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Guest Editorial

Southern Ocean GLOBEC Research and the Future

The International Global Ocean Ecosystems Dynamics (GLOBEC) Programme will end in early 2010, after almost 20 years. GLOBEC science has provided fundamental changes in our understanding of the scales of interactions in marine ecosystems, alternative views of marine food webs, and the influence of humans in marine ecosystem processes. Since Southern Ocean GLOBEC (SO GLOBEC) was one of the regional research programmes it is appropriate to reflect on i) its specific contributions, ii) how these might guide future Southern Ocean research, and iii) the key gaps for our future understanding of Southern Ocean ecosystems and the impact that global change and human uses will have on them.

The SO GLOBEC science questions looked at habitat, prey, predators, and competitors of Antarctic krill as well as krill biology and physiology. Integrating studies of the physical environment and biological populations allowed new insights impossible to achieve with a traditional disciplinary approach. The extensive multi-disciplinary datasets and interdisciplinary models are important SO GLOBEC legacies as are the development of an international community of researchers trained in interdisciplinary science and the recognition of the importance of international cooperation. A lesson from SO GLOBEC is that central coordination, integrated data management, and a common research focus are critical underpinnings that can determine programme success. This is an important consideration for the long-term, climate-scale programmes now being planned.

The species-centric and comparative approaches that underpinned SO GLOBEC science resulted in significant advances in the understanding of Antarctic marine food webs, the physical environment, and coupling between the two (especially during the austral winter) whilst integration across diverse datasets elucidated the ecology and biology of top predators, including seabirds, penguins, and seals. Indeed the response of these to environmental and lower trophic level variability is clearly integral to understanding marine ecosystem response to climate change and future research must be designed to incorporate effects that occur throughout the food web.

The trophic level(s) that support Antarctic krill and its predators, related carbon and nutrient cycling, flux export and the effects of past and current resource exploitation were not explicitly included in SO GLOBEC research because of the intentional focus on a key species within the larger food web. Thus, potential changes in marine primary production, biogeochemical cycling, and food web modifications arising from climate and anthropogenic factors influencing higher trophic levels were not explicit in SO GLOBEC analyses. However, SO GLOBEC provided sufficient background, understanding, and data sets to allow key gaps in understanding to be identified so that future programmes can address the end-to-end operation of food webs and to provide invaluable inputs for the ongoing ecosystem based management approaches promoted by the Commission for the Conservation of Antarctic Living Marine Resources (CCAMLR).

Environmental change and increasing resource exploitation in the Southern Ocean will open new and complex research questions that will require international, coordinated, interdisciplinary studies. Already there is a need for integrated circumpolar analyses and modelling of Southern Ocean climate and ecosystem dynamics, evidenced by the new Integrating Climate and Ecosystem Dynamics (ICED) Program. And we must also develop long-term programmes as envisaged by the Southern Ocean Observing System (SOOS), for the essential time-series that will identify future trajectories for Southern Ocean ecosystems, a capability which is being developed as part of ICED in the Southern Ocean Sentinel project. The SO GLOBEC programme marks real changes in how Southern Ocean ecosystems are viewed. We must ensure that lessons from SO GLOBEC make future programmes truly integrative research - a challenging but essential approach to understand and predict future potential states for the Southern Ocean.

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