SCAR XXIX/COMNAP XVIII Workshop

Establishing a Coordinated Southern Ocean Observing System (SOOS)

SCAR XXIX/COMNAP XVIII Workshop

0900 – 1700 Saturday 15 July

CSIRO Marine Laboratories, Castray Esplanade, Battery Point, Hobart

Complied by Judy Horsburgh,

Antarctic Wildlife Unit, University of Tasmania

(with editorial comments from the participants added by Victoria Wadley)

Introduction

The importance of the Southern Ocean in global climate, and its role in climate change, is well known, and this region has become an important focus of climate and oceanographic research. The region is remote and logistically difficult to access, and national research programs use a range of methods to collect the data required to conduct Southern Ocean research. Ship-based techniques and ARGO floats are used at present, and there is increasing interest in data that can be obtained from birds and mammals that live in the region. By coordinating these data, working in cooperation with established observation systems, an observation system for the Southern Ocean could provide benefits during the International Polar Year 2007/08 and a legacy for the future.

Seals and seabirds range widely over the Southern Ocean, often visiting areas inaccessible to research vessels and ocean buoys, in particular during the winter. These animals also operate along physical features such as the continental shelf, the marginal sea-ice zone and frontal regions, areas of particular interest to oceanographers. The success of the CoML (Census of Marine Life) program TOPP (Tagging of Pacific Pelagics: http://www.toppcensus.org) has demonstrated the feasibility of a large-scale multi-species approach to investigating predators and their interactions with the marine environment. The more recent SEaOS (Southern Elephant seals as Ocean Samplers: http://biology.st-andrews.ac.uk/seaos/index.html) program has seen the maturation of sensor technology that now enables high-resolution temperature and conductivity sensors to be incorporated into satellite transmitters small enough to be carried by seals. This provides a powerful tool for investigating the fundamental relationships of predators and the physical properties of their environment, and also a means of collecting high-resolution physical oceanography data that will be an important supplement to existing data sets.

The Census of Antarctic Marine Life (CAML) is coordinating projects on top predators, as part of an integrated approach to the diversity of organisms and their environment. The potential of this approach has been recognised by the International Polar Year (IPY), which has endorsed Marine Mammal Exploration of the Oceans – Pole to Pole (MEOP) as one of its programs. Such a program would be an important adjunct to major biology and oceanographic initiatives such as CoML and the Global Ocean Observing

System (GOOS). Partnerships will be explored with the established earth observing systems, Global Earth Observation (GEO) and Global Earth Observation System of Systems (GEOSS). Establishing links to the UN Convention of Climate Change and similar bodies will be valuable.

This workshop, held as an associated meeting during SCAR XXIX/COMNAP XVIII, brought together on an opportunistic basis a group of oceanographers, biologists and engineers, to examine the feasibility of establishing a Southern Ocean Observation System (SOOS) and in particular to investigate the possibility of incorporating data collected by marine mammals and seabirds. In reference to observation systems in the other oceans of the world, the importance of sustainable and coordinated observations was emphasized.

Workshop Objectives

- Determine if there is a need for a special system for the Southern Ocean, or if it should be included in a global system.

    - Review existing systems and technology
    - Review oceanographic data sets collected by seals and seabirds
    - Review important biological questions
    - Consider what species would be suitable for on-going studies
    - Asses data-handling and compatibility issues and consider protocols for integrating data sets
    - Consider existing ocean data-sets that would benefit from such data
    - Establish a framework for on-going data collection (post-IPY)
    - Address outreach facilities to share the vision beyond the technical community

- Outline the next steps and produce a brief report highlighting the main elements for presentation to CAML to seek funding.
- Develop a general idea of what a SOOS would look like and identify a group of people who will take the process forward.

Agenda

Time	Chair	Speaker	TOPIC
9:00		**Tony Haymet**	Welcome from CSIRO and POGO, housekeeping, safety briefing
9:05	Haymet	**Michael Stoddart**	Welcome from CoML and CAML
9:10		**Colin Summerhayes**	Brief Intro: What is GOOS? Questions and Discussion
9:25		**Eberhard Fahrbach**	Status and plans for a Southern Ocean observing system for climate Questions and Discussion
9:50	Stoddart	**Martin Biuw**	Coastal and Continental margin processes Questions and Discussion
10:15		***Mitsuo Fukuchi**	Phytoplankton Questions and Discussion
10:40		**Graham Hosie**	Zooplankton, including krill and CPR Questions and Discussion
11:05			**Morning Tea**
11:25		**Phillipe Koubbi**	Coupled biological and physical mesoscale processes in modelling fish habitat
11:50	Hindell	**Colin Southwell**	Trends in seals and seabirds Questions and Discussion
12:15		***Dan Costa &** ***Mike Fedak**	Animal borne ocean sensors: an example (TOPP) and prospects for the SO Questions and Discussion
12:40		**Steve Ackley**	Towards a sea ice observing system Questions and Discussion
13:05		***Bill Kirkwood**	How can we observe what is happening under the sea ice? Questions and Discussion
13:30			**Lunch and Discussions**
14:15	Rintoul	**Peter Dexter** ***Taco de Bruin**	Brief Intro: What is JCOMM? SO integrated data base Questions and Discussion
14:40		**Discussion: Leader Steve Rintoul**	Where to from here? Part 1
15:25			**Quick Tea and Coffee and back to work**
15:40		**Discussion: Leader Mark Hindell**	Where to from here? Part 2 & Communicating our thoughts
16:30		**Tony Haymet**	Wrap up and thank you

List of participants:

This list includes names and email addresses of people who registered for the SOOS workshop. It includes perhaps 4-5 names of people who registered but did not attend. Other names were taken from those who expressed an interest in being informed of outcomes. Some were from name tags handed in and made up on the morning of the workshop. Probably there will be some names missing from this list.

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Introductory Presentations:

The morning and early afternoon consisted of a series of summaries from each discipline that may be involved in a SOOS. The group acknowledged at the outset that it

was not completely inclusive and that many people who could potentially be involved were not present, having not attended the preceding SCAR meeting.

All of the speakers have allowed there presentations to be used in this report and these are available as an electronic appendix.

Eberhard Fahrbach	Status and plans for a Southern Ocean Observing System for climate
Colin Summerhayes	The GOOS (Global Ocean Observing System) and the Southern Ocean
Martin Biuw	A circumpolar snapshot of the Southern Ocean by animal-borne sensors
Graham Hosie	Continuous Plankton Records (CPR) Survey: A Southern Ocean Monitoring System
Simon Wright	Use of regularly migrating non-biological platforms as vehicles for spatio-temporal sampling of Southern Ocean systems
Phillipe Koubbi	Coupled biological and physical mesoscale processes in modeling fish habitat
Mike Fedak	Marine mammals as oceanographic samplers
Dan Costa	Tagging Of Pacific Pelagics. An 'organismal-eye' view of the North Pacific: Tagging 23 TOP predators simultaneously
Kit Kovacs	Marine Mammal Exploration of the Oceans – Pole to Pole (MEOP)
Colin Southwell	The CCAMLR Ecosystem Monitoring Program: Some observations
Steve Ackley	Antarctic sea ice thickness and mass balance: Present state of knowledge and plans for IPY and beyond
Bill Kirkwood	How can we observe what is happening under the sea ice
Peter Dexter	JCOMM. The Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology: Coordinating

	Operational Oceanography and Marine Meteorology Globally
Taco de Bruin	An integrated Southern Ocean database from the data manager's viewpoint

Summary of discussion

The remainder of the afternoon was devoted to open discussion, led by Steve Rintoul and Mark Hindell. This has been briefly summarized below.

The need for a SOOS: special features of the Southern Ocean

It was established at the outset of the discussion that all present were in favour of developing a SOOS. The need for a region specific approach was discussed. The Southern Ocean is part of the global climate system but the Polar Regions are more sensitive to climate change. A SOOS is potentially the 'canary' for global climate change. The Southern Ocean ecosystem is also unique with krill as a key element in the food web. Southern Ocean plankton are major producers of oxygen and key carbon sinks.

Integrate existing systems

Opportunities exist for extending cooperation between oceanographers and biologists, and to integrate existing systems into a SOOS. The SCAR/SCOR Expert Group on the Southern Ocean is one existing body prepared to help with establishing a SOOS. This group is an ideal platform to ensure that the flow between observations and the system is sustainable, and the needs clearly defined. It is not an exclusive group and is open to input from all areas.

The ICED (Integrated Analyses of Circumpolar Climate Interactions and Ecosystem Dynamics in the Southern Ocean) program members have been working on a science implementation plan and experience gained during this process may be useful for SOOS.

There are also many efforts operating outside the Southern Ocean with experience that would be helpful in setting up an SOOS. For example, in the US there are the Ocean Research Interactive Observatory Networks (ORION) and the Integrated Ocean Observing System (IOOS). These are sustained research observatories with a core fundamental component that individuals can 'piggy back' on.

Arctic models could be used for predator monitoring. The Arctic Climate Impact Assessment has generated a monitoring system, the Barents Sea Monitoring Plan. The

IWC has a long record of whale numbers and the biomass recovery is a model that could be used in a Southern Ocean monitoring system.

Links to IPY goals

One of the main goals of the IPY is to develop observing systems in both the Arctic and Antarctic. Another focus of IPY is data sharing. The SCAR-Marine Biodiversity Information Network (SCAR-MarBIN) Webportal aligns with the Antarctic Treaty and IPY data policy protocols. It would be difficult to deliver on these protocols without an SOOS. However, IPY has only a two year timeframe, and while it will be central in establishing observing systems, on-going coordination and commitment is required for a successful SOOS.

Ship-based surveys

There is a large amount of important data being generated from ship-based sampling in the Southern Ocean and much of this is not being made available on a broad scale at present. As part of an SOOS it would be important that all parties make their data available. The observational data from these vessels may not be sustained but all data can be assimilated in to models, even ad hoc data are useful for this.

The role of animal-borne oceanographic sensors

Animal tagging will be both an observational and an operational system. The potential for this approach to provide operational oceanographic information from regions of the Southern Ocean inaccessible to ships and ARGO floats, particularly during the winter months. Presentations from the morning session illustrated how data from SEaOS have already been used in this way. Broadening this approach to include other species, and other sensors (such as PAR radiation) was supported by all present.

Monitoring predator populations

The role of the CCAMLR Ecosystem Monitoring Program (CEMP) was also discussed. Using easily monitored predators to indicate changes in distribution and abundance of marine resources has been the focus of this program, and a SOOS could benefit from incorporating this work. Physics and biology can't be separated; a change in habitat use reflects a change in environment and is important to all disciplines.

The questions SOOS should answer: what SOOS should 'look like'

One approach to developing a SOOS is to ask "what are the questions SOOS can answer that can't be answered in any other way". Design and implementation should be considered in parallel, taking into account what is needed and what is already in place. We should also consider what questions may need to be asked in the future, and attempt to establish what observations may be needed to answer these questions.

Expanded coverage of the Southern Ocean, especially during the winter months, is essential. Based on the success of the ARGO and SeaOS programs, this is a realistic goal. Regional input would also be important for SOOS.

In discussion, the concept was put forward that SOOS should address, at least in part, applications relevant to specific users/user groups, as a means of developing advocacy and support for long-term sustainability. The Antarctic Treaty Consultative Meeting (ATCM, see http://www.atcm2006.gov.uk), the Conference of the Parties, Convention on Biodiversity (COP, see http://www.biodiv.org/convention/cops.asp) and the United Nations Framework Convention on Climate Change (UNFCCC, see http://unfccc.int/2860.php) were specifically mentioned.

It is important to consider what SOOS would look after a number of years. Consider the legacy and what dividends would ensue from the establishment of the system. Sustainable activities relate to the IPY mission statement and this should be an element of the design.

Data-handling

Existing systems should be used as much as possible. We already have the structure of the World Ocean Database Project (WOD) within the World Data Centres (WDC). Individual researchers add value by feeding data into these databases but many are reluctant to invest the time and effort. There is a greater recognized need for ongoing data pooling in the Arctic because of the importance to user communities. The user community in the Southern Ocean is small and there is little impetus for ongoing funding that goes beyond a single research project. We need to identify user communities that will provide pressure to pool data.

Moving forward

A three-day workshop in about twelve months time is a logical next step. It should encompass a bigger, more inclusive group, perhaps with CoML's input. There is a lot of preliminary work needed before we proceed to a workshop and the preparation of a number of white papers arising from the current workshop would be a good intermediate step. It may also be useful for smaller subgroups to meet at more specific sub disciplinary meetings initially and then to interface with the larger effort. It would also be useful to go to the wider community for input, perhaps via a website.

Conclusions

- The establishment of a SOOS is timely and likely to be of great value across all the disciplines represented at the workshop. The northern edge of the subtropical front should be used as the northern border of the Southern Ocean; the CCAMLR boundaries are too small.

- We need to go beyond individual needs and look at collective needs. Perhaps in defining priorities it is not so much the needs of each sub-group that should be considered first, but what needs the sub-groups have in common. This can then be built on.

- In all areas (data collection, handling and sharing) existing systems should be used as much as possible.

- This is an opportunity to put things in to a broader context. SOOS is a means to justify proposals and get support.

- We need to consider what SOOS would look like in a couple of years. Look at it as a legacy and what dividends would ensue from the establishment of the system. Sustainable activities relate to the IPY mission statement and this should be an element of the design.

- The system should provide a base network that can be built on in the future. If the system is designed to provide a base that can be built on, and this is done

well, output may be fed in from areas that were not originally designed to feed into a particular part of the system.

Next steps

- Work towards a workshop in the next twelve months or so. Identify possible timing and venues, probably associated with another meeting. Antarctic Treaty Parties will be most interested in a SOOS so it makes sense to present the plan at an Antarctic Treaty Consultative Meeting, or perhaps through the Global Climate Ocean Observing System (GCOS) to the UN Framework Convention on Climate Change (COP/UNFCCC). This will be done in conjunction with Global Earth Observations (GEO) and Global Earth Observations System of Systems (GEOSS).

- It may be useful for smaller subgroups to meet at more specific sub disciplinary meetings initially and then to interface with the larger effort.

- We should make early contact with GEO, GEOSS and the GOOS steering committee and get support from the Intergovernmental Oceanographic Commission (IOC).

For the next meeting:

- Prepare a background document outlining what we have now (summaries of the talks from this meeting), what is missing, and what is needed to fill the gaps

- Prepare a series of white papers (Max 5-6 pages plus figures):
    - Climate and Ecosystems (including plankton, fisheries and large predators)
    - Physical Climate – CLIVAR/CliC
    - Animal-borne sensors
    - Biogeochemistry and the carbon cycle
    - Under ice and ice issues

Organising Committee for the next SOOS workshop: Dan Costa, Peter Dexter, Eberhard Fahrbach, Julie Hall, Tony Haymet (Convenor), Mark Hindell, Graham Hosie, Steve Rintoul, Colin Summerhayes, Michael Stoddart (Convenor), Victoria Wadley.

Tentative timing for the next SOOS Workshop – the possibilities included :

1. In December 2006; Dan Costa suggested in conjunction with a session that the biologger group is organizing at the American Geophysical Union 2006 AGU Fall Meeting, 11-15 December 2006, to be held in San Francisco, CA. The deadline for abstract submissions is 7 September 2006. For more information, visit www.agu.org/meetings/fm06/

2. In the northern Spring; Peter Dexter suggested in conjunction with the next GOOS scientific steering committee meeting in March 2007. This is now unlikely as the GSSC will be in Korea and they already have a science symposium planned in association.

3. With the SCAR Oceanography Group, probably October 2007; suggested by Colin Summerhayes. Julie Hall and other workshop participants are on the SCAR/SCOR group addressing issues including the SOOS.

4. In conjunction with POGO meeting January 2007 in Qingdao; suggested by Tony Haymet.

After the Workshop, news articles were posted on the CAML website www.caml.aq and the POGO website www.ocean-partners.org All participants agreed at the meeting that their presentations could be made freely available on the web. The convenors decided that the full report of the meeting should be posted on the CAML website, together with the link to the presentations from the meeting.

The scientific community present at the Workshop voiced a strong consensus of opinion that developing an observation system for the Southern Ocean is worthwhile. This initial discussion advanced significantly towards why a SOOS is needed and what would be included. The group stopped short of addressing the structure required – this was understood to require a further meeting. In particular, the

assembled group was not representative of all the disciplines and organizations that would be interested in setting up a SOOS.

The results of the Workshop and the recommendations were compiled by the participants. There is no Secretariat or dedicated resource to carry the work forward. Various ways of providing this need were discussed at the Workshop. The Organising Committee for the next SOOS Workshop will address the administrative function.