

Australia's Antarctic Scientific Research Programme 2007/08

Summary

The major field programmes conducted by Australia in the 2007/2008 Antarctic season occurred principally in the Southern Ocean and not on land. Three projects under the International Polar Year 2007-2008 (IPY) were conducted: (1) Sea Ice Physics Experiment (SIPEX); (2) Collaborative East Antarctic Marine Census (CEAMARC), and (3) Climate of Antarctica and the Southern Ocean (CASO). In addition, Australia led the IPY project 'Aliens in Antarctica'. All projects involved many scientists from overseas. Terrestrial activities included station and near station-based studies into atmospheric research, history of penguin occupation and some lake sampling occurred as part of long-term ecosystem research.

Sea Ice Physics and Ecosystem Experiment SIPEX)

SIPEX was organised jointly by the Antarctic Climate & Ecosystems Cooperative Research Centre (ACE CRC) and the Australian Antarctic Division, and carried out in October and November 2007. Eighty-six scientists from eight nations used a suite of cutting-edge technologies to study processes on the sea-ice surface, as well as within and under the ice in the region East of Australia's Casey Station. Two helicopters, equipped with laser and radar altimeters, were used to measure the height of the snow and ice surfaces above sea level. The helicopter data were complemented by information gathered from ice coring and other work directly on the ice. The combined information will help validate satellite altimetry data, which will soon be used to monitor changes in sea ice thickness around Antarctica.

Sea-ice researchers also made the first measurements of the fluid permeability - the ability of fluid to flow through channels in the ice - of the seasonal Antarctic sea-ice pack. With permeability affecting polar biology and oceanography, these initial data will have important implications.

Biologists combined classical ice coring techniques with a remotely operated vehicle (ROV) to study the underside of the sea-ice, to map the distribution of ice algae - microscopic plants that live in and on the underside of the ice. ROV observations showed high concentrations of Antarctic krill living at the underside of the sea-ice as well as in cracks between ice floes. Using trawls and underwater cameras, the biology team mapped the distribution and the condition of the krill. Krill found in and around the ice were in better condition than those found in areas of open water suggesting a better quality of food available to them. Other scientists worked on ice algae physiology and sea-ice biogeochemistry to better understand what happens in the Antarctic sea-ice zone during the transition from winter to summer.

Oceanographers studied the water mass properties and currents beneath the sea-ice and found that, contrary to what was expected, the patterns of sea-ice drift appear to be affected more by ocean currents than by wind.

Collaborative East Antarctic Marine Census

The Collaborative East Antarctic Marine Census (CEAMARC) involves scientists and research vessels from Australia, Japan and France, and forms part of a major Australian Antarctic Division-led IPY project, the 'Census of Antarctic Marine Life'. Field work, utilising three ships, was undertaken from mid-December 2007 to the end of February 2008.

CEAMARC aims to understand the processes that have led to the evolution and survival of marine life existing on the continental shelf; on the sea-floor in the deep waters; and in the water column

from the surface downwards, so that scientists can predict how these organisms will respond to future climate-related environmental changes. Work aboard the *Aurora Australis* from December 2007 to late January 2008 focussed on the diversity of fish and sea-floor-dwelling (benthic) organisms living below the 200 m isobath, and the environmental conditions in which they live. The use of high definition underwater video equipment allowed outstanding pictures to be taken of complex marine assemblages living at depths of up to 2 000 m.

The French ship, *l'Astrolabe*, and the Japanese ship *Umitaka Maru* also participated in this collaborative project studying the biodiversity of the open ocean, concentrating on plankton and mid-water fish.

Together, the three voyages investigated the diversity of the open ocean and sea-floor fauna, from gene to habitat level, and will compare these with similar studies in other parts of the Southern Ocean. This will help scientists understand the whole community composition and structure, which in turn will help them understand the impacts of climate change and how marine communities have adapted to the unique Antarctic environment, and establish a benchmark against which future ocean change can be assessed.

Climate of Antarctica and the Southern Ocean (CASO)

The Climate of Antarctica and the Southern Ocean (CASO) project provides the first circumpolar snapshot of the physical, biogeochemical, atmospheric and ecological environments in the Southern Ocean region. This work contributes to an understanding of how the Antarctic and Southern Ocean regions drive and respond to climate change and variability.

CASO includes 25 individual projects involving scientists from 18 nations and is integrated with CEAMARC.

Field work includes a range of new technologies such as:

- A circumpolar array of 'sea-ice drifters' - robotic devices measuring a range of ice, ocean and atmosphere parameters.
- Ocean floats deployed to measure temperature and salinity throughout the Southern Ocean, including acoustically-tracked floats in ice-covered areas for the first time.
- Current meter moorings and pressure gauges to provide a time series of ocean currents and water mass properties.
- An expanded array of weather stations and atmospheric observations to measure atmospheric variability.
- Oceanographic sensors deployed on marine mammals, which will provide the first measurements of ocean conditions around Antarctica during winter.

Observations from these instruments are being closely integrated with a range of modelling studies being conducted in Australia's Antarctic programme.

Aliens in Antarctica

As the amount of travel increases, the impact of non-native (alien) species that people unwittingly carry with them is emerging as a significant environmental challenge for the 21st Century. The impact of these alien species ranges from minor transient introductions to substantial loss of biodiversity and ecosystem changes. It is now easier for humans (and their unintended living cargo) to travel to and around the Antarctic than ever before, and many more people are doing so with an expected 40 000 doing so in 2007/08. The impacts of invasive species have so far been restricted to the milder sub-Antarctic islands. However, as climate change causes parts of the Antarctic continent to warm, it will become easier for non-native species to gain a foothold.

During the annual migration of scientists and tourists to the Antarctic in 2007/08, the Australian Antarctic Division-led IPY project 'Aliens in Antarctica' examined the clothing people wear in Antarctica through vacuuming in pockets, around seams and in Velcro fasteners. This research provides a unique snapshot of the number of spores, seeds, invertebrates and eggs transported to the continent by human activity. Subsequent analysis will provide an assessment of the extent of transfer of alien species into an entire biome. The project is examining the activities of nearly 20 national programmes and over 30 tourism operations, and involves scientists from ten nations. When fully analysed, the data will provide evidence of the magnitude of the problem.

AUSTRALIAN OFFICE HOLDERS IN ICSU AND AFFILIATED BODIES

PERSON	INTERNATIONAL BODY	POSITION	TERM OF OFFICE
Dr I. Allison	ICSU-WMO Joint committee on International Polar Year	2007-08	Co-Chair,

SCAR Physical Sciences

Dr N. Adams	Expert Group on Operational Meteorology in the Antarctic,	Member
A/P. M. Ashley	Action Group on Plateau Astronomical Site Testing in Antarctica,	Leader
Prof B. Fraser	Standing Scientific Group on Physical Sciences,	Member
Dr I. Goodwin	Expert Group on International Trans-Antarctic Scientific Expedition	Co-chair
Dr T. Jacka	Standing Scientific Group on Physical Sciences, Expert Group on Ice Sheet Mass Balance and Sea Level, Coordinator	Member
Dr S. Nicol	Expert Group on Oceanography,	Member
Dr S. Pendlebury	Expert Group on Operational Meteorology in the Antarctic,	Member
Dr S. Rintoul	Expert Group on Oceanography,	Member
Prof K. Rosman	Action Group on Environmental Contamination in Antarctica,	Member
Prof J. Storey	Expert Group on Antarctic Astronomy and Astrophysics,	Leader
Dr A. Worby,	Expert Group on Antarctic Sea-Ice Processes and Climate,	Co-chair
Dr T. van Ommen	Standing Scientific Group on Physical Sciences Programme Group on Antarctica and Global Climate System,	Secretary Member

SCAR Geosciences

Dr. H. Brolsma	Standing Scientific Group on Geosciences, Expert group on Geospatial Information – Geographic Information	Member Member
Dr. D. Gore	Programme group on Antarctic Climate Evolution,	Member
Dr J. Finney	Standing Committee on Antarctic Data Maps,	Member
Dr. G. Johnstone	Expert group on Geospatial Information – Geodesy,	Member
Dr. J. Manning	Standing Scientific Group on Geosciences,	Member
Dr P. O'Brien	Standing Scientific Group on Geosciences, Action group on Acoustics in the Marine Environment,	Member Chair
Mr J. Sayers	Standing Scientific Group on Geosciences,	Member
Prof. C. Wilson	Standing Scientific Group on Geosciences,	Member

SCAR Life Sciences

Dr J. Ayton,	Standing Group on Life Sciences, Expert Group on Human Biology and Medicine, Secretary	Member Secretary
Dr D. Bergstrom	Programme Group on Evolution and Biodiversity in the Antarctic,	Secretary
Dr M. Hindell	SCAR Expert Group on Seals, member	
Dr G. Hosie	Standing Group on Life Sciences, Action Group in the Southern Hemisphere Continuous Plankton Recorder Survey,	Member Co-Chair
Dr H. Marchant	Standing Group on Life Sciences,	Member
Dr M. Stoddart	Census on Antarctic Marine Life,	Chair
Dr M. Stoddart	Standing Group on Life Sciences,	Member
Dr D. Watts	Steering Committee SCAR-Marine Biodiversity Network,	Member
Dr E. Woehler	Standing Group on Life Sciences, Expert group on Birds,	Member Chair

Other SCAR Bodies

Dr G. Hosie	SCAR representative to CCAMLR, Standing Committee on Antarctic Treaty System,	Member Member
Dr M. Stoddart	Standing Committee on Antarctic Treaty System,	Member
Dr D. Watts	Joint Committee on Antarctic Data Management,	Member

World Climate Research Program (Antarctic-relevant components)

Dr V. Lytle	CliC International Project Office,	Director
Dr A. Worby	Scientific Steering Group, Climate and Cryosphere (CliC), Chair	Co-Vice-
Prof M. England	CliC Data Management and Information Panel,	Member
Dr S. Rintoul	CLIVAR Working Group on Ocean Model Development, CLIVAR/CliC/SCAR Southern Ocean Region Implementation Panel	Member