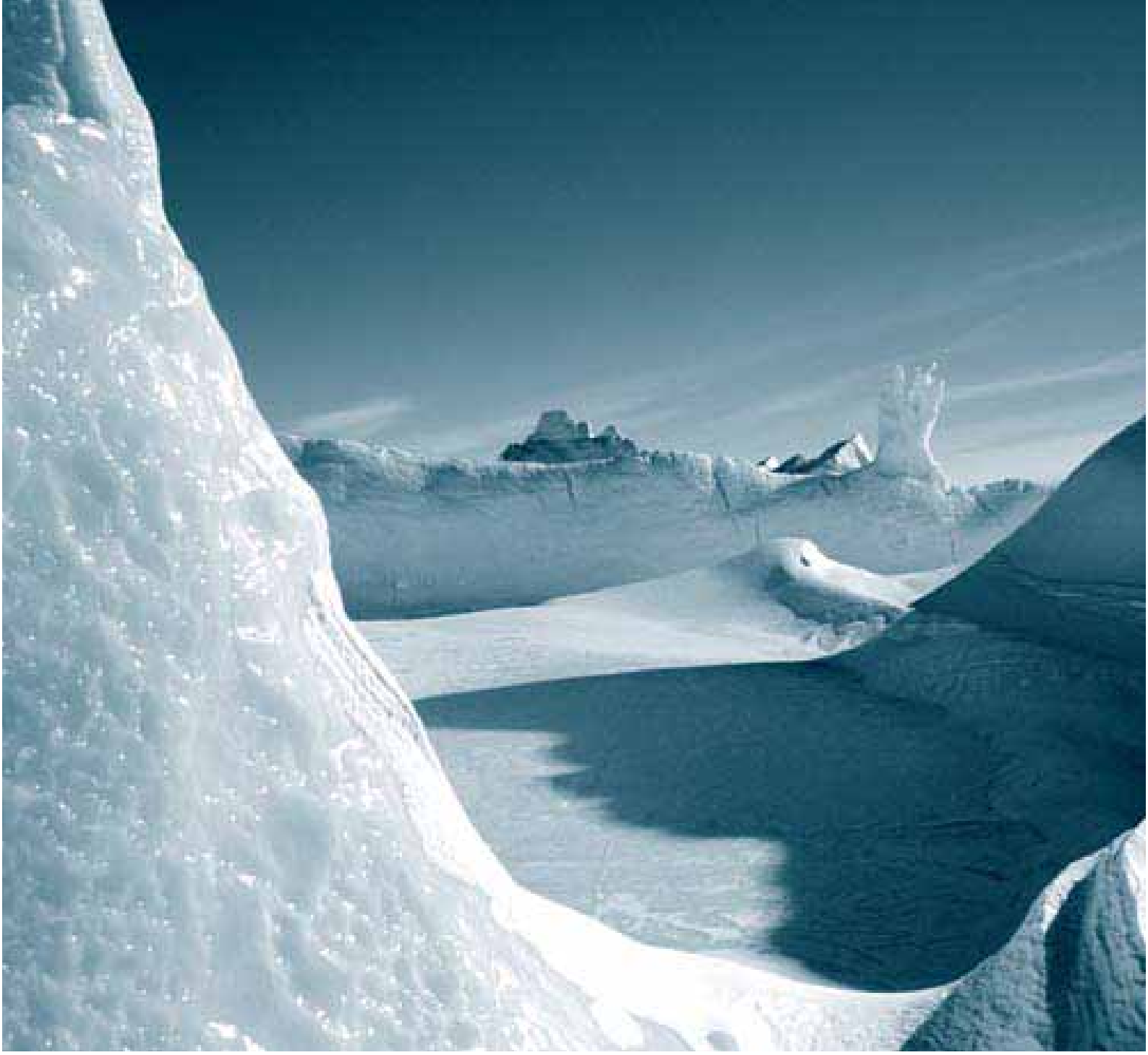


Outcome 2—Antarctica

Antarctica

The Department of the Environment and Water Resources is advancing Australia's interests in Antarctica by carrying out Antarctic and Southern Ocean programmes, participating in international forums, and conducting scientific research.

Main responsibilities for this outcome

- Antarctic Treaty System
- Antarctic and Southern Ocean environment protection
- Australian Antarctic Territory and Territory of Heard Island and McDonald Islands administration
- Antarctic and Southern Ocean research

Australian Antarctic Division

Objectives

Antarctic policy

- Maintain the Antarctic Treaty System, to enhance Australia's influence in it and enhance international protection for Antarctica as a zone of peace and science
- Protect the environment of Antarctica, the Southern Ocean and the Territory of Heard Island and McDonald Islands including its marine living resources and seabirds

Antarctic science

- Improve understanding of Antarctica's role in the global climate system
- Conduct and support science to protect the Antarctic environment and Southern Ocean ecosystems, and support other research of practical value
- Provide data to Australian and international institutions and support them to undertake research

Results 2006–07

- The establishment of an intercontinental air link between Australia and Antarctica is progressing well, with flights scheduled to commence in the 2007–08 summer. A five-year lease for an Airbus A319 aircraft was signed and the long-range aircraft arrived in Australia on 20 February 2007. The blue-ice runway foundation has been graded. Demonstration flights have been conducted to test processes and procedures and confirm the suitability of the runway's navigation aids and support systems.
- The Australian Antarctic Division is playing a key role in International Polar Year activities. The International Polar Year will be held over 24 months from March 2007 to March 2009. Australia will lead eight scientific projects, co-lead three, and participate in 46 other international projects.
- The Australian Centre for Applied Marine Mammal Science was established in 2006 and is the first major national research centre focused on understanding, protecting and conserving whales, dolphins, seals and dugongs in the Australian region. The centre is based in the Australian Antarctic Division and has an extensive network of science partners throughout Australia.
- Australia led work with its Antarctic Treaty partners China, Russia, Romania and India to finalise the formal management plan for the Larsemann Hills, an important Antarctic coastal ice-free area.
- Australia's proposal to improve procedures for reviewing and revising the 70-plus management plans for Antarctic protected areas was endorsed by the Committee for Environmental Protection, established by the Antarctic Treaty.
- The construction and operation of Mawson station's two wind-power turbines was well received by the 2007 meeting of the Committee for Environmental Protection as a significant achievement and a model of energy management in Antarctica.
- The Antarctic science programme supported 118 projects, which led to 393 publications including 154 peer-reviewed papers. A recent review of publications output from the world's Antarctic programmes shows that Australia's output ranks third, after the United States and the United Kingdom.

Antarctic policy

The department's Australian Antarctic Division advances Australia's policy interests in Antarctica by supporting and participating in the Antarctic Treaty System. This includes taking an active and influential role in forums of the Antarctic Treaty Consultative Meeting, the Committee for Environmental Protection, and the Commission for the Conservation of Antarctic Marine Living Resources (conservation, fishing and ecosystem management). The division also takes an active role in the Agreement on the Conservation of Albatrosses and Petrels (seabird conservation).

The division administers the Australian Antarctic Territory, which covers 42 per cent of the Antarctic continent, as well as the Territory of Heard Island and McDonald Islands 4,000 kilometres south-west of Perth. It also leads or participates in a range of cross-portfolio forums related to Antarctica.

Antarctic Treaty System

The Australian Government considers that supporting and participating in the Antarctic Treaty System is the best way to advance Australia's Antarctic policy interests. The Antarctic Treaty System has grown into a wide-ranging regime for managing Antarctica, with a particular emphasis on environmental protection. It also provides for scientific and logistic cooperation. Since 1961, 46 countries have become parties to the treaty.

During the year the Australian Antarctic Division continued to play a leading role in representing Australia's interests at Antarctic Treaty meetings. The most significant annual forums are the Antarctic Treaty Consultative Meeting, the annual meeting of the Committee for Environmental Protection and meetings under the Convention on the Conservation of Antarctic Marine Living Resources. The Committee for Environmental Protection is responsible for developing the regulatory framework established by the Protocol on Environmental Protection to the Antarctic Treaty.

Improvements to tourism management

While Antarctic tourism is a relatively small component of the tourism industry worldwide, the number and diversity of operations is increasing and the number of visitors continues to grow, particularly in the Antarctic Peninsula region. Australian companies are active in the Antarctic tourism industry, and many Australians visit Antarctica as tourists. The Australian Government is alert to the possibility of environmental impacts from this activity.

Australia was successful in obtaining agreement to improvements to tourism management at the 2007 Antarctic Treaty Consultative Meeting. The meeting

agreed that all parties to the treaty should discourage any tourism activities which may substantially contribute to the long-term degradation of the Antarctic environment. Australia has for some years worked hard to build support for this position among the treaty parties, and the agreement will help safeguard Antarctica from inappropriate tourism development.

Building on rules that have been used by the tourism industry, the operation guidelines were agreed including that landing tourists from very large vessels (those carrying more than 500 passengers) should be discouraged in the interests of safety and environmental protection. Other guidelines adopted for avoiding environmental impacts were that only one tourist vessel should visit a landing site at a time; only 100 tourists should be allowed onshore at a landing site at a time; and there should be at least one guide for every 20 tourists ashore.

Australia has been a strong advocate for the use of site-specific guidelines for Antarctic landing sites visited by ship-based tourists. The parties built on work in previous years by adding guidelines for two more sites. This means that the 15 most popular sites are now covered by specific management arrangements. Work to develop guidelines for other sites will continue.

Protecting the Antarctic environment

The 1991 Protocol on Environmental Protection to the Antarctic Treaty (Madrid Protocol) requires Australia and other signatories to minimise the environmental impacts of activities in Antarctica. The Australian Antarctic Division implements Australia's obligations under the protocol and administers environmental legislation in Antarctica and the sub-Antarctic.

Australia participated in multilateral work to develop the Committee for Environmental Protection's first prioritised five-year work plan, adopted in May 2007. The plan covers Australia's policy interests and priorities including preventing the introduction of non-native species, responding to the environmental effects of climate change and global pollution on the Antarctic environment, and establishing a representative system of Antarctic marine protected areas.

Over several years, Australia led work with Antarctic Treaty partners China, Russia, Romania and India to develop a management plan for the Larsemann Hills, one of East Antarctica's most significant coastal ice-free areas or 'oases'. The plan aims to protect the environment by establishing a formal framework for close collaboration and cooperation in science, operations and environmental protection. It was approved by the Antarctic Treaty Consultative Meeting and is expected to come into force in August 2007.

The Committee for Environmental Protection also endorsed Australia's proposal to streamline procedures for reviewing and revising the growing number of management plans for Antarctic protected and managed areas. There are over 70 such management plans in place and at least 10 new or revised plans to consider annually, so the new process will allow the committee to direct further effort and time to addressing the most important challenges facing the Antarctic environment.

Environment protection laws

The Australian Government minimises the environmental impacts of Antarctic operations, including cumulative impacts, by assessing possible impacts under the *Antarctic Treaty (Environment Protection) Act 1980* and the *Environment Protection and Biodiversity Conservation Act 1999.*

The *Antarctic Treaty (Environment Protection) Act 1980* gives effect to Australia's obligations under the Protocol on Environmental Protection to the Antarctic Treaty. In 2006–07 the *Antarctic Treaty (Environment Protection) Act 1980* was amended to better implement Australia's international obligations under the Convention on the Conservation of Antarctic Seals to protect Antarctic seals and conserve the Antarctic environment. The changes came into effect on 11 June 2007. Provisions concerning the protection of Antarctic seals were transferred from the Antarctic Seals Conservation Regulations 1986 to the Act, thereby enabling appropriate penalties to be imposed for offences relating to seals. Offences in relation to the disturbance of Antarctic flora and fauna were also updated.

New offences were created relating to unlawfully gathering and collecting rocks and meteorites with a maximum penalty of two years imprisonment and 120 penalty units. This amendment was introduced to give effect to Resolution 3 adopted by the 2001 Antarctic Treaty Consultative Meeting. Resolution 3 encouraged parties to the Madrid Protocol to take legal or administrative steps necessary to preserve Antarctic meteorites so that they are collected and curated according to accepted scientific standards, and are made available for scientific purposes.

Recognising that one of the key features of the Madrid Protocol is the prohibition on mining in the Antarctic, the maximum penalty imposable on an individual for engaging in a mining activity in Antarctica is now 16 years imprisonment plus a pecuniary penalty of 1,000 penalty units.

Heard Island and McDonald Islands Marine Reserve

The Australian Antarctic Division manages the reserve on behalf of the Director of National Parks. Management results for 2006–07 are reported in the annual report of the Director of National Parks (see www.environment.gov.au/parks/publications).

Environmental management system

The Australian Antarctic Division continued to operate a certified environmental management system in accordance with the international ISO 14001 standard. The system ensures that management measures to protect the environment are implemented for those aspects of the organisation's activities most likely to have more than a negligible impact on the environment. Australia is a major proponent of the systematic approach to environmental management through the Committee for Environmental Protection.

Renewable energy at Mawson

The Australian Antarctic Division has installed two wind turbines at Mawson station. In suitable wind conditions the turbines contribute approximately 90 per cent of the station's energy needs, so that fuel use in 2006–07 was approximately 34 per cent less than 2002 levels. Over the 2006–07 summer, a trial hydrogen generation and storage system using excess power from the wind turbines was installed. The hydrogen was used in a fuel cell to power the hydroponics facility at Mawson and in cooking facilities to demonstrate the viability of hydrogen as a future energy source and storage system at the stations.

Australia submitted a paper on the construction and operation of the Mawson wind turbines to the 2007 Committee for Environmental Protection meeting. This wind-power initiative was well received as a significant achievement and a model example of energy management in Antarctica.

Wind turbines at Mawson station. *Photo: Gary Dowse*

Clean-up operations

Environmental monitoring of the clean-up of the old tip site near Casey station continued, with sampling of the marine environment to determine whether the removal of pollutants has resulted in improved environmental conditions and the recovery of local marine communities.

Old fuel spill sites at Casey station and Macquarie Island are also being managed using a range of novel techniques. The deployment of a permeable reactive barrier at Casey station is likely to be the first use of this technology in a cold region environment. Its effectiveness under freeze and thaw conditions is being monitored with a view to wider use in the Antarctic and other freezing sites, such as alpine areas (see also the section on remediation research and the case study on cleaning up contaminated sites in this chapter).

In February 2007 the Australian Quarantine Inspection Service declined to issue the Australian Antarctic Division a permit to bring back to Australia waste excavated from an old (pre 1980) tip site at Thala Valley near Casey Station. Accordingly Australia is unable at this time to fully meet its obligations under Annexe III of the Protocol on Environmental Protection to the Antarctic Treaty.

Australia submitted two papers to the 2007 Committee for Environmental Protection meeting reporting on the Australian Antarctic Division's past and planned clean-up research. Other treaty parties expressed interest in collaborating with Australia in continuing assessment and remediation research.

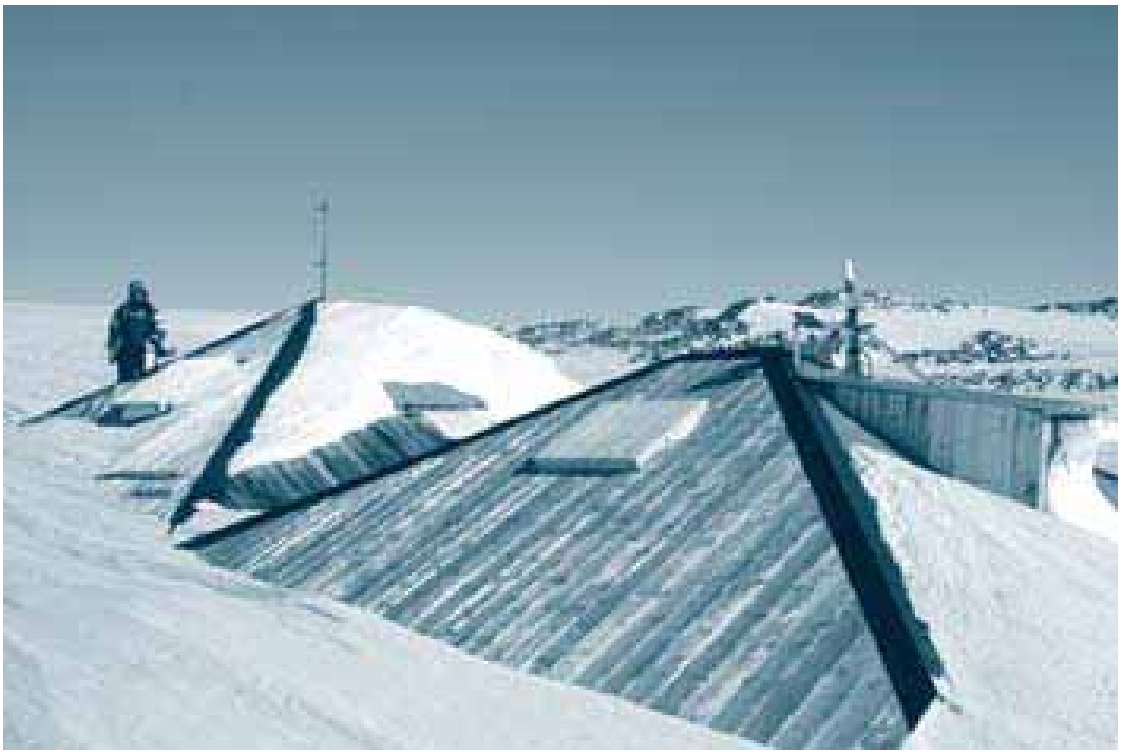
Antarctic heritage

Mawson's Huts historic site

Australia's most significant Antarctic heritage site, Cape Denison, contains the national heritage listed Mawson's huts, which rank alongside those of Scott and Shackleton as icons of the 'heroic era' of Antarctic exploration. The Australian Antarctic Division manages the Mawson's Huts historic site.

In October–December 2006 the Mawson's Huts Foundation completed significant conservation work on Mawson's living quarters, the main historic hut. This involved 'overcladding' its timber roof, worn thin by a century of blizzard-driven ice crystals, and fixing a layer of new timber boards on top of the original roof which is now protected from the elements. The Australian Antarctic Division provided logistical support for the expedition and oversaw development of the conservation works plan.

In May 2007 the Australian Government provided a grant of $1.34 million over four years to the Mawson's Huts Foundation to continue its conservation work. The Australian Antarctic Division will continue to work closely with the foundation to



Roof of Mawson's main hut in snowdrifts. Photo: Angus McDonald

manage this important work and raise awareness of the site. A draft management plan was released for public comment in July 2007, in accordance with the requirements of the *Environment Protection and Biodiversity Conservation Act 1999.*

Heritage buildings on Antarctic stations

The Australian Antarctic Division is also responsible for other places of cultural heritage significance in the Australian Antarctic Territory, including on its operational stations. To meet new Commonwealth heritage obligations, the division used several years' worth of field work commissioned from heritage professionals to develop a comprehensive register of the features, values and histories of Australia's Antarctic heritage places. This work, completed in June 2007, is the first step towards developing new management plans for Australia's Antarctic heritage.

Conserving heritage buildings

During the 2006–07 summer the Australian Antarctic Division commenced conservation works on Mawson station's Biscoe Hut (otherwise known as the 'Old Chippies Workshop'), one of the earliest buildings associated with Australia's modern Antarctic programme. The timber hut forms part of the Commonwealth Heritage listed old station complex which was established in 1954.

Planning for the hut's conservation was accelerated after the hut sustained fire damage in 2003. Works finally commenced in earnest in 2006–07 following the development of a work plan, approvals under the *Antarctic Treaty (Environment Protection) Act 1980* and *Environment Protection and Biodiversity Conservation Act 1999*, and the 2005–06 pre-positioning of materials during the short summer period when ships can access the region.

The summer team spent 1,089 person hours on site, commencing a detailed, staged photographic record; removing damaged rafters, walls and fittings; and completing major structural repairs.

Inside Biscoe Hut at Mawson station. *Photo: Mike Staples*

Protecting the Southern Ocean

Commission for the Conservation of Antarctic Marine Living Resources

The 24-member international Commission for the Conservation of Antarctic Marine Living Resources is responsible for the conservation of Antarctic marine living resources and fisheries management in the Southern Ocean. Australia is a founding member of the commission, with the director of the Australian Antarctic Division leading Australian delegations to the commission, which meets annually in Hobart.

In addition to illegal, unregulated and unreported fishing, which continues to be a problem in the area, the reinvigoration of the krill fishery also presents a challenge for the commission. Recent developments, such as the introduction of super trawlers and the continuous fishing system (new technology which involves pumping krill constantly from the trawl), have highlighted the potential for the krill fishery to negatively impact on the Southern Ocean ecosystem if it is not managed in a precautionary and sustainable manner. Australia is playing a lead role in seeking to ensure that improved conservation measures for the krill fishery are adopted.

Combating illegal, unregulated and unreported fishing

In recent years, highly organised illegal, unregulated and unreported fishing for Patagonian toothfish in the Southern Ocean has heavily depleted several fish species, and has brought some seabird populations to the brink of extinction.

The Australian Antarctic Division therefore continues to play a key role in actions aimed at combating illegal, unregulated and unreported fishing, and is working with other government departments in developing and implementing the Australian Government's position. As part of this work, the division provides support to the government's armed fisheries patrols in the Southern Ocean.

Australia's actions and collaborations with members of the Commission for the Conservation of Antarctic Marine Living Resources have seen a reduction in the level of illegal, unregulated and unreported fishing in the Southern Ocean, particularly within Australia's sub-Antarctic Exclusive Economic Zone. However, the threat from illegal, unregulated and unreported fishing continues on the adjacent high seas, seriously threatening Australia's Southern Ocean conservation goals.

Albatrosses and petrels

The Australian Antarctic Division leads Australia's participation in the Agreement on the Conservation of Albatrosses and Petrels. Under the agreement, Australia and other parties support activities to conserve albatrosses and petrels. This includes encouraging regional fisheries organisations responsible for the management

of high seas fisheries, especially longline fisheries, to develop and implement measures to reduce or prevent seabird bycatch.

In July 2006, a revised Australian threat abatement plan for the incidental catch (or bycatch) of seabirds during oceanic longline fishing operations (prepared in accordance with the *Environment Protection and Biodiversity Conservation Act 1999*) was approved by the minister. The plan, developed by the Australian Antarctic Division in consultation with other government agencies, fishing and conservation interests, replaces the first plan approved in 2001. The new plan recognises the substantial progress made in Australian fisheries since 2001 in reducing seabird bycatch, and requires government agencies to take a range of actions to further decrease bycatch in domestic and international fisheries. These include applying mitigation measures and seabird bycatch limits to Australian fisheries, and promoting mitigation measures at international forums.

The potential for fishers to dramatically reduce seabird bycatch in longline fisheries was resoundingly demonstrated at the October 2006 meeting of the Commission for the Conservation of Antarctic Marine Living Resources. Seabird bycatch in fisheries managed by the commission was estimated at a total of only two seabirds, with no albatrosses killed; a reduction of many thousands from the levels killed less than a decade ago. This result reflects many years of effort by the Australian Antarctic Division and others in systematically improving the commission's mitigation and compliance measures.

The challenge is now to get other regional fisheries organisations, especially those managing high seas longline fisheries, to follow the commission's lead in developing, evaluating and refining seabird mitigation measures.

Antarctic science

A core component of advancing Australia's Antarctic interests is to carry out and support scientific research in Antarctica and the Southern Ocean. Support for Antarctic research also reinforces Australia's influence in the Antarctic Treaty System.

The Australian Antarctic Division undertakes and supports research, including providing logistical support for researchers, and provides data on physical, biological and human sciences to Australian and international institutions. The division maintains three permanent stations in Antarctica and one at Macquarie Island. Each summer the division deploys around 200 people to these stations and to field camps. The expeditions are supplied by chartered ships and aircraft.

Australia's Antarctic science programme

Australia's Antarctic science programme plays a significant role in advancing understanding of the global climate system, the Antarctic environment and Southern Ocean ecosystems, adaptation by plants and animals to global change, meteorology, the geological history of the Australian continent, and the impact of human activities in Antarctica.

In 2006–07 the Antarctic science programme supported 118 projects, which led to 393 publications including 154 peer-reviewed papers. Since 1999 the programme has produced 1,340 peer reviewed publications.

Antarctica's influence on climate

Antarctica influences global climate because of its low temperatures, circumpolar ocean and immense size. Antarctica's vast ice sheets and annual sea ice cover affect the heat balance of the globe, circulation in the oceans and atmosphere, and how much carbon dioxide the oceans absorb.

Climate change is beginning to cause large-scale changes to ice cover in some parts of the Antarctic. Several ice shelves along the Antarctic Peninsula have collapsed rapidly, including the Larsen B Ice Shelf in 2002. In other regions the grounded ice is discharging more rapidly into the ocean, and it is estimated that melt of the Antarctic ice sheets is currently adding 0.2 millimetres per year to global sea level rise. These changes could also affect major ocean currents and food webs.

One of the four priorities in the Antarctic Science Strategy 2004–05 to 2008–09 is adding to knowledge of Antarctica's influence on climate. The Australian Antarctic Division works closely with the Antarctic Climate and Ecosystems Cooperative Research Centre and the Australian Greenhouse Office to carry out this research. The division also works with the CSIRO Wealth from Oceans Flagship programme.

Southern Ocean research—Sub-Antarctic Zone Sensitivity to Climate Change (SAZ-SENSE)

The Australian Antarctic Division's chartered research ship *Aurora Australis* carried out a five-week research voyage in sub-Antarctic waters in January and February 2007. The purpose of the voyage was to study the Southern Ocean marine ecosystems, their influence on carbon dioxide exchange with the atmosphere and the deep ocean, and their sensitivity to past and future global change including climate warming, ocean stratification, and ocean acidification from human carbon dioxide emissions.

The work particularly looked at the effects on plankton communities of adding iron from natural sources to the Southern Ocean, and adding carbon dioxide from human sources.

The sub-Antarctic zone is globally important in the uptake of carbon dioxide due to its enormous area and significant productivity.

The research was carried out by a large multinational team from the Australian Antarctic Division, the Antarctic Climate and Ecosystems Cooperative Research Centre, CSIRO Marine and Atmospheric Research, and universities in Australia, France, Belgium, the United Kingdom, United States, Netherlands and New Zealand.

Data analyses are still under way, but scientists are confident that the very successful sampling regime used will allow the processes underpinning global changes to be defined and measured.

Law Dome ice core project

Law Dome, inland from Casey station, has been a focal point for Australian glaciological research since the 1960s. Its ice sheet preserves a unique record of the climate, and ice cores drilled on Law Dome provide a climate record stretching back 90,000 years, with very high resolution over the last few thousand years. A study using the recent record from these and other ice cores has shown that the amount of snowfall over Antarctica varies greatly from year to year and place to place, but there has been no significant trend over the last 50 years. Temperatures over the same period show some indication of warming, but this is masked by patterns of variability that occur on 10-year time scales. Ongoing analysis of the Law Dome ice cores is continuing at the Antarctic Climate and Ecosystems Cooperative Research Centre focusing particularly on the relationship between rainfall in southern Australia and the record of snowfall in the Law Dome ice cores.

Amery Ice Shelf

The Amery Ice Shelf is a 60,000 square kilometre floating ice mass between Davis and Mawson stations. Ice draining from a region of inland Antarctica one and a half times the size of the Murray–Darling Basin passes through the Amery.

A study of the interaction between the ice shelf and the underlying ocean cavity has been undertaken over several years by Australian researchers and has involved drilling four holes more than 500 metres deep through the shelf and deploying instruments into the underlying ocean. Results from the study have shown that more than half of the ice passing through the Amery is lost as melt from the base of the ice shelf, and that the circulation under the ice shelf is driven by a combination of processes in the open ocean north of the shelf, and by freshening of the water due to this ice melt. There are some areas where ice refreezes back onto the ice shelf, but much of this refrozen ice is porous and inherently less stable than the original ice from the interior. Video imagery taken through the boreholes has also revealed a surprisingly rich diversity of marine life beneath the ice shelf, both in the water column and on the sea floor, more than 100 kilometres from the open ocean.

Work is also being conducted on large rifts that are developing near the Amery Ice Shelf front, which will lead to a giant new iceberg breaking off. Detailed observations show that the expansion of the rifts occurs faster in summer than in winter and that it occurs in short, sharp bursts followed by periods of relative quiet. It is expected that the new iceberg will calve within the next few years. This work is a collaboration between American and Australian scientists.

International Polar Year

The International Polar Year will be held over 24 months from March 2007 to March 2009. It will mark the 50th anniversary of the International Geophysical Year, which lasted 18 months from July 1957 to December 1958, and stimulated the development of the Antarctic Treaty. Australia will lead eight scientific projects, co-lead three, and participate in 46 other international projects during the International Polar Year. Notably, the Australian Antarctic Division is coordinating the Census of Antarctic Marine Life in 2007–08. Interest in this project is high, with almost 20 ships scheduled to participate in field work which will develop a robust baseline of knowledge of the marine biodiversity around Antarctica. The Australian Antarctic Division and the Antarctic Climate and Ecosystems Cooperative Research Centre will also conduct a winter sea ice voyage in August 2007 to examine climate–ecosystem links.

Australian Centre for Applied Marine Mammal Science

The centre was established in 2006 and is the first major national research centre focused on understanding, protecting and conserving the whales, dolphins, seals

and dugongs in Australia's region. The centre will build upon Australia's existing research efforts and, through its coordination role, will provide an integrated, strategic, cross-jurisdictional approach to support marine mammal conservation, management and policy priorities.

The centre is based in Hobart at the Australian Antarctic Division and has an extensive network of science partners throughout Australia. A stakeholder advisory committee and a scientific committee work with the centre staff to review priority research needs and select competitive bids for commissioned research.

The centre was established with initial funding from the Australian Government's $100 million Commonwealth Environment Research Facility programme and existing staff and resources from the Australian Antarctic Division's marine mammal research group. Along with further funding from other government marine mammal research funds, universities and industry groups, the centre is establishing a substantial fund from which commissioned, prioritised research is being supported. In 2006–07, the Commonwealth Environment Research Facility programme funded 15 new research projects on the management and conservation of marine mammals.

Monitoring Adélie penguins

Australia has been monitoring Adélie penguins at Béchervaise Island near Mawson station since 1990 as part of an international programme studying the effects of krill abundance on penguins, and collecting baseline data in the event that krill fishing returns to the region.

An Adélie penguin crossing the automatic recording system. Photo: Judy Clarke

Adélie penguins are large consumers of krill and are therefore useful indicators of the effects of changes in krill abundance brought about by harvesting. Results, submitted to the Commission for the Conservation of Antarctic Marine Living Resources annually, have shown that the penguins' breeding success is affected by krill availability and sea ice conditions.

Automated solar powered camera to monitor Adélie penguins. Photo: Kym Newber

An automated recording system registers the birds as they enter and leave the colony. Many of the birds can be individually identified by microchips implanted under the skin. These are detected via an antenna near the colony. Two infra-red beams, which are cut sequentially by the birds as they pass by, record the time of passing and direction of travel. This information tells scientists about the length of time the birds have been foraging at sea.

The Australian Antarctic Division recently developed an automated camera, powered by solar panels, to monitor aspects of Adélie chick survival and breeding chronology. During the winter months when there is no sun the cameras 'sleep' and 'awaken' as the summer returns to record a series of photographs throughout the breeding season. In 2006–07 six cameras were installed at new island sites in the Mawson region to broaden the study area and provide a more comprehensive picture of penguin activity. The extra monitoring from the cameras will give a substantial boost to understanding of the penguins' needs, which will help ensure that the human harvest of krill does not adversely affect any element of the Southern Ocean Antarctic marine ecosystem.

Ozone research

A study of the meteorological conditions in the Antarctic stratosphere using data for the period 1995–2005 has revealed a relationship between winter temperatures and the eventual size of the spring ozone hole. This relationship was used to accurately forecast key parameters for the 2006 ozone hole one month before its development began, and three months before it reached maximum size. In particular, the forecast accurately predicted that the ozone hole would reach record-breaking proportions. This work is part of a collaborative programme of Antarctic ozone research between the Australian Antarctic Division and the Bureau of Meteorology.

Remediation research

Australian Antarctic Division scientists are using toxicological experiments to study the sensitivity of Antarctic marine invertebrates, seabed communities and soil processes so that environmental standards specific to the Antarctic environment can be developed. These standards will assist Australia to prioritise the clean-up of sites of past activity and will allow sites to be classified based on rigorous scientific data, according to the risk they pose to the environment.

Australian Antarctic Division scientists are leading a partnership of industry and scientists from Australia and overseas to develop remediation technologies for contaminated sites in cold regions. Permeable reactive barriers for use in freeze and thaw conditions are being developed collaboratively with BP Exploration in Alaska, the University of Melbourne, and Macquarie University.

Other collaborative projects include developing and applying methods for quantitative monitoring of fuel spills, and technologies for removing heavy-metal contaminants from run-off associated with abandoned waste disposal sites.

First trial injecting air into soil contaminated with fuel at Macquarie Island. *Photo: John Rayner*

Cleaning up contaminated sites

Australian Antarctic Division research at sites contaminated with old fuel spills has demonstrated the role of oxygen in decontamination. The amount of oxygen in the soil is important in stimulating microbial activity that can break down the hydrocarbons in the fuel and eventually decontaminate the soil.

Practical application of this research at Macquarie Island has shown that injecting air into contaminated soil significantly increases the rate of decontamination.

Second trial injecting air into soil contaminated with fuel at Macquarie Island using micro-ports. This form of injection was successful in aerating the soil profile.

Photo: John Rayner

Antarctic science grants

The Australian Antarctic Division supports the Australian Antarctic Science Grants Programme. Applications for 2006–07 grants were sought nationally in May 2006, prompting 142 research proposals. Following independent assessment, 49 proposals were awarded grants with a total value of almost $750,000.

Antarctic air link

A contract to provide the intercontinental air service between Hobart and Antarctica was signed by the Australian Antarctic Division and Skytraders Pty Ltd in December 2006. A five-year lease for an Airbus A319 aircraft was signed and the long-range aircraft arrived in Australia on 20 February 2007.

Demonstration flights have been conducted to test processes and procedures and to confirm the suitability of the runway's navigation aids and support systems.

Construction of the Wilkins Runway in Antarctica is progressing well. The runway foundation has been graded, enabling wheeled aircraft to use the runway. A compressed snow pavement will be applied progressively each summer. After initial certification flights, passenger flights are planned to commence in the 2007–08 summer, with the frequency of flights increasing over future seasons.

International logistic cooperation

During 2006–07 the Australian Antarctic Division was closely involved in several activities with other countries, including provision of:

- planning support to the Japanese Antarctic programme for its 2008–09 season
- practical logistic support to the Chinese Antarctic programme's 2006–07 season
- practical logistic support to the Russian, German, Chinese, and United States Antarctic programmes as part of a multinational International Polar Year project
- support to the Korea Polar Research Institute in their planning for a new station, as well as a practical demonstration of Australian logistics and station operations
- detailed planning to support the French Antarctic programme following an incident on the resupply vessel *L'Astrolabe*; however, in the end, the division's assistance was not needed.

International management meetings

Concurrent meetings of the international Council of Managers of National Antarctic Programmes and the Scientific Committee on Antarctic Research were hosted by the Australian Antarctic Division in Hobart from 26–30 July 2006. These bodies include representatives from countries with a national presence in Antarctica and promote better management through sharing operational experience, data and innovations.

Results for performance indicators

Performance indicator	2006–07 results
Antarctic Treaty System	
The degree to which Australia's policy interests are advanced through international forums, particularly (i) the Antarctic Treaty Consultative Meetings (ii) the Commission for the Conservation of Antarctic Marine Living Resources and (iii) the Committee for Environmental Protection	Australia participated in annual and out-of-session meetings of the Antarctic Treaty Consultative Meeting, the Commission for the Conservation of Antarctic Marine Living Resources, and the Committee for Environmental Protection (i) At the Antarctic Treaty Consultative Meeting Australia was successful in obtaining agreement to improvements to tourism management (ii) Through the Commission for the Conservation of Antarctic Marine Living Resources Australia was instrumental in the adoption of several conservation measures, including prohibiting the use of gill-nets in waters managed by the commission, and in highlighting the need for more consistent management of the krill fisheries (iii) Australia led work to develop a management plan for the Larsemann Hills. The plan was endorsed by the Committee for Environmental Protection. The committee also endorsed Australia's proposal to streamline procedures for reviewing and revising the growing number of management plans for protected and managed areas in Antarctica. Australia helped develop the committee's first prioritised 5-year work plan. Australia submitted a well-received paper on Mawson wind turbines, a model example of best practice energy management in Antarctica
Illegal, unregulated and unreported fishing	
The extent of Australia's influence within the Commission for the Conservation of Antarctic Marine Living Resources on measures to combat illegal, unreported and unregulated fishing for toothfish	Australia continued to play a lead role within the Commission for the Conservation of Antarctic Marine Living Resources in developing measures to combat illegal, unreported and unregulated fishing of toothfish. At the commission's October 2006 meeting Australia played a lead role in obtaining agreement to review the system of inspection, in adopting a cooperative enhancement programme for non-parties implicated in illegal, unreported and unregulated fishing and in adopting port access restriction measures
International seabird conservation	
The extent of Australia's influence in changing fishery practices, including reduction in the number of albatrosses caught by fishing gear	Australia's influence in changing international fishery practices is considerable in the Commission for the Conservation of Antarctic Marine Living Resources Seabird mortality in longline fisheries managed by the commission was estimated at only 2 (including zero albatrosses) in the 2005–06 season. This reflects systematic improvements in the commission's seabird bycatch mitigation measures and compliance regime, many of which were initiated by Australia Despite Australia's efforts, the performance of many other regional fisheries management organisations in reducing seabird bycatch remains generally poor

Performance indicator	2006–07 results
Protecting the Antarctic environment	
Trend in the number of plants, invertebrates and diseases introduced to Antarctica and the Heard Island and McDonald Islands Territory	No new introduced plants, invertebrates or diseases were recorded Eradication of the fungus gnat infestation at Casey station in August 2006 appears to have been successful. Monitoring for the gnat will continue The extent of the expansion of the invasive alien grass species *Poa annua* on Heard Island is unknown as Australian Antarctic Division staff did not visit the island during the year
Number of environmental incidents unresolved after 6 months	Since the Hazard and Suggested Improvement Reporting System began in October 2004 almost 300 environmental reports have been logged by expeditioners and head office staff. As at 30 June 2007, 64 environmental reports remain current. Most of these are suggestions for improvement and are awaiting resources to implement There are 13 unresolved environmental incidents older than 6 months. Some of these remain open for ongoing monitoring purposes while some await sample test results or guidance from other areas of the department. For example, removal of old graffiti on rocks in Antarctica relies on the development of a biodegradable removal agent. Another example is analysis of long-term bioremediation treatment of hydrocarbon contaminated soil samples. Another incident cannot be closed until major infrastructure is replaced with more modern equipment
Number and extent of oil spills and remediation action taken	Fuel leaking from a double-skinned tank was contained by the outer skin with only a very minor amount escaping to some already fuel-contaminated soil at Casey station Approximately 200 litres leaked from heavy equipment on a hard stand at Casey and the site is being considered for remediation. A further 3.5 litres of engine oil spilled from a vibrating roller; the affected soil has been removed and packed into drums for return to Australia
Number of environmental impact assessments (i) completed by the department (ii) submitted by third parties and assessed by the department (iii) audited under Australia's Antarctic Environmental Management System as a percentage of total completed	(i) 50 (23 science, 16 non-science, 11 tourism or non-government), and 19 variations were authorised. 25 authorisations remained current from previous years (ii) 11 tourism or non-government (iii) 8.5% (6 of the 73 active authorisations) Note: All near-station activities are subject to routine scrutiny by *Antarctic Treaty (Environment Protection) Act 1980* inspectors and most authorisations are subject to other reporting requirements

Performance indicator	2006–07 results
Support for Antarctic science	
Successful completion of the elements of the Antarctic Science Strategy 2004–05 to 2008–09	118 projects from 27 institutions were undertaken to address 4 priority areas. 55 projects addressed the ice, ocean, atmosphere, climate priority area, 35 addressed the Southern Ocean ecosystems, 36 addressed adaptations to environmental change and 24 projects addressed impacts of human activity in Antarctica. Many projects addressed more than 1 priority area
Number of peer-reviewed scientific papers produced by scientists participating in the Antarctic science programme	154
Number of scientists active in Antarctic and Southern Ocean science	131 (including 57 marine scientists)
Australia–Antarctic Airlink	
Test flights are undertaken in 2006–07 First operational flights commence in 2007–08	An intercontinental aircraft was leased and delivered; demonstration flights were conducted; runway construction and maintenance continues
Output 2.1 and 2.1 Antarctic Policy and Antarctic science	
The minister is satisfied with the timeliness and accuracy of briefs and draft ministerial correspondence provided by the department	Minister was satisfied with timeliness and quality of briefs. The department has experienced challenges in responding to the unprecedented volume of correspondence now being received, but procedural adjustments and new systems have improved timeliness
Percentage of payments that are consistent with the terms and conditions of funding (Target: 100%) [1]	100%
Percentage of participants in the Australian Antarctic Programme whose participation is consistent with the terms and conditions of logistic support (Target: 100%) [1]	100%
Price	See resources table below

1 Applies to provision of grants programmes funded entirely from the appropriations for the output.

Resources

Elements of pricing	Budget prices $'000	Actual expenses $'000
Departmental outputs		
Output 2.1: Antarctic policy	40,289	45,995
Output 2.2: Antarctic science	83,677	81,775
Total Outcome 2	**123,966**	**127,770**
Administered items		
Mawson's Hut Foundation	1,300	1,300
Decisions taken but not yet announced	3,000	0
Total	**4,300**	**1,300**