

# Thirty metres under the sea ice

Divers from the Australian Antarctic Division's (AAD) Environmental Protection and Change programme ventured into the seldom visited but fascinating under-ice marine environment off Casey last summer. The team supported a variety of national and international research projects investigating the biodiversity of nearshore Antarctic marine ecosystems, and the effects of human activity on these systems at local and global scales.



MARTIN RIDDLE

A rich diversity of life exists under the sea ice, including these feather duster worms, sea urchins, sponges and a starfish.

Research diving under Antarctic sea ice represents the culmination of a lot of personal preparation and team endeavour. Each diver undergoes pre-trip familiarisation training and dive medicals, in addition to the normal pre-trip medicals and training. Equipment is tested, checked and re-checked at Kingston, and once again when we arrive on station.

Not long after our arrival at Casey, a drilling team was out on the sea ice surveying access routes and digging holes through the 1.3-2 m thick sea ice. More than 80 holes (90 cm diameter) were drilled through the sea ice, both for divers and to deploy equipment and instruments, such as sediment traps and oxygen probes.



JONNY STARK

Tenders assist divers into the dive hole.

Safety is paramount and each diver undergoes multiple checks as their 'tender' assists them into their dry suit and dive harness, and helps them shuffle to the dive hole. Once in the water you are released from the awkwardness and the pull of the massive weights needed to counteract the dry suit buoyancy, and can float freely and comfortably in the -1.85°C waters. After descending 1-2 m through an icy, water filled tunnel, you enter one of the worlds most rarely visited and spectacular environments.

At first it's very dark. The sea ice filters out a lot of sunlight, initially creating a mysterious, eerie gloom. Your eyes adjust quickly, however, revealing a brightly coloured world as you descend to depths of up to 30 m. Red, green, yellow and orange sponges, crimson sea urchins, pink and orange sea anemones, white fan worms, colourful sea stars and red, green and brown algae can cover any rocky surface. Sea-mice (burrowing urchins) and giant worms, metres long, crawl through the muddy sediments. The water itself is amongst the clearest in the world, and even with the low light levels, visibility of 50 m or more is common. Looking upwards provides a vivid reminder of where you are. Pools of trapped air move about like puddles of mercury on the thick icy roof and sunlight streams through the dive holes, sending brilliant columns of light to the sea floor below.

Apart from marvelling at the sights there is a lot of hard work to be done.

In the flurry of diving activity last summer, a wide variety of samples were collected during 188 person dives (more than 132 hours underwater) over eight weeks. Cores of sediment collected from the sea floor continued the AAD's long-term biological monitoring of the Thala Valley clean-up, as well as providing Malaysian and Tasmanian scientists with diatoms for their work on the community composition and molecular ecology of

these single celled marine algae. Other AAD work included collecting a variety of marine organisms for a new study of nearshore marine food webs, and a study of how depth affects communities of invertebrates living on the sea floor.

We also retrieved a long-term experiment investigating the effects of hydrocarbons (such as Special Antarctic Blend diesel) on marine communities. Trays of sediment, some treated with hydrocarbons and some untreated, were left sitting on the sea floor for up to five years, to allow invertebrates to colonise and establish communities. Differences among these communities will indicate how spills of petroleum products may affect nearshore marine communities in Antarctica, how long the oils may persist, and how long recovery will take.

Continuing another long running project, Dr John Runcie of the University of Sydney, conducted fine scale measurements of the photosynthetic activity of various species of macroalgae and diatoms on the sea floor and the underside of the sea ice. Decreased photosynthetic activity in these marine plants in the bays close to Casey may indicate stress caused by contaminants entering the nearshore marine ecosystem. University of New South Wales PhD students, Nicole Hill and Graeme Clarke, continued research, begun in 2005-06, on communities of marine invertebrates living on small boulders, recruitment tiles and sediment trays. Characterisation of the invertebrate fauna and flora of the nearshore region of Casey, from a variety of Australian Antarctic science projects, will add to our knowledge of the biodiversity of nearshore marine habitats in Eastern Antarctica, ultimately aiding our efforts to protect this environment and manage our impacts.

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