IMOS Integrated Marine Observing System

AUSTRALIAN CONTINUOUS PLANKTON AusCPR RECORDER SURVEY

Survey Newsletter

An update from the Australian Continuous Plankton (AusCPR) Recorder Survey

Australian Continuous Plankton Recorder Survey (AusCPR)

The Australian Continuous Plankton Recorder (AusCPR) survey measures plankton communities as a guide to the health of Australia's oceans. It is part of the Ships of Opportunity (SOOP) Facility in Australia's Integrated Marine Observing System (IMOS) and is jointly operated by CSIRO Marine and Atmospheric Research (CMAR) and the Australian Antarctic Division (AAD). The aims of the survey are to:

- *map phytoplankton and zooplankton biodiversity and distribution*
- *develop the first long-term zooplankton baseline for Australian waters*
- *document plankton changes in response to climate change*
- *provide indices for fisheries management*
- *detect harmful algal blooms*
- *validate satellite remote sensing*
- *initialise and test ecosystem models*

Table of Contents

Data update	2
Australian dust storm associated with potentially pathogenic fungal "bloom"	3
New labs for Queensland team	4
Update from the Western Australia team	5
Update from the Tasmanian team	6
AusCPR linked with international 'Malaspina Expedition'	7
New CTD-F for plankton recorders	7
Southern Ocean CPR celebrates 20 years	8

A note from the AusCPR project directors…

Anthony J. Richardson (CSIRO/UQ) & Graham Hosie (AAD)

This is our second newsletter, and the 6 months since our inaugural one has flown by! Thanks Anita for continuing to put the newsletter together. We would also like to take this opportunity to congratulate our sister survey, the Southern Ocean CPR (SO-CPR) program run by Graham Hosie (AAD), on its 20th anniversary on the 12th Jan 2011 (see their article on page 8).

We have been busy since Newsletter #1 in Oct 2010. We have completed 17 tows and counted 662 plankton samples. We have continued to provide support for the CPR operations in the Southern Ocean during the 2010/2011 season. Around Australia, we have continued to tow the East Australian Current route, from Brisbane-Sydney-Melbourne and around to Adelaide in Oct 2010, Dec 2010 and Mar 2011. We have also towed from Sydney-Hobart in Nov 2010 aboard the Southern Surveyor.

More recently, we have been involved in the Spanish Malaspina voyage, towing Fremantle-Sydney-Auckland. The Malaspina expedition is circumnavigating the globe, conducting interdisciplinary research to assess the impact of global change on the oceans and its biodiversity. It is named after the Italian-born Spanish naval officer, Alejandro Malaspina, who commanded Spain's first voyage of scientific discovery in the 18th century, including research in Australia, and who died some 200 years ago. These tows in Australian and New Zealand waters will be included in the IMOS dataset. We will also be able to compare our CPR data with data from regular plankton samples taken with a 40 µm mesh net. Thank you to Carlos Duarte for inviting us to participate and thanks Frank Coman and James McLaughlin for making this a reality.

On matters of instrumentation, we are now starting to collect concomitant environmental information using a CTD-F onboard the CPR. This will be useful for relating plankton to environmental conditions, will provide some information on phytoplankton groups that we do not sample, and will also provide data for the SST component of the SOOP program. Frank Coman has written a short article on p. 7 describing what we are doing.

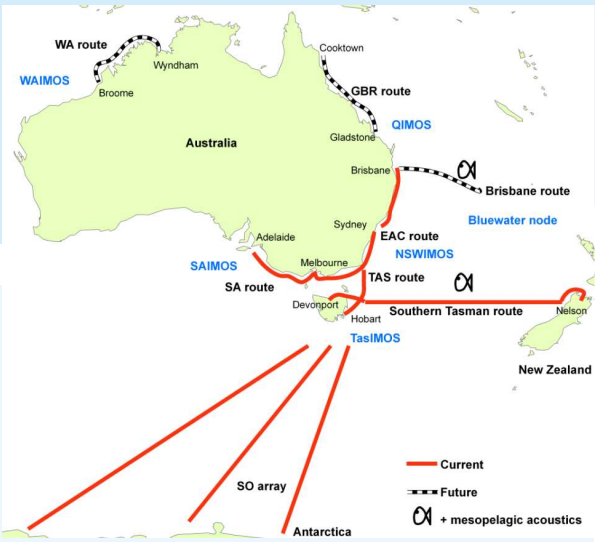
I would also like to highlight the patience of the AusCPR Team in Brisbane in working through the issues with the new laboratory at the EcoSciences Precinct. The lab was unusable for nearly 2 months because of dangerous odours. By working with OH&S staff here to rectify the situation, the AusCPR Team has ensured a safe working environment. Thanks.

Finally, we would like to highlight an upcoming AusCPR workshop. We are having a 1-day workshop at our new home in the new Ecosciences Precinct in Brisbane. In the morning, this workshop will cover how the CPR works and our taxonomic analysis, and in the afternoon we will discuss strengths and weaknesses of CPR data and potential uses and research ideas. Please let us know if you would like to attend.

Australian Government Department of Innovation, Industry, Science and Research
CSIRO
Australian Government Department of Sustainability, Environment, Water, Population and Communities Australian Antarctic Division

Plankton data update

Route	Towed since	Vessel	Frequency
Brisbane - Sydney	Jun 2009	ANL *Windarra*	2 monthly
Sydney - Melbourne	Jun 2009	ANL *Windarra*	2 monthly
Melbourne - Adelaide	Sep 2010	ANL *Windarra*	2 monthly
Tasmania - New Zealand	Aug 2010	FV *Rehua*	annual
Tasmania - Antarctica	Nov 2008	RSV *Aurora Australis*	spring to autumn
Tasmanian East Coast	Sep 2010	*Southern Surveyor*	ad hoc



Plankton data are available free of charge at http://imos.aodn.org.au/webportal/.
Visit http://imos.org.au/emii.html for information on data use.

	Total distance towed (nm)	Total tows processed	Phytoplankton colour segments processed	Phytoplankton segments processed	Zooplankton segments processed	Total phytoplankton taxa	Total zooplankton taxa
Brisbane – Sydney	4367	8	548	139	139	80	291
Sydney – Melbourne	5040	10	809	206	206	72	321
Melbourne – Adelaide	1300	1	89	22	22	30	106
Sydney – Hobart	409	1	82	20	20	19	121
Burnie – Nelson	1143	1	228	57	57	30	101
Australia – Antarctica*	9396	11	1628	1496	1628	83	169

** This is a part of 30,000 data records (150,000 nmiles) for 228 zooplankton and 83 protistan taxa available from the SO-CPR survey that has been operating for the past 20 years.*

Above: The ANL Windarra (Image: Les Blair www.marinetraffic.com).

Above: The RV Southern Surveyor (Image: Edwina Hollander, CSIRO www.scienceimage.csiro.au).

Above: The FV Rehua (Image www.action-engineering.co.nz).

Above: The RSV Aurora Australis (Image: AAD).

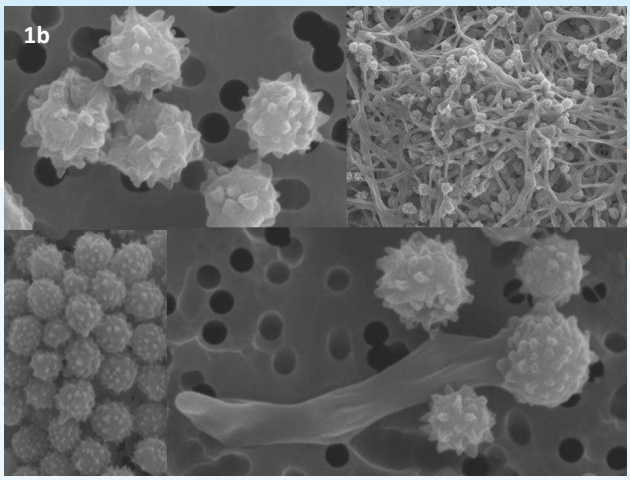
Australian dust storm associated with potentially pathogenic fungal "bloom"

Gustaaf Hallegraeff [1], Frank Coman[2], Claire Davies[2], Anita Slotwinski[2], LucyWhittock[1]; Anthony Richardson[2], David McLeod[2]

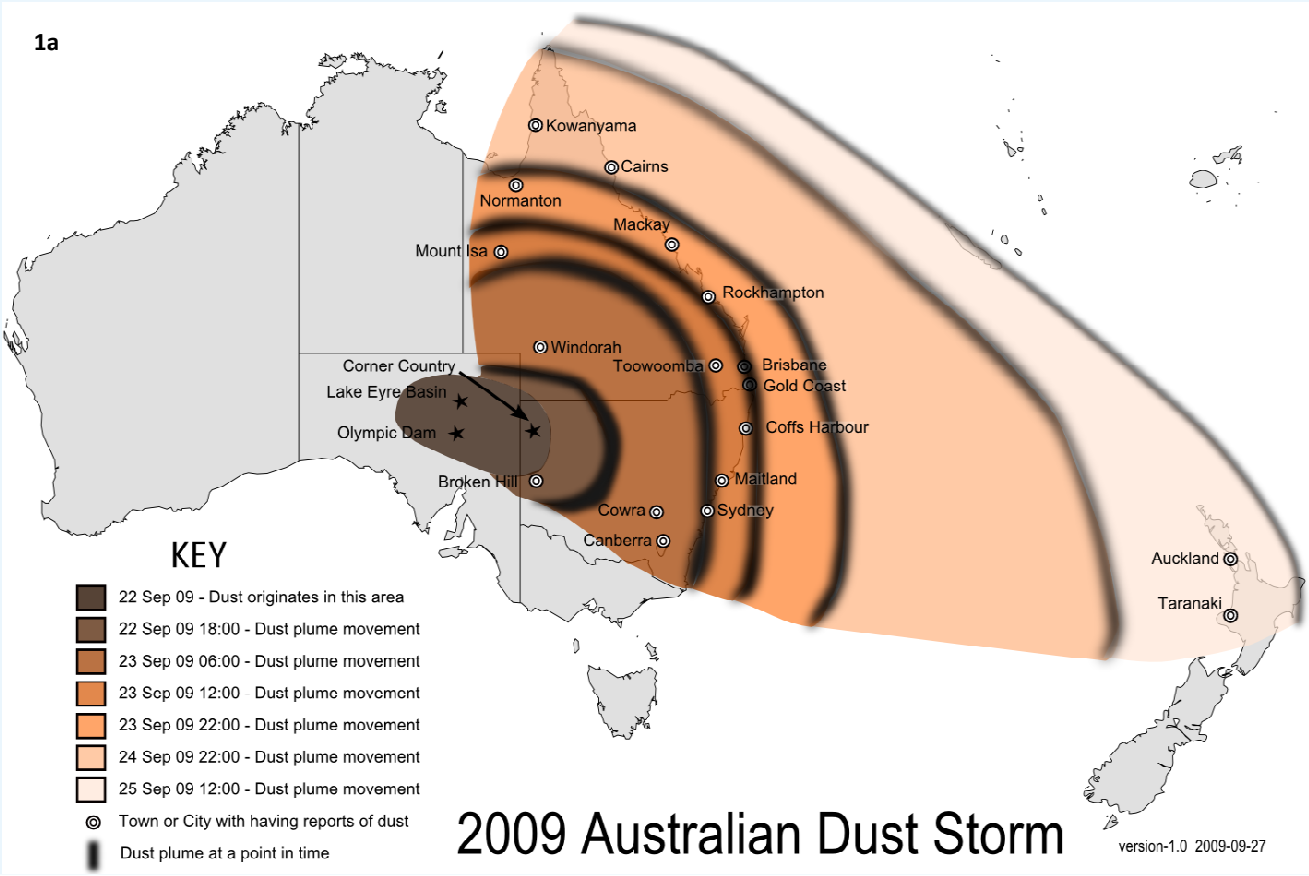
During the 3 days following 22 Sept 2009, after a severe 10 year drought, a massive dust plume originating in the Lake Eyre Basin swept eastward, reaching a width of 500km and length of 5500km before it traversed the Tasman Sea to reach New Zealand. Airports on the east coast of Australia were temporarily closed and visibility was limited to <50m in some areas. Some 16 Tg of dust was stripped from central Australia with 75,000 t/h estimated to have crossed the NSW coast.

In the wake of this dust event, we screened CPR samples for potential impacts on phytoplankton communities. Unexpectedly, we discovered massive concentrations of 5 µm diameter black spinose fungal spores in coastal samples collected between Brisbane and Sydney from 16-20 Oct 2009 (up to 150,000 spores per m^3). The formalin-preserved plankton recorder silks, which were returned to the lab within 10 days after towing, appeared black as if they were covered in oil. We know that there has not been a similar event reported by the North Atlantic CPR survey (20-60ºN, over the past 70 yrs), the Southern Ocean survey (over the past 20 yrs) or the North Pacific survey over the past decade.

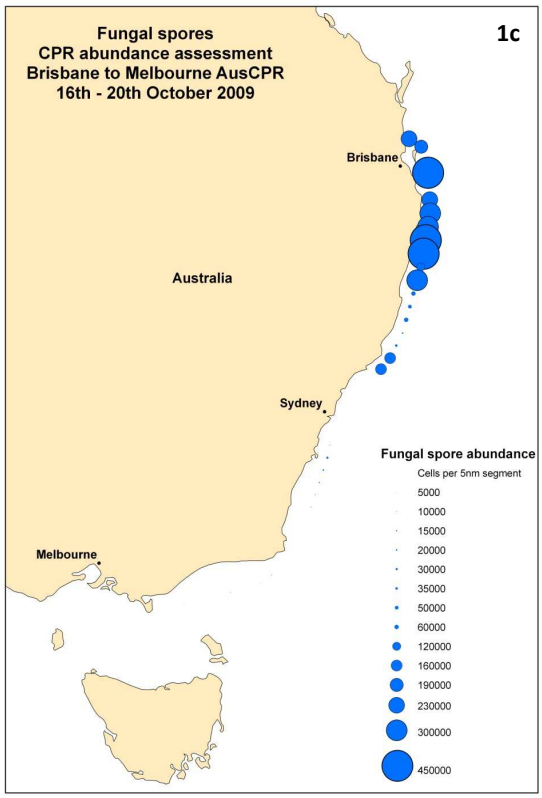
Using molecular sequencing of 3 different genes (the conservative LSU, ITS and variable beta tubulin gene) we unambiguously identified this fungus as *Aspergillus sydowii* (99-100% sequence match). We succeeded in establishing viable sporulating cultures, even from formalin preserved material and from samples kept at -20°C for several months.



In aqueous medium, fungal cultures grew better in fresh than salt water, but with spore formation occurring exclusively at the air-water interface and with only hyphens proliferating submerged in liquid medium. *A. sydowii* is believed to essentially be a terrestrial fungus, but well capable of growing in the sea. This species has previously been cultured from Caribbean air samples and then used to inoculate *Gorgonia* sea fan corals where it caused a disease termed "aspergillosis". This initial work claimed *A. sydowii* to be the main causative agent of a widespread outbreak of Caribbean sea-fan disease and increased influx of African dust was proposed as the source of coral mortality in nature. Subsequent physiological and toxicological work suggested that the strains in African dust



Australian dust storm associated with potentially pathogenic fungal "bloom" cont…



and as sea fan pathogens were distinct, hence raising the possibility that African dust was not the source of the pathogen although it still could have played a nutrient enrichment role to allow fungal pathogen proliferation. Further, in the past 5 years Caribbean sea fans have developed increased resistance to this disease. The changing parameters in the host/pathogen dynamics involved and the precise role of aeolian dust therefore are still unclear. While on the Great Barrier Reef we have not yet seen any soft coral disease outbreaks similar to those observed in the Caribbean, this very significant 2009 Australian *Aspergillus* fungal bloom and laboratory evidence of stimulation of this fungus by freshwater runoff raises similar questions. Critically, continuous plankton recorder samples have proved to be suitable for interrogation by scanning electron microscopy, molecular probes and also cultivation of fungal spores to address these questions.

Fig.1a. Extent of Sept/Oct 2009 Australian dust storm covering an area equivalent to 25 x surface of England (map from Wikipedia); **Fig.1b.** SEM. *Aspergillus sydowii* conidiospores; **Fig.1c** Abundance of fungal spores in Brisbane-Sydney coastal waters in 16-20 Oct 2009 collected on Continuous Plankton Recorder silks

1 Institute for Marine & Antarctic Studies, University of Tasmania;
2 CSIRO Marine & Atmospheric Research, Brisbane

REFERENCES

Bruno JF et al. 2003. Nutrient enrichment can increase the severity of coral diseases. *Ecology Letters* 6, 1056-1061; Geiser, DM et al. 1998. Cause of sea-fan death in the West Indies. *Nature* 394:137-138; Peterson, SW. 2008. Phylogenetic analysis of *Aspergillus* species using DNA sequences from four loci. *Mycologia* 100, 205-226; Rypien KL et al. 2008. Globally panmictic population structure in the opportunistic fungal pathogen *Aspergillus sydowii*. *Mol.Ecol.*17: 4068-4078; Smith, G.W. et al. 1996. Caribbean sea-fan mortalities. *Nature* 383: 487; Weir-Brush, JR. et al. 2004. The relationship between gorgonian coral (Cnidaria: Gorgonacea) disease and African dust storms. *Aerobiologia* 20:119-126.

QLD Plankton Team Moves to New Laboratory at Dutton Park Ecosciences Precinct

The Queensland based Plankton Team recently moved from the bayside labs at Cleveland to the new Ecosciences Precinct at Dutton Park, about 4km from Brisbane CBD. The Boggo Road Ecosciences Precinct is located on the historic Boggo Road Gaol site. The precinct houses around 1,000 staff from CSIRO and two Queensland Government agencies (the 'Department of Environment and Resource Management' and the 'Department of Employment, Economic Development and Innovation'), and consists of labs, offices, greenhouses, insecthouses, workshops and other staff support areas. This includes more than 250 CSIRO staff from six research divisions and four National Research Flagships.

Above: The new plankton laboratory space at the Ecosciences Precinct in QLD (Image:A.Slotwinski)

The plankton team are enjoying working in the new facilities, however there have also been many challenges to the move, including less lab and sample storage space, and desks that don't fare too well with vibration making microscopy slightly difficult. As with all new buildings it takes some time to get settled and to modify the project work areas.

We are, however, finding the orange and green colour schemes in the labs and offices particularly cheerful to work in. The state of the art meeting rooms, large communal kitchen areas, a variety of seating nooks and spectacular rainforest type atriums add to the pleasant working environment. The precinct is great for meeting with work friends and collaborating with colleagues from different departments and agencies.

Recent visitors to the AusCPR labs :

Tim Lynch (CSIRO)
Mark Underwood (CSIRO)
Andreas Marouchos (CSIRO)
Keith Brander (Danish Technical University)

Project update from Western Australia

Joanna Strzelecki

WA AusCPR laboratory has been fitted with two new Leica microscopes with attached camera for zooplankton and phytoplankton counts. In November, Claire Davies spent 10 days in the laboratory to provide training in CPR methodology, sample processing and data handling. We started processing samples collected during Southern Surveyor transit voyage 29 March to 7 April 2010. The plan of the voyage was to follow the Leeuwin Current as closely as possible (Fig. 1). At this time of the year the Leeuwin Current becomes stronger and is correlated with increased phytoplankton biomass.

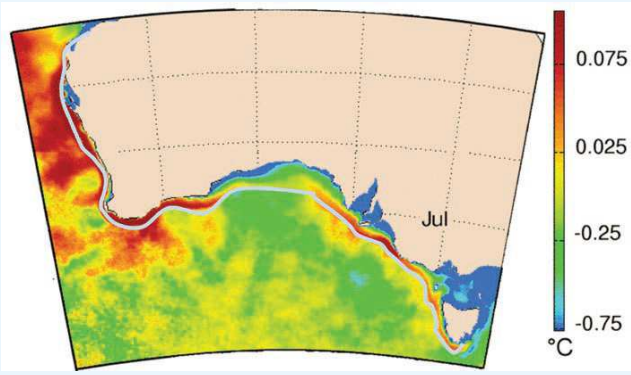


Figure. 1 Map of the SST anomaly. Grey line indicates Leeuwin Current. (http://www.marine.csiro.au/nationalfacility/voyagedocs/2010/MNF-SS01-2010_transit_plan.pdf) .

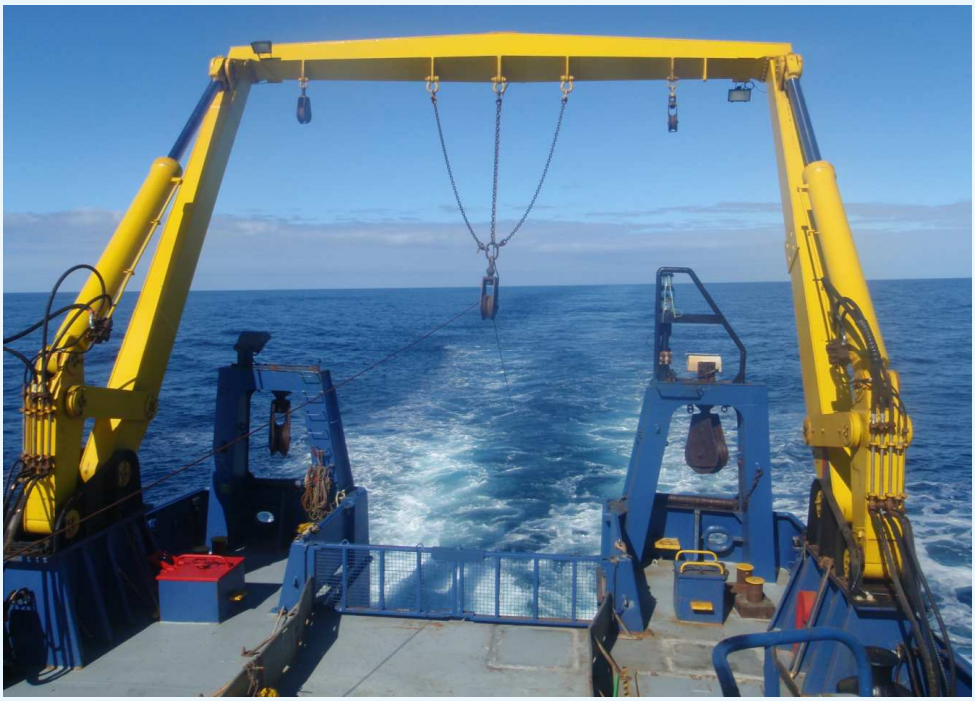
Zooplankton samples showed high diversity. Calanoid copepods of genera *Calocalanus*, *Paracalanus* and *Clausocalanus* dominated together with small cyclopoid copepods belonging to Oithonidae, Corycaeidae and Oncaeidae).

A Day of Data Discussions at the Western Australian IMOS Science and Data Uptake Workshop – Feb 2011

James McLaughlin

WAIMOS, the West Australian node of the Integrated Marine Observing System held a science and data uptake workshop on 24 February 2011. The workshop was held to raise awareness of WAIMOS and other complementary data streams, facilitate access to IMOS and other datasets (including the Australian Ocean Data Network – AODN), and increase utility, uptake and impact of IMOS data. Invitations were sent seeking participation from all sectors – university, federal and state government, consultancies and industry.

The workshop consisted of a series of short talks in the morning session covering the various data streams with AusCPR represented in the Ships of Opportunity (SOOP) facility by James McLaughlin. The afternoon session consisted of a discussion period focused on utility, uptake and use of data, with a particular emphasis on increasing collaborative multi-disciplinary use of WAIMOS data and increasing the utility of data products for a wide range of end users. On the whole, the day was well attended with representation from all sectors and highlighted the specific publically available data IMOS provides. Discussions ensued highlighted by offers to contribute data to the AODN by those not currently under the IMOS banner, possible datasets to try and have included, and ways of publicising IMOS further in WA to generate additional interest in available data.

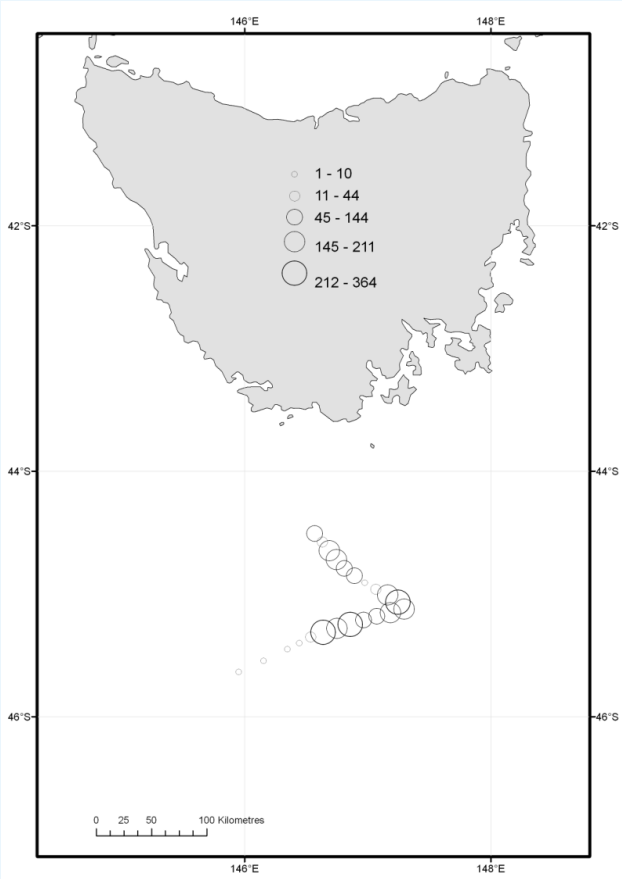


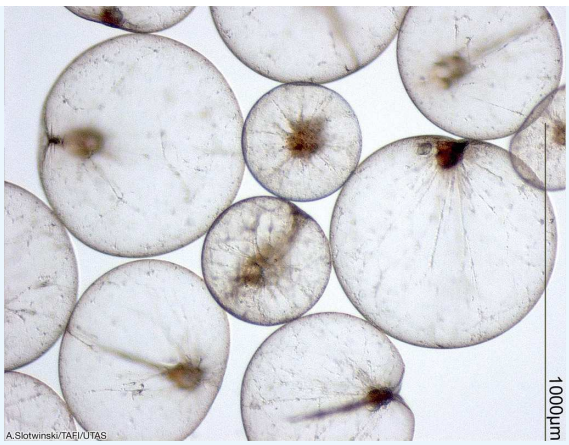
Left: Launching of the CPR from the Southern Surveyor.
Image: Dave McLeod

Project update from Tasmania

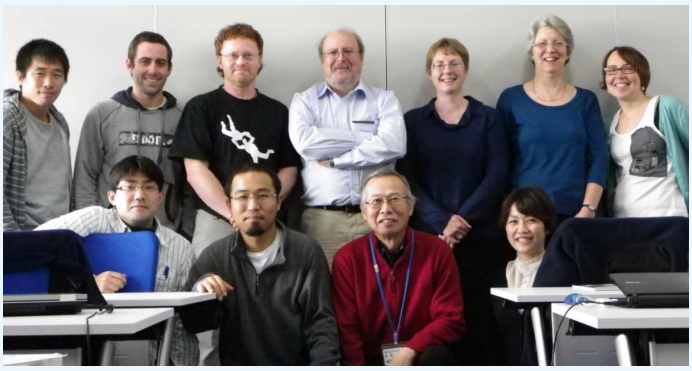
Dave McLeod

The 2010/2011 shipping season in the Southern Ocean is drawing to a close with the RSV *Aurora Australis* due to finish its work on the 1st of May. Plenty of samples have been collected since October last year and processing of samples from Voyage 1 and 2 has begun. A species of note that has been counted by AusCPR in the Southern Ocean for the first time is *Noctiluca scintillans.* This large phagotrophic dinoflagellate is thought to be predominately associated with diatom blooms in coastal waters. It is of some interest that it is being found in cool, oceanic waters well south of Tasmania in the CPR. It has long been known to occur in Australia but since the early 1990's it has begun to increase its range and also the frequency of blooms. As the rest of the seasons samples are counted we will gain further understanding of the duration and extent of this occurrence.





In November of 2010, the SCAR Southern Ocean CPR Survey (SO-CPR) conducted a Zooplankton Standards Workshop in Tokyo, Japan. The main aim of the workshop was to ensure continued taxanomic consistency amongst analysts from multiple laboratories and to discuss plans for the future. I was lucky enough to attend the workshop, along with many members of the SO-CPR Community. I found the week-long workshop to be very useful in confirming identifications of zooplankton taxa and also allowing people involved in all parts of the program to contribute to strategies for the future. AusCPR has very close links with SO-CPR which is of great benefit to both surveys as it allows exchange of information, ideas and equipment. A big thankyou must go to Kunio Takahashi and Mitsuo Fukuchi for being such wonderful hosts of the workshop, held at the National Institute of Polar Research (NIPR) in Tokyo.



Above: SO-CPR Zooplankton Standards Workshop participants, November 2010.

AusCPR contributed significantly to a paper published by the SO-CPR Survey late last year. The Zooplankton Atlas of the Southern Ocean: The SCAR SO-CPR Survey (1991-2008) is a combination of over 18 years of data published as a series of biogeographical charts. These maps document the distribution of the 50 most abundant zooplankton taxa collected by the SO-CPR survey over that period. The Atlas is being used as basis for conducting spatial modelling with the aim of predicting species distributions in areas of the Southern Ocean unable to be sampled by SO-CPR. The Atlas also serves as a ready reference for researchers interested in the distribution of zooplankton in the Southern Ocean. It is hoped that more detailed atlas' including seasonal and fine-scale distributions will be possible as sufficient data is gathered.

Top Left: Distribution of *Noctiluca scintillans* south of Tasmania represented as numbers per 5 nautical mile segment from tow 1 of Voyage 2 2010/2011..

Left: *Noctiluca scintillans* (Image: Anita Slotwinski)

AusCPR survey features in the 'Malaspina Expedition' – a modern voyage of discovery

Anita Slotwinski

The AusCPR survey has recently been a part of one of the world's largest collaborative scientific undertakings, the Spanish Malaspina Expedition. As part of the expedition, the AusCPR survey is conducting the first continuous plankton survey around southern Australia, from the Leeuwin Current off the Western Australia coast to the East Australia Current off NSW.

Above: B.I.O. Hespérides in the Indian Ocean (Image:Lucas Laursen). www.http://blogs.nature.com/news/thegreatbeyond/2011/03/malaspina_expedition.html

The Malaspina Expedition is named after a Spanish nobleman-turned-explorer and contemporary of Captain Cook. In 1792 Alessandro Malaspina visited the recently established English colony of Port Jackson (modern-day Sydney) as part of his exploration of the Pacific Ocean, one that lasted five years.

The overall aims of the Malaspina Expedition, an $A23 million Spanish Government project, are to assess the impact of climate change and pollution on the oceans and explore their biodiversity. Together two research vessels, the *Hespérides* and the *Sarmiento de Gamboa*, impressive ships run by the Spanish Navy, will sail 42,000 nautical miles during their nine-month circumnavigation.

The AusCPR survey would like to thank Carlos Duarte for the invitation to participate in the exciting expedition and the crew for all the effort in deployment. AusCPR project co-director Anthony Richardson was involved in a panel discussion on global change science and collaborations with the navy to be aired in the future on ABC radio program Background Briefing.
(http://www.abc.net.au/rn/backgroundbriefing/)

New CTD-F for AusCPR's

Frank Coman

A new CTD-F has been purchased to trial in the payload section of the continuous plankton recorders. The system is configured from an RBR 420 CTD coupled to three turner designs Cyclops-7 fluorometers (Figure 1). The three fluorometers chosen were chlorophyll *a*, phycoerythrin and a custom configuration with an excitation wavelength of 530 nm and an emission wavelength of 665 nm. This third Cyclops sensor is designed to detect diatoms. When the CTD-F was delivered it came with 2 standard mounting clamps and three custom clamps to hold the Cyclops sensors. Placing the unit in the payload area it appeared to be quite vulnerable to damage and it was decided that we would need to have a protective cage along with a support system constructed for the CTD-F (Figure 2). A slight modification was required for the two mounting clamps, as well as some modification to the tail and payload area of the CPR unit. The CTD-F can now be securely and safely placed into the payload area (Figure 3 and 4). The next step is prepare the CTD-F for logging and deploy it on a CPR tow, in the first instance we will probably use a research ship, or vessel with research staff on board so we can ensure the mounting system and protective cage afford the necessary protection for the CTD-F.

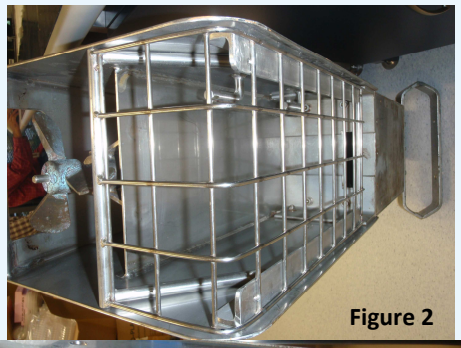


Figure 2

Figure 3

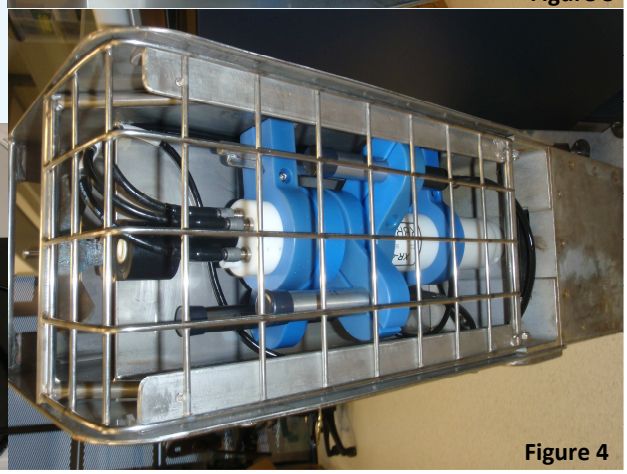


Figure 4

Figure 1

The Southern Ocean CPR Survey Celebrates 20 years

Graham Hosie

Duarte, Cebrian and Marba (1992) said that "long-term monitoring programs are, paradoxically, among the shortest projects in marine science: many are initiated but few survive a decade". It was therefore with great pleasure that we celebrated the 20th anniversary of Southern Ocean tows on 12 January 2011.

The AAD based Southern Ocean CPR Survey started in 1991 at a time when global warming was known, the effects of UV were starting to be studied and we were completely unaware of the pending problem of ocean acidification. Nonetheless, we established the CPR survey to monitor the Southern Ocean and Antarctic waters as we expected events such as global warming to have a significant effect on plankton and Antarctic krill at the base and centre of the food web, with subsequent effects on the survival of predators.

The Survey has grown to involve 14 nations which conduct Antarctic research. The Survey has subsequently helped establish new CPR surveys in Japan, New Zealand, South America and of course actively supported the establishment of the IMOS AusCPR Survey. The Survey covers about 70% of the Southern Ocean and has travelled more than 150,000 nautical miles, using 14 vessels to collect more than 30,000 samples at 5 nautical mile resolution, coupled with environmental data. Approximately 240 zooplankton species or higher taxa are routinely recorded plus another 83 protistan taxa since 2008 through the support from IMOS AusCPR.

The Survey has recently published the first Southern CPR zooplankton atlas (McLeod et al., 2010, Polar Science 4, 353-385), as well as new methods for modelling the circum-Antarctic distribution patterns of plankton such as the copepod *Oithona similis* (Pinkerton et al., 2010, Deep-Sea Research 57, 469–485). As part of the 20 year celebration a dedicated CPR session was convened at the SCAR (Scientific Committee on Antarctic Research) Open Science Conference in Buenos Aires in July 2010 to highlight the achievements of the survey. The Survey also made it to the web page of Australia's Chief Scientist (http://www.chiefscientist.gov.au/2010/12/mapping-plankton-pathways-in-the-southern-ocean/).

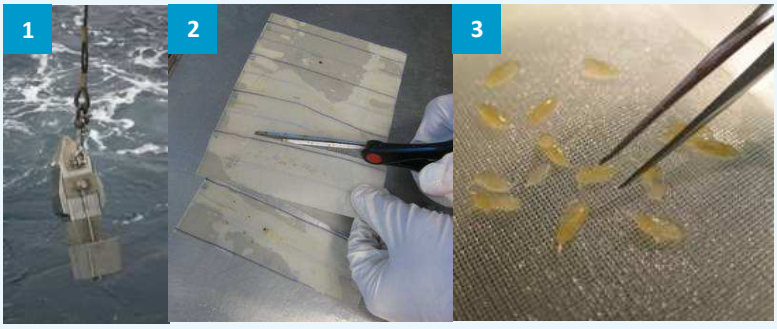
AusCPR Methodology: How do we collect data?

1. The CPR is towed 100 metres behind the ship at about 10 metres water depth. It is towed for about 400 nautical miles per 'tow' and plankton is trapped between layers of silk in an internal cassette.

2. The internal CPR cassette is returned to the lab within a few days of towing and the silk samples are unrolled and cut into segments.

3. Silk segments are analysed for phyto- and zooplankton.

If you are interested to learn more about the methodology please visit our website http://imos.org.au/auscpr.html



Note: The methods used by AusCPR are a combination of SAHFOS and SO-CPR methodology. For further information go to http://www.sahfos.ac.uk/about-us/cpr-survey/the-cpr-survey.aspx and http://data.aad.gov.au/aadc/cpr/

If you would like to join the

Friends of the AusCPR Survey

mailing list and receive newsletters and updates on research and developments please email Anita.Slotwinski@csiro.au

Contacts

AusCPR Project Leaders:

Anthony J. Richardson
Phone: +61 07 3826 7183
Anthony.Richardson@csiro.au

Graham Hosie
Phone: +61 03 6232 3364
Graham.Hosie@aad.gov.au

Visit the AusCPR website at http://imos.org.au/auscpr.html

Visit the NRS website at http://imos.org.au/anmnnrs.html

Further team contact details can be located at http://imos.org.au/australiancontinuousplanktonr6.html

Newsletter author: Anita Slotwinski

IMOS Integrated Marine Observing System

CSIRO

Australian Government
Department of Sustainability, Environment, Water, Population and Communities
Australian Antarctic Division

Australian Government
Department of Innovation, Industry, Science and Research

IMOS is supported by the Australian Government through the National Collaborative Research Infrastructure Strategy and the Super Science Initiative