



WP 19

Agenda Item: 4.4.4

Person Responsible: R Bellerby,
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XXXIII SCAR Delegates Meeting

Auckland, New Zealand, 1-3rd September 2014

The Southern Ocean Acidification Report

Executive Summary

Title: The Southern Ocean Acidification Report

Authors: R Bellerby, M Sparrow (plus various for actual Acidification Report)

Introduction/ Background: SCAR formed an AG to write a high-profile report on Ocean Acidification in the Southern Ocean.

Important Issues or Factors: Publication of the report has been moved to 1st June 2015 to coincide with the next Antarctic Treaty Meeting.

Expected Benefits/Outcomes: This report will be the definitive report on ocean acidification in the Southern Ocean. It should be recognised that this report will have impact beyond SCAR, in particular with the Antarctic Treaty.

Budget Implications: A total of \$10,000 was approved from various different budget lines.

The Southern Ocean Acidification Report

Background

The uptake of carbon by the Southern Ocean and resulting changes in carbonate chemistry are likely to have significant consequences for biological and biogeochemical processes in the ocean. The SCAR/SCOR co-sponsored Southern Ocean Observing System (SOOS) recognizes this as one of its six overarching scientific challenges (Rintoul et al., 2012; www.soos.aq), highlighting the need for more CO₂ air-sea flux measurements as well as full water column sections to track the inventory of anthropogenic CO₂ and other properties related to acidification and changes in carbonate chemistry (see WP18).

The lowering of Ocean pH was highlighted in the original SCAR Antarctic Climate Change and the Environment (ACCE) report as well as subsequent updates (Turner et al., 2009, 2012). Recognizing that there was no group focusing specifically on the evaluation of the current understanding of ocean acidification in the southern Ocean, SCAR approved the formation of an Ocean Acidification Action Group in 2010 under the leadership of Dr Richard Bellerby, who was already leading an equivalent effort in the Arctic (AMAP, 2013).

The initial form of the action group consisted of a cross-disciplinary team of ocean acidification experts representing the fields of marine carbonate chemistry, global and regional modelling, marine ecology, marine ecology, ecotoxicology/physiology and paleoceanography. Its terms of reference were to:

- define our present understanding of the contemporary rates and future scenarios of Southern Ocean acidification;
- document ecosystem and organism responses from experimental perturbations and geological records;
- identify present and planned observational and experimental strategies;
- identify gaps in our understanding of the rates and regionality of ocean acidification;
- define strategies for future Southern ocean acidification research.

It was always recognized that production of a report focusing on the above should be performed in consultation with existing global ocean acidification efforts (e.g. SOLAS/IMBER Sub Group 3, US Ocean Carbon Biogeochemistry, ICED, the CLIVAR/CliC/SCAR Southern Ocean Observing Panel and the SOOS Steering Committee) since the main idea behind this report is consolidation and review of existing work with a focus on the Southern Ocean, as well as making recommendations for the future.

The work of the Ocean Acidification group also links strongly with several other SCAR groups, in particular:

1. Antarctic Climate Change in the 21st Century (AntClim21), which focuses on how the Antarctic environment will change over the 21st Century. To achieve this goal, AntClim21 will focus on three themes of research: (a) Quantification of Antarctic climate variability, (b) Climate model verification for the Antarctic region and (c) Antarctic climate projection to 2100 AD
2. Antarctic Thresholds - Ecosystem Resilience and Adaptation (AnT-ERA), the main goal of which is to facilitate the science required to examine changes in biological processes, from the molecular to the ecosystem level, in Antarctic and Sub- Antarctic marine, freshwater and terrestrial ecosystems. Tolerance limits as well as thresholds, resistance and resilience to environmental change will be determined.
3. State of the Antarctic Ecosystem (AntEco) aims to inform our understanding of current biodiversity and patterns therein, to distinguish the impact of present processes from historical signals, and to use this knowledge to develop scenarios of its future state through interdisciplinary approaches

The Report

The report itself was originally scheduled for publication (after review) in August 2014. However, although the majority of the report has already been drafted, because of the time commitments of various of the co-authors this has been delayed to 1st June 2015 to coincide with the next Antarctic Treaty Meeting. It should be recognised that this report will have impact beyond SCAR, in particular with the Antarctic Treaty.

The Table of Contents are:

1. Introduction
 - 1.1. The role of SCAR
 - 1.2. The Southern Ocean
 - 1.3. The science of ocean acidification
 - 1.4. Marine Carbon Dioxide chemistry and ocean acidification
2. Southern Ocean acidification
 - 2.1. Observed Changes in carbonate chemistry
 - 2.2. Recent and future ocean acidification
3. Biological responses
 - 3.1. Phytoplankton
 - 3.2. Zooplankton and mesopelagic
 - 3.3. Benthos
4. Conclusions

Delegates are asked to note progress and the revised dates for publication.