Census of Antarctic Marine Life (CAML)

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The CAML project is directed by a Scientific Steering Committee of ten international scientists (see www.caml.aq at Contacts) as appointed by SCAR.

http://www.caml.aq

1. LONG-TERM GOALS

The Census of Antarctic Marine Life (CAML) is an ambitious 5-year project that will focus the attention of the public on the ice-bound oceans surrounding Antarctica during the International Polar Year (IPY) in 2007/08. Its goal is to study the evolution of life in Antarctic waters, to determine how this has influenced the diversity of the present biota, and to use these observations to predict how it might respond to future change. The project will integrate knowledge across all regions, biomes, habitats and fields of study to strengthen our knowledge of ecosystem dynamics in this high latitude, frozen ocean system. Only through a multi-scale level of investigation will a better understanding of the diversity and status of Antarctica's marine life be obtained.

2. OBJECTIVES

The CAML supports studies investigating the spectrum of biological complexity ranging at the molecular level from genes and genomes, to species and populations. These are nested in a framework of communities and ecosystems, with a common goal of better understanding Antarctic marine life and the attributes of marine organisms that inhabit the Southern Ocean - perhaps the most distinctive ocean system on Earth. A central activity of the CAML will occur during the IPY, in which a large-scale international effort will be mounted to sample different regions of the Antarctic marine environment synoptically. In addition, CAML is establishing an international network of Antarctic marine scientists linking information through SCAR-MarBIN as the regional, Antarctic node of OBIS. This will provide a centralized data and metadata resource for Antarctic marine diversity studies, ranging from viruses to whales. Strong links with ArcOD ensure a bipolar approach to ice-ocean biodiversity.

The objectives are as follows:

- To undertake a species inventory of the Antarctic slopes and abyssal plains
- Undertake an inventory of benthic fauna under disintegrating ice shelves
- Undertake an inventory of plankton, nekton and sea ice-associated biota at all levels of biological organization from viruses to vertebrates
- To assess the critical habitats for Antarctic top predators
- To develop a sustainable network of interoperable databases for all Antarctic biodiversity data (SCAR-Marine Biodiversity Information Network) integrated in OBIS.

3. APPROACH

Implementation of such a breadth of study over such a large area necessitates the cooperation of the National Antarctic programs. The forthcoming IPY provides an essential platform for wide-scale logistical cooperation between nations; over twelve have already committed ship-time for the CAML. Coordination of CAML, coincidental with the IPY, provides the means to significantly advance our understanding of the evolution and biology of this vast and fascinating region of the Earth.

In order to achieve CAML's objectives, a number of field-based activities have been designed to together form a robust census. Both field-based and laboratory activities are required to answer the key questions surrounding Antarctic marine biological diversity.

Following acceptance in June 2005 by CAML's Scientific Steering Committee of this broad-scale scientific plan, the Science Statement was posted on the website. Detailed planning sessions have been held, with input from a wide range of scientists and with the operators of Antarctic research vessels. These discussions have gone hand-in-hand with the development of data management protocols, sampling protocols, coordination arrangements for samples from several vessels to be subject to taxonomic analysis, final publication, and public outreach. The main aspects of this approach are to develop strategies for the following:

- Data management – with SCAR-MarBIN and OBIS
- CAML and IPY observatory sites for the future
- Uniform sampling technologies
- Pelagic community sampling
- Protocols for investigating top predators and coordinating with the CoML TOPP project
- Sample handling/storage/locations of samples for future reference
- Relationships with other SCAR and CoML programs
- Taxonomic analyses

4. WORK COMPLETED

The CAML Project Manager, Dr Victoria Wadley, appointed in April 2005, coordinates CAML activities. Office headquarters for CAML have been provided in Hobart, Tasmania at the Australian Government Antarctic Division. After two years of startup funding for the Antarctic data portal SCAR-MarBIN from CAML/SCAR, the Belgian Biodiversity Platform has provided funding for a further four years. The Belgian Museum in Brussels provides office facilities for SCAR-MarBIN.

The CAML Scientific Steering Committee (see list on website) and 10 invited experts met in Bremerhaven from 6-8 June 2006, to discuss the implementation of CAML's science plan. For each of the Antarctic biomes (eg. Pelagic zone) a Working Group and a leader was appointed. Development of uniform protocols for sampling each biome (available from the website) has facilitated negotiations with National Antarctic Programs regarding ship availability, supporting a full range of desired scientific activities.

The CAML project has been promoted by presentations and sponsored workshops at the following forums in 2006:
February: Cephalopod International Advisory Council, Hobart, Australia
March: CAML Antarctic Microbe Workshop at Polar Microbe Symposium, Innsbruck, Austria
April: International Antarctic Tourist Operators Conference, Washington D.C. USA
May: CoML Barcoding Workshop, Amsterdam, Netherlands
June: SCAR-MarBIN Workshop, Bremerhaven, Germany;
June: Antarctic Treaty Meeting, Edinburgh, UK
July: SCAR XXIX/COMNAP XVIII Hobart, Australia (970 delegates);
July: CAML Colonisation and Dispersal Workshop;
July: Workshop to examine the feasibility of a Southern Ocean Observation System convened jointly by CAML/Partnership for Observation of the Global Oceans (POGO);
July: Deepsea Biology Symposium, Southampton, UK
August: I CAML-OLA Concepcion, Chile
August: Australian Society of Fish Biology, Hobart, Australia
October: CAML Top Predators Mini-Workshop, Itabashi, near Tokyo, Japan.

A number of proposals for CAML studies during the IPY have been submitted. Two proposals were funded by the German national program: Benthic Communities beneath the Larsen A+B Iceshelves and ANDEEP-SYSTCO. An Australia/France collaborative proposal was approved by the Australian Science Advisory Committee for 50 days' ship time on R V Aurora Australis in 2007/08. The BIOFLAME voyage of James Clark Ross in 2008 has been confirmed by the British Antarctic Survey as a CAML collaboration. Other nations, including New Zealand, are close to commitments of ship time for CAML in IPY. CAML was selected by the IPY Joint Committee as a lead proposal in the Marine Biodiversity cluster. To date, 24 projects have been gathered under the CAML banner. Proposals for CAML research to national funding bodies have been approved or are currently under consideration.

A major initiative was launched in South America, the consortium I OLA CAML. The initial meeting in Concepcion, Chile in August 2006 achieved significant collaboration among South American nations that have Antarctic programs. To sustain the effort, CAML has appointed a coordinator based in Rio de Janiero, Brazil.

5. WORK PLANNED

In June, 2007 the CAML Scientific Steering Committee will meet in Bialowiezha, Poland to ensure that planning for the scientific work is on schedule. It will assess progress with the migration of data from the Zoological Institute in St Petersburg to SCAR-MarBIN. As usual, the SSC meeting will be held back-to-back with the SCAR-MarBIN Workshop, this time with a day of overlap to facilitate data synthesis. On the first voyage dedicated entirely to CAML in December 2006, CAML scientists on *Polarstern* will test the sample-tracking database, sampling protocols, interactive web-based ship schedule and real-time

media reporting. The Scientific Steering Committee will ensure the availability of specialised equipment and other practical matters, including the nomination and briefing of a coordinating scientist on each ship. During 2007 negotiations will be held with a number of national museums around the world to hold and curate the samples collected during CAML.

In July 2006, SCAR submitted a CAML renewal proposal to the Sloan Foundation for continuation of funding. Comments were submitted in response to comments from five reviewers. The review was helpful to the CAML SSC in planning activities and synthesis to 2010.

6. RESULTS

CAML is amongst the newest CoML projects, having started in early 2005. As such, the project is in the planning stage and the results are yet to be delivered. To date, CAML has coordinated international experts on Antarctic biodiversity and promoted its objectives to a wide audience of scientists. Planning for the field projects and ships is well underway. The combined knowledge of CAML scientists is currently addressing the immediate challenge of aligning the science and infrastructure, to meet critical deadlines in preparation for the 2007/08 field season for IPY. The results will depend largely on the success of this planning stage of the project.

The Antarctic regional node of OBIS, SCAR-MarBIN, has made significant progress during 2006. SCAR-MarBIN adheres closely to OBIS standards, using tools already accessible at OBIS. Modelling, integration and visualization tools have been installed, to facilitate collaboration with other CoML projects.

Several important initiatives on Antarctic marine biodiversity information have been added independently in the last year, in particular the BAS SOMBASE (Southern Ocean Mollusc database); the NZ BioRoss database (Biodiversity of the Ross Sea) and the Belgian-French BIANZO databases. On the other hand, world-wide species databases – including Antarctic species - have been built already for several important marine taxa (e.g. FishBase, AlgaeBase, Hexacorallia, CephBase etc). SCAR-MarBIN is the first step attempt to co-ordinate such efforts by networking these databases and the biodiversity records made available by many national Antarctic data centres, providing a single and easy access to the marine biodiversity information and to maximize the exploitation of these resources.

Since its inception in late October 2005 SCAR-MarBIN's website **(**www.scarmarbin.be**)** has received 145,000+ hits from 8,600+ visitors. It has over 5,400 species in its Register of Antarctic Marine Species (RAMS) – mainly macro and meiobenthos; over 130,000 distribution records; and more than 8,000 locations in its Gazetteer. Data are being provided by 16 providers.

Its portal contains general information, RAMS, distribution data, mapping tools, a browseable/searchable Antarctic Maritime Gazetteer, a forum, downloads, photo gallery, news, help section, events, feedback, thematic links and an Education, Outreach and Communication section. The RAMS is expected to be fully operable in March 2007

7. IMPACT AND APPLICATIONS

a. Ocean Observing Systems

CAML will provide legacy sites for future generations of Antarctic researchers. The Scientific Steering Committee has already identified a long time-series of samples from the sea floor of Admiralty Bay, King George Island, Antarctic Peninsula with the possibility to resample the same sites during the IPY through international cooperation between Brazil and Peru. An evolutionary study of the Cenozoic bryozoans in Antarctica will integrate the past, present and future biota in relation to climate change.

In July 2006, a Workshop to examine the feasibility of a Southern Ocean Observation System (SOOS) was convened jointly by CAML and the Partnership for Observation of the Global Oceans (POGO). The one-day meeting brought consensus from the assembled scientific community that a SOOS is needed. A Workshop is planned to develop a framework for a SOOS and to invite selected experts in relevant fields to ensure adequate coverage of the many disciplines. A report of the Workshop is on the website www.caml.aq.

Data exchange with scientists from other disciplines was discussed during the SCAR Open Science Conference in Hobart, Tasmania. SCAR-MarBIN coordinator agreed with SCAR-SSG-GS Chair (Dr Steffen Vogt) and with members of the Joint Committee on Antarctic Data Management (JCADM) on standards and best practices in data exchange in order to be able to use oceanographic/geographic data for biodiversity modelling purposes. SCAR-MarBIN already complies with these standards, making biodiversity data useable for scientists from other disciplines.

b. Marine Ecosystem-based Resource Management

In collaboration with the Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR), CAML is promoting studies that further the ecosystem-based management of Antarctic resources. To date, this includes CAML links with two proposals submitted for IPY.

SCAR-MarBIN, CCAMLR and the Committee for Environmental Protection have started communication and agreed that SCAR-MarBIN serving raw data will be an essential tool in the design of any future Marine Protected Areas (MPAs) in the Southern Ocean. This means that CCAMLR and SCAR-MarBIN will need to exchange data openly.

c. Capacity Building and Training

To encourage young scientists to participate, CAML has invited broad participation by presentations at conferences during 2006. Two young scientists were sponsored to present CAML “Demonstration projects” at SCAR XXIX/COMNAP XVIII in Hobart, Australia in July 2006. An initiative has been discussed for a CAML scholarship, to build skills for future research. This would develop a range of techniques including DNA barcoding, to solve problems of evolution of Antarctic organisms.

Funds are set aside in CAML’s budget for assisting young scientists to join research vessels for field studies, in line with the objectives of CoML and IPY. The CAML Scientific Steering Committee includes young scientists who are aware of the capacity building challenges and potential.

8. GEOGRAPHIC EXPANSION

Field studies for the CAML project are located in the waters around Antarctica – including the Southern Ocean and waters south of the polar front. In the sense that the Southern Ocean drives the "ocean conveyor belt" of the global overturning circulation, Antarctic biodiversity studies are inherently global in their approach. Initiatives such as collaboration with TOPP will extend the geographic scope of the project. The uniform sampling protocols developed by CAML may be applicable in other locations.

Spin Off Project Name	Principal Investigator	Geographic Locale
MEOP Marine Mammal Exploration of the Oceans Pole to Pole	Kit Kovacs Mike Fedak Dan Costa	Southern Ocean (through SOOS collaboration)
CeDAMar	Brigitte Hilbig	Deep-Sea Biodiversity
ANDEEP/SYSTCO	Angelika Brandt	Antarctic deep sea biodiversity

9. RELATED EFFORTS

a. Links to Other CoML Projects

Project Name	Cross-Over Person(s)	Nature of Relationship
ArcOD	Dr Russell Hopcroft Dr Rolf Gradinger Dr Bodil Bluhm	Polar biodiversity comparisons during IPY
CeDAMar	Dr Brigitte Ebbe	Deep-Sea Biodiversity
ChEss	Dr Paul Tyler	Deep-water chemosynthetic ecosystems, Antarctic processes
COMARGE	Myriam Sibuet	Potential collaboration on Antarctic continental margin
NAGISA	Robin Rigby	Nearshore transect in Antarctica
TOPP	Dr Dan Costa	Bio-logging by marine vertebrates in Antarctic habitat
OBIS	Dr Bruno Danis	SCAR-MarBIN regional node
University of Rhode Island	Ms Sara Hickox Ms Darlene Crew Trist	Education and Outreach

b. Partnerships

Organization Name	Point-of-Contact	Nature of Relationship
Australian Government Antarctic Division	Professor Michael Stoddart	CAML headquarters
CCAMLR	Dr Denzil Miller	Antarctic living resources
COMNAP	Professor José Retamales	Antarctic logistics
Cousteau Society	Dr Tarik Chekchak	Education and Outreach
Belgian Biodiversity Platform	Dr Claude DeBroyer	Biodiversity informatics

International Polar Foundation	Dr Gauthier Chapelle	Education and Outreach
International Polar Year	Dr Ian Allison	Collaboration
SCAR	Dr Colin Summerhayes	International connections, funds management

10. EDUCATION & OUTREACH

In addition to presentations and posters at scientific conferences, CAML brochures have been distributed to a variety of forums, with translations to French, German, Portuguese and Spanish.

The education and outreach plan for CAML has been drafted, following the advice of the Scientific Steering Committee, in collaboration with The Cousteau Society (Dr Tarik Chekchak) and Dr Gauthier Chapelle (International Polar Foundation).

The CAML website went live in June 2005 and was restructured in July 2006, following advice from the SSC meeting in Bremerhaven. An interactive web-based ship plan provides a list of all vessels involved with CAML during IPY, however for political reasons the prototype is currently available only in the members' secure area of the website. An ecosystem graphic that leads to images, video and text on selected species is under development.

In collaboration with URI, CAML and its E+O partners are developing a media kit for transmissions from vessels in Antarctica during IPY. The prototype will be tested on the first CAML voyage, *Polarstern* in December 2006. Dr Gauthier Chapelle will accompany this voyage and provide media material.

CAML's South American consortium OLA-CAML is coordinating the E&O for biodiversity research from the South American nations, following the inaugural meeting in August 2006.
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