

Australia's current and future Southern Ocean routine marine observations

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Australia's modern era of Antarctic marine ecosystem research commenced with the international BIOMASS (Biological Investigation of Marine Antarctic System and Stocks) programme in 1980. This also marked the formal start of Japan and Australia working together to study the marine biology of the region (Hosie 2004). Most of Australia's research at that time focussed on surveys on the distribution and abundance of Antarctic krill. Studies on phytoplankton, zooplankton, fish, and other trophic levels were mainly secondary to the krill research. The CCAMLR Ecosystem Monitoring Programme (C-EMP) commenced in 1984 and a long-term Adélie penguin monitoring programme was established soon after near Mawson station. The first extensive and sustainable monitoring programme, the Southern Ocean Continuous Plankton Recorder (SO-CPR) Survey, was established in 1991 (Hosie et al., 2003). The Survey objectives are to map the spatial-temporal patterns of zooplankton, and then to use the sensitivity of plankton to environmental change as early warning indicators of the health of the Southern Ocean (Hosie et al. 2003). Japan joined the survey in 1999 contributing a number of fixed transects to the SO-CPR Survey while augmenting the existing JARE observational programme (Takahashi 2006, 2010). Several more countries have joined the Survey providing information on the distribution patterns and abundances of zooplankton species for about 70% of the Southern Ocean at varying time scales, e.g. monthly, seasonally, annually (Fig. 1; McLeod et al. 2010). The highest concentration of CPR samples are south and west of Australia collected by Australia and Japan. In 2006, SCAR endorsed the Survey as an official SCAR project. The SO-CPR Survey is now a foundation component of the Global Alliance of CPR Surveys (GACS). This will allow us to assess changes in the Southern Ocean plankton at not only the local and regional level but also in a global context. Other long-term observational programmes have since been established, such as the routine physical/chemical oceanography and phytoplankton observations conducted annually between Hobart and Dumont d'Urville, now operating nearly two decades. More recently, Australia established a new national Integrated Marine Observing System (IMOS) which has a strong focus on the Southern Ocean. A new programme now being developed called Sentinel aims to understand long term changes and trends in key biological processes in the Southern Ocean and in doing so will provide early warning of climate change impacts on global marine and other ecosystems based on Southern Ocean ecosystem indicators, as well as assessments of climate change impacts in the region. One component of Sentinel is a series of north-south transects, upstream, along and downstream of the Kerguelen Plateau in the Indian Ocean sector, that will have an integrated set of marine physical, chemical and biological observations (Fig. 2; Constable 2009). All these programmes, CPR, IMOS, Sentinel, will be central components of the new SCAR-SCOR Southern Ocean Observing System (SOOS). This provides another opportunity for Japan and Australia to work together to contribute to SOOS. In support of this, the recent Japan-Australia JST-DIISR funded collaborative project has helped bring together our collective past marine data that will form the benchmark and foundation datasets to understand future trends and changes.

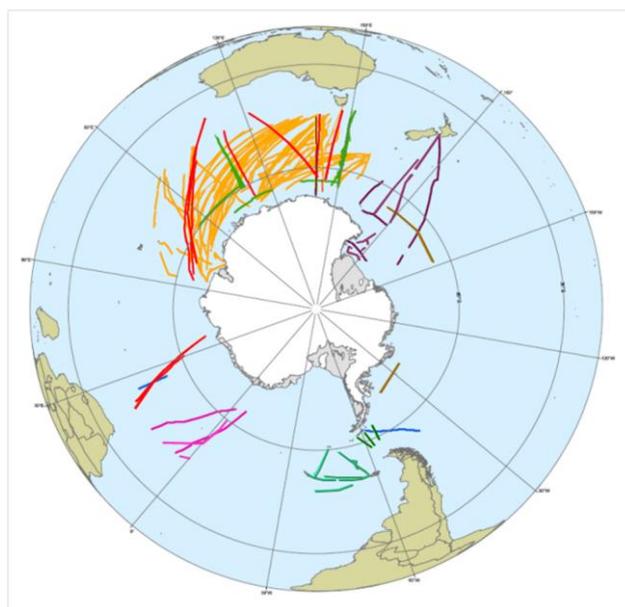


Figure 1. CPR tows conducted in the Southern Ocean since 1991.

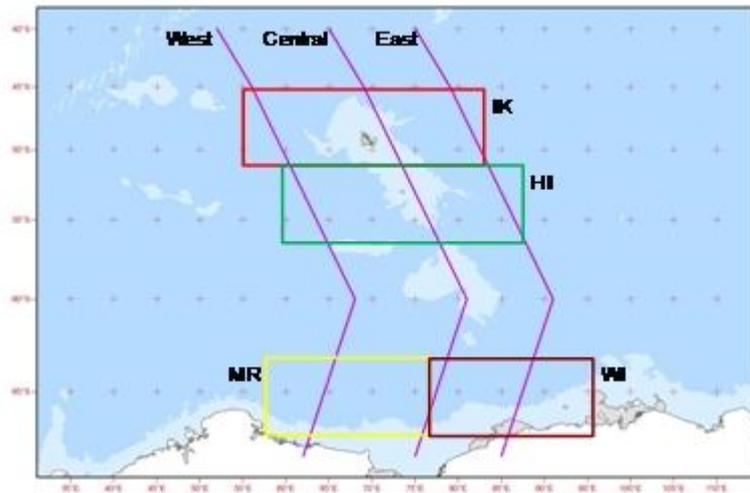


Figure 2. Proposed sampling scheme for Sentinel in the Indian Sector of the Southern Ocean, showing the integrated study areas and transects for measuring change. Lines represent transects for regular ship transects. Boxes reflect areas in which studies on ecosystem dynamics can complement regular measurements on transects – IK- Îles Kerguelen, HI - Heard Island and McDonald Islands, MR - coast off MacRobertson Land, WI - West Ice Shelf.

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