

Census of Antarctic Marine Life

Firstly, could you explain what inspired the CAML initiative and outline its overall aims and objectives?

The Census of Antarctic Marine Life (CAML) was inspired by the urgent need for a robust benchmark of marine biodiversity in the waters around Antarctica, against which the effects of future climate change could be measured. Recent changes such as melting ice shelves and ocean acidification have been reported in the polar oceans, particularly in parts of the Antarctic Peninsula where the warming rate is the fastest in the world. The seasonal cycle of melting ice forms oxygen-rich 'Antarctic deep bottom water' which refreshes all the ocean basins of the planet. Changes in the circulation and biodiversity of the Southern Ocean will have global impact. The initiatives of the global Census of Marine Life (COML) and the International Polar Year (IPY) provided the impetus to act now. The CAML is a project of the Scientific Committee on Antarctic Research (SCAR).

The first set of results from the census are due to be released in October this year. What have been the most significant findings and successes thus far?

The species richness discovered has exceeded expectations, disproving the long-held paradigm that species diversity decreases from the tropics to the poles. Our Register of Antarctic Marine Species houses 15,500 different organisms, spanning 17 phyla from

microbes to whales. The glaciation cycles in Antarctica during the last 35 million years provide a natural laboratory for studying climate change. For example, CAML molecular research has shown that octopus repeatedly colonised the deep sea, riding the thermohaline circulation during periods of glacial minima.

An innovative project, the Encyclopaedia of Life, aims to develop an online encyclopaedia of 16 million species. Have you made much progress on this aspect of the programme and how long will this take to produce?

The Encyclopaedia of Life aims to produce a page for each species, including those from the ice ocean around Antarctica. We are contributing illustrated field guides and DNA signatures for the online format. Progress on this ambitious programme will continue well beyond the end of CAML in 2010.

How do you propose to estimate the number of species yet unknown to science? Surely this cannot be an informed estimate but more of a guess?

This is like asking an astronomer how many asteroids will be discovered in our solar system! Marine biologists are using innovative technology to capture and uniquely identify an ever-increasing number of species. Modern underwater imaging devices, DNA barcoding, and animal-borne sensors, in addition to classical methods,



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Dr Victoria Wadley, CAML Project Manager, outlines the urgency behind the formation of the strategy to set a marker for marine biodiversity in Antarctic waters

are giving us new insights into the diversity, distribution and abundance of marine life. In most taxonomic groups and habitats around Antarctica, the number of species has not yet reached a plateau. The final number could be orders of magnitude more than the 15,500 we have recorded to date.

CAML is producing maps to illustrate the location of particular species. This has obvious applications for marine monitoring and the effects of global change, but could this information also be used to illegally hunt marine creatures, such as whales?

The hunter knows his prey, at a scale finer than most scientific surveys. Some of our earliest information came from the sealers and whalers of the Southern Ocean. The CAML survey has stored 1.1 million records of species occurrences; these are not on a spatial or temporal scale of resolution that would assist illegal fishers.

Could you elaborate on the roles of the field projects that you have employed in your studies? Which have been the most successful in fulfilling their remits?

During the International Polar Year, CAML coordinated the biggest-ever survey of Antarctic marine biodiversity on 18 research voyages. Given the cost of fuel and running icebreakers, it is unlikely that this will ever be repeated. Daily web-postings from each voyage attracted students and the public worldwide. Media attention was focused on the field projects on collapsing ice shelves, which showed iceberg scour on the seafloor animal communities, sponges colonising the sunlit ocean once the ice had disappeared and whales moving in to feed in the newly-productive waters.

It has been predicted that commercial fishing could end by 2050 if current anthropogenic trends are not halted. Can the work of CAML help to avert this kind of global crisis?

Antarctica provides an opportunity to assess the early stages of climate change on ecosystems, away from the sources of anthropogenic input. Fishing around Antarctica is governed by the international Commission for the Conservation of Antarctic Marine Living Resources. A CAML voyage collected samples to support their declaration of the first Vulnerable Marine Ecosystem, to assist in preserving biodiversity from commercial harvest. Anthropogenic changes such as the increasing acidification of the oceans, with repercussions of reduced carbon drawdown by organisms in the Southern Ocean, are a concern for the entire ecosystem, including fishers and all humankind.

International collaboration is becoming an ever more important aspect of science. Who were the main partners to the CAML initiative and what did they attribute to your work?

SCAR worked closely with CAML, appointing the Scientific Steering Committee and administering the funding. The research programmes of each Antarctic nation contributed the voyages for the CAML survey. Over 300 scientists from 30 nations took part. A special consortium mobilised the seven nations in South America with Antarctic programmes to coordinate their biodiversity field projects for the first time. The most successful aspect has been the international collaboration in sharing data through a portal (www.scarmarbin.be) to analyse the taxonomic and spatial coverage of all the surveys.

Who have been the major financial contributors to CAML? Is there ample funding for this kind of marine census?

The coordination by CAML was funded by the Alfred P Sloan Foundation (New York) as part of the multi-million dollar Census of Marine Life. Total Foundation, Equipe Cousteau, Marie Curie Foundation and many other agencies have supported the initiative. The national Antarctic research programmes funded the voyages, sample analysis and data sharing. The cost of operating vessels in the remote, inhospitable ice ocean is far greater than for marine research elsewhere; the available funds only partly meet the requests of scientists. The urgent concerns about the effects of climate change in the Southern Ocean is slowly attracting public attention and research funding.

What are your plans for the future of CAML once the first datasets are released in October? Are there any particular areas that have been highlighted by your research that you would like to focus on?

We have taken a significant step towards documentation of Antarctic marine life. The synthesis of CAML's research results is changing our ideas about the sculpting forces of evolution that have produced the biodiversity that we see today, and we may imagine in the future. As CAML researchers process the wealth of material collected during the survey, the biogeographic patterns are becoming clearer, with an understanding of the underlying habitats and ocean currents. A Southern Ocean Observing System is proposed to provide an international, sustainable, integrated series of observations on the health of the Southern Ocean. CAML has made recommendations on the biological components for this System. Funding is being sought to implement a network of observing sites, as a legacy of the IPY and CAML.