004–05 through to 2006 have been chosen from an Australia-wide field of 65 applicants. A station leader for Macquarie Island has been selected and will begin work in 2005. The new Antarctic leaders are:


WAYNE PAPPS

Jeremy Smith – Casey Jeremy came to Antarctic service after 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 some 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.

The 2004–05 season at Casey Station will mark Jeremy's fourth year as a station seader in Antarctica. He has previously occupied the position at Macquarie Island in 1996 and at Davis in 2001 and 2003.

Rachael Robertson – Davis Rachael recently arrived at the AAD after 14 years in the field of environmental management, working as a park ranger across metropolitan Melbourne and country Victoria. Her most recent posting as chief ranger for the West Coast District of Parks Victoria involved leading a team of 54 staff in the management of national parks, reserves and marine protected areas from Torquay to the South Australian border, and including the world famous Twelve Apostles.


GLEN JACOBSON

Rachael has experience across a wide range of areas including staff management; supervising the delivery of research programs; managing OH&S – including the implementation of maintenance programs; protected area legislation; and policy development and compliance. She is an accredited fire fighter, mad Geelong supporter and Shackleton enthusiast. Her posting to Davis station will be her first experience in Antarctica.

Graham Cook – Mawson Graham has spent the past three years in a dual role as operations manager with Federal Hotels' Strahan Village Resort and manager of Gordon River Cruises on Tasmania's west coast. Between 1991 and 2001 he was responsible for the operation of a number of remote Aboriginal community stores and Aboriginal enterprise developments in Arnhem Land in the Northern Territory, the Kimberley in Western Australia, the Tanami and Great Sandy Desert areas, and the northern goldfields of Western Australia.

Graham has travelled extensively throughout South-East Asia. Although ten years in the tropics allowed little opportunity for practice, he is a keen mountaineer, skier and bushwalker. This will be his first trip to Antarctica.


GLEN JACOBSON

ANTARCTICA is the sort of place where you feel that anything could happen. For me one of the most enduring qualities is its capacity for surprise; the explosive exhale of a Weddell seal beneath, while stepping astride a tide-crack; an iceberg the size of a battleship rolling across your path; the wonder of a breathtaking panorama revealed behind a subsiding blizzard. This photo reminds me of one of those times. The peaks, on the spine of the Antarctic Peninsula, were new to us and leapt out of the landscape after a week-long white-out. It's a place where the elements dictate the terms and we become onlookers. There's something uplifting about having somewhere like that in the world.

—Kieran Lawton

KIERAN LAWTON

FREEZE FRAME

Kieran Lawton has had a varied involvement with Antarctica for over a decade. He's visited 16 times; as an expedition leader, mountain guide, field training officer and biologist. He's now working on seabird conservation, as part of the Antarctic Marine Living Resources program at the Australian Antarctic Division.

ROGER KIRKWOOD

ANTARCTICA
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Australian Government
Department of the Environment and Heritage
Australian Antarctic Division