



IMOS Plankton Newsletter

The Australian Continuous Plankton Recorder Survey & National Reference Stations

There has been considerable change in the Plankton Team since our last newsletter. Anita Slotwinski is back after 1 year of maternity leave with Asha. It is great to have you back for 3 days a week Anita. Welcome back!

After working with AusCPR for 5 years, Dave McLeod left the survey in July. Dave has done an outstanding job delivering data in the Southern Ocean for AusCPR. Dave was a friendly, hard-working and bright plankton analyst. We thank you Dave for your substantial contribution and wish you all the best in your new career. We will all miss you.

We also have a new staff member. Julian Uribe has joined us as a casual for one year to help us count plankton samples. Julian has extensive experience identifying plankton, especially the copepods, siphonophores, tintinnids and phytoplankton. He has worked with us previously counting flood samples from Moreton Bay.

His experience has meant that rather than the typical one-year training necessary for a new plankton analyst, he was able to start counting zooplankton samples from the National Reference Station within one week of starting. Welcome aboard Julian!

Other good news for the Plankton Team is that the positions of Anita Slotwinski and Claire Davies at CSIRO have been made indefinite. It is great that their high standards of science delivery and the need for their roles as been recognized. Thank you to Dave Brewer for his hard work that made this happen.

I would also like to mention the release of Australian Marine Zooplankton: a taxonomic guide and atlas <http://www.imas.utas.edu.au/zooplankton> at AMSA in July. This has been a successful collaboration with Kerrie Swadling (University of Tasmania). The website has downloadable species-level taxonomic sheets for 150 zooplankton species. Each sheet has taxonomic information, beautiful photographs, diagrams, distribution maps, information on the ecology and key references. We hope you find this guide useful and we welcome any feedback. You can find out more information about the guide and website in the article by Kerrie on p. X in this newsletter. I would like to take this opportunity to thank the Plankton Team including Claire Davies, Anita Slotwinski, Frank Coman, Mark Tonks, Nicole Murphy and Wayne Rochester, as well as Kerrie Swadling and Jason Beard from the UTas side, for all their hard work to make this guide a reality.

Finally, there has been some good news regarding funding. Due to the hard work of all in IMOS, particularly the Tim Moltmann and the leadership team, the Commonwealth Government has provided an additional \$25.6 million for the 2013/2014 and 2014/2015 financial year. You may remember that IMOS was going to shrink to a minimum scenario over this period, but can now look forward to greater funding, just below the typical amounts for the initial years. This is good news for IMOS and good news for AusCPR and the National Reference Stations.

Thank you for taking the time to read our newsletter.
Anthony J. Richardson

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Integrated Marine Observing System (IMOS) Plankton Data 2007 – 2013

Visit the AusCPR website at <http://www.imos.org.au/australiancontinuousplankton.html>

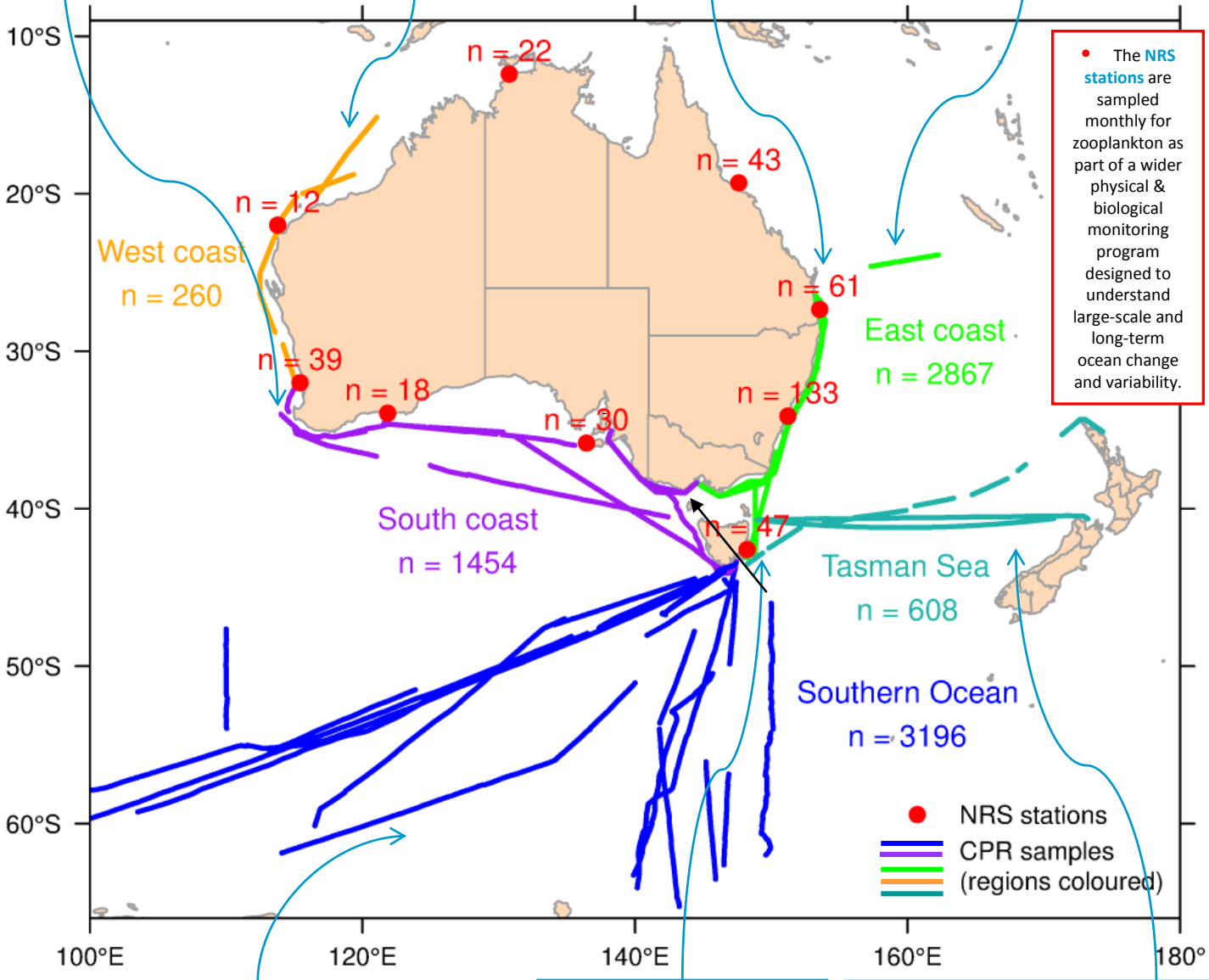
The **South Coast route** extends from Melbourne to Fremantle and is an extension of the EAC route. This route monitors the movement of warm water species southwards from the Leeuwin Current.

The new **WA route** runs between Fremantle and the Kimberly coast along the Leeuwin Current. The north-west region has potential for strong development of industries such as gas and mining.

The **EAC route** extends from Brisbane to Adelaide down the east coast of Australia and follows the southward-flowing warm-water East Australia Current. This region is forecast to warm more than anywhere else in the Southern Hemisphere this century.

The **GBR route** extends from Brisbane to Cairns. The Great Barrier Reef is an area likely to be strongly affected by warming and ocean acidification.

• The **NRS stations** are sampled monthly for zooplankton as part of a wider physical & biological monitoring program designed to understand large-scale and long-term ocean change and variability.



The **Southern Ocean routes** below Australia are conducted by the SCAR SO-CPR Survey through the AAD and NIPR Japan, with support of the AusCPR. These routes extend from just south of Australia to the sea-ice edge or the Antarctic continent. Together with the EAC route, the Southern Ocean sampling allows a almost continuous transect running between the warm tropical waters of QLD and the cold polar waters of the Antarctic.

The **TAS route** extends down the east coast of Tasmania, which is also subjected to the influence of the EAC. There is already some evidence of warm-water species moving southward.

The **Southern Tasman route** extends from Burnie, Tasmania (around latitude 40.4°S) to Nelson, New Zealand (latitude 40.7°S). This is an important area for fisheries and our survey links in with an existing mesopelagic acoustic survey.

Plankton data update

Route	Start	Ship	Freq	Dist (nm)	Tows	# PCI Samples	# Phyto samples	# Zoo Samples	Total phyto taxa	Total zoo taxa
Brisbane – Sydney	Jun 2009	ANL Windarra	2 monthly	5255	15	1045	266	266	110	415
Sydney – Melbourne	Jun 2009	ANL Windarra	2 monthly	7485	17	1497	381	373	100	393
Melbourne – Adelaide	Sep 2010	ANL Windarra	2 monthly	2840	4	568	101	86	61	226
Sydney – Hobart	Sep 2010	Southern Surveyor	ad hoc	410	1	82	20	20	19	121
Freemantle -Sydney	Mar 2011	Hespérides	annual	1185	1	237	60	60	32	192
Burnie – Nelson	Aug 2010	FV Rehua	annual	1143	1	228	57	57	30	103
Auckland–Hobart	June 2011	Southern Surveyor	ad hoc	960	1	192	49	49	22	142
Nelson–Burnie	June 2012	FV Rehua	annual	940	1	188	47	47	19	107
Fremantle – Broome	April 2010	Southern Surveyor	ad hoc	910	1	182	48	31	60	227
Exmouth–Scott Reef	Nov 2011	RV Solander	quarterly	390	1	78	-	-	-	-
Brisbane-Fiji	April 2012	RV Cape Ferguson	quarterly	280	1	56	14	14	19	85
Hobart – Brisbane	April 2012	Southern Surveyor	ad hoc	515	1	103	-	-	-	-
Hobart – Freemantle	Mar 2010	Southern Surveyor	ad hoc	3245	2	649	165	165	75	113
Hobart – Hobart	July 2012	Southern Surveyor	ad hoc	665	1	133	131	-	-	-
Hobart – Sydney	Sep 2010	Southern Surveyor	ad hoc	420	1	84	21	21	34	144
Australia – Antarctica*	Nov 2008	RSV Aurora Australis	spring to autumn	15315	37	3196	2254	2702	205	179

* This is a part of ~35,000 data records (175,000 nmiles) from 646 tows, for 240 zooplankton and 83 protistan taxa available from the SO-CPR survey that has been operating for the past 22 years.



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

National Reference Stations plankton data update

Station	Start date	Biomass samples	Total zoop taxa
Darwin	Jun 2011	7	87
Esperance	May 2009	11	132
Kangaroo Island	May 2012	9	162
Maria Island	Aug 2012	35	234
Ningaloo	Feb 2012	5	57
North Stradbroke island	Sep 2008	48	381
Port Hacking	Feb 2009	40	318
Rottnest Island	Nov 2011	23	213
Yongala	Sep 2009	30	232



Above: Frank Coman and Claire Davies collecting a plankton sample at the Stradbroke Island NRS station.

Do we need all the IMOS National Reference Stations? An analysis of the variation in plankton composition

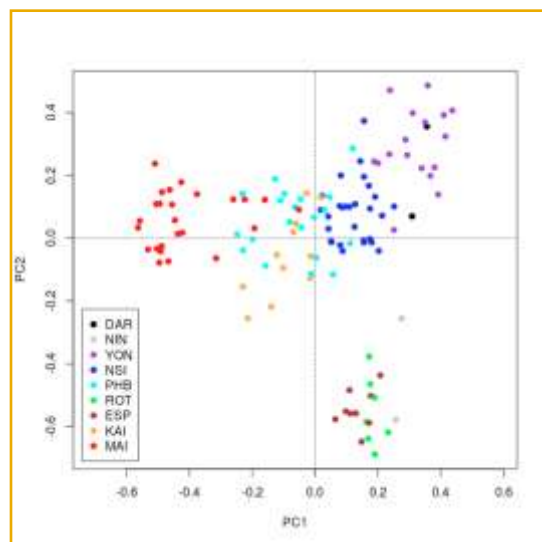
Anthony J. Richardson & Wayne Rochester

To assess the unique footprint of each of the National Reference Stations (NRS) in terms of the physical properties of temperature and sea surface height, Oke and Sakov (2012) analysed data from a fine-resolution physical model and satellite (Oke & Sakov 2012). It is interesting to ask a similar question about the biology. Although it is not possible to conduct the same analysis on the biology at the NRS, as this would require a robust fine-scale model of the plankton composition over entire Australian domain, we have conducted a complimentary analysis. A more tractable biological question using the plankton data is: “how different are the IMOS National Reference Stations in terms of their species compositions?” The implication is that stations with similar species compositions through time could be redundant.

We used Principal Component Analysis (PCA) to find the major modes of variability in plankton data from the NRS. The first PC explains the most variance in the data and subsequent PCs explain a declining proportion of the variance. By plotting the original data points from each NRS on PC1 and PC2, we can see how similar/different they are in terms of species composition.

Zooplankton analysis of all National Reference Stations

Copepods comprise 55% of the abundance of zooplankton across all the NRS; they can also be identified to a species level, a task that is difficult for many zooplankton groups. Copepods are thus ideal for a PCA (Fig. 1). The most different stations in terms of copepod communities is Maria Island (MAI), Yongala (YON) and the Western Australian stations of Esperance (ESP) and Rottnest (ROT), although they are similar to themselves. The NRS on the east coast of Australia exhibit a gradient in copepod community composition, particularly on PC1, with distinct regions from right to left for YON, North Stradbroke Island (NSI), Port Hacking (PHB) and MAI. Using permutational MANOVA, a test of whether two or more groups are significantly different in multivariate space, shows that the NRS stations vary significantly among one another and that the specific difference between NSI and PHB is significant ($p < 0.0001$).



Right: Fig. 1. Copepod communities from samples from each NRS. Data were taken since Jan 2011, as the level of taxonomic identification for copepods has been stable since then.

Update from Queensland

Frank Coman

The Brisbane laboratory has been busy since April last year with many activities beyond our regular plankton analyses. Notably, Anita Slotwinski has been absent on Maternity leave from August 2012 until her return just this month. While it is going to be hard to spend time away from her daughter Asha, Anita is keen to get back into the laboratory and has already begun with the production of this newsletter. Felipe Gusmao also left our group to return to Brazil with his new family. Felipe is now working at University of São Paulo, Marine Biology Centre (CEBIMar) (USP), Brazil and is still keeping in contact with us, and we are continuing to work some of the data he was working with while he was in our laboratory. The Brisbane staff have continued to count both continuous plankton recorder samples and also zooplankton samples from the national reference station (NRS) project and from August 2012 also began to count the NRS phytoplankton samples. Pru Bonham and David McLeod visited the Brisbane laboratories in July 2012, for some final training from Pru before the group took over counting these samples from her. Pru also visited the laboratories again just recently to go through some of the more difficult taxa we have been encountering in the NRS phytoplankton samples, and it certainly made it clear that regular refresher courses for taxonomic identifications are certainly very worthwhile for any survey project. We also had a visit from Lisa Gershwin in November 2012 to help us with our jellyfish identifications.

Visitors to our laboratory this year have included Julia Reisser and Murphy Birnberg who were in Brisbane in July 2013 to look at the plastics collected by the continuous plankton recorder and Iain Suthers who visited in July to discuss possible collaborations. During the year we have also had many students come through the laboratory. Alex Coughlan, Amelia Armstrong and Ryan Thornton all participated in vacation scholarships in our laboratory and Amelia and Alex have continued their association and have been working on their honours projects in our laboratory. Amelia has been working with ZooScan and Alex with the phytoplankton database. Lydie, Fabrice and Chris who were all previously working in our laboratories have all completed their PhDs now. Sarah Pausina is continuing with her study after a break when her daughter Amber was born and Julian Uribe has continued to work with us, and will be counting zooplankton samples part time with us for the next 6 months.

Other training the group has been involved with has been an R-course at the University of Queensland in November 2012 and a taxonomic course Anita attended in Sweden in April 2012. Most of the group attended the annual AMSA conference at the Gold Coast in July 2013. Anthony and Claire represented the team at the GACS meeting in Paris in September 2012, and the majority of the group have assisted with the University of Queensland field course conducted on Stradbroke Island in April of 2012 and 2013. Mark has continued to assist with the Northern Prawn Fishery and Torres Strait Lobster surveys and Frank also assisted with the 2013 Lobster survey.

Since the last newsletter the team at the Queensland laboratory has also collected EAC CPR deployments between Brisbane and Adelaide on the ANL Windarra, between Tasmania and Nelson, New Zealand on the FV Rehua and several samples from the AIMS vessels RV Cape Ferguson and RV Solander. We have also managed to collect a number of samples from the MNF vessel the Southern Surveyor as its service time has been extended while its replacement the RV Investigator is being constructed. The ANL Windarra has now been removed from servicing the route we were towing, but ANL have been very helpful in sourcing a new ship to sample from, the SCT Vietnam.

Sampling at the National Reference station at North Stradbroke Island has continued most months, but with regular sampling crew being unavailable for a number of months this year we have had to rely on assistance from a number of other staff and students through the year. Everyone who has come on board has been enthusiastic and proficient and we have managed to successfully complete all samplings, and we thank all these people very much.

Brisbane Lab Visitors 2013

Anthony Richardson

Jack and Joan Greenwood (formerly UQ): 12 Aug 2013. It was great to show the Greenwoods around our lab. They were impressed with the enthusiastic vibe, the many splendid posters of plankton, the quality of our microscopes, and the recent innovations such as the ability to produce size spectra and to identify plankton automatically to a coarse level using ZooScan. It was great to hear about their zooplankton work at UQ over the past 30 years. Particularly interesting was discussions about the mysid work they did in the Pumicestone Passage 15 years ago that would form a good baseline for comparison with current sampling.

Julia Reisser (UWA): 22-26 July 2013. I would like to thank Julia for taking the time to come and visit our Lab, and work with us on microplastics. Julia is doing her PhD on microplastics around Australia. Thanks to her hard work, we found some unexpected complications with our microplastics data. While we get to the bottom of this, unfortunately we will not be releasing these data.

Graeme Hays and Patricia Lee (Deakin University): 12- 15 July. Graeme and Patricia visited after the AMSA conference. Graeme is an extremely enthusiastic scientist and he provided inspiration for the Plankton Team. We have since advertised for a joint PhD student to investigate the speed of climate change using AusCPR and UK plankton data.

Iain Suthers (UNSW): 28- 29 Aug. Iain gave a fascinating talk at Ecosciences Precinct on zooplankton size spectra. We discussed many things including statistical analyses that each of the Plankton Team could undertake. Iain's knowledge and experience of interpreting size spectra was especially valuable for Amelia Armstrong, one of our Hons students. It is hoped that this collaboration will continue through an Honours student next year to work on the LOPC (Laser Optical Plankton Counter).

Pru Bonham (formerly CSIRO): 12 Sep. Pru visited to provide Quality Assurance for our phytoplankton identification. We appreciate you making time for us Pru, especially considering you are retired. It was great to take you for dinner afterwards to show our appreciation.

Felicity Maccunuly (CSIRO): 16-20 Sep. Felicity is from CSIRO in Hobart and came to visit to see what we do in terms of plankton identification. We showed Felicity different facets of our work, including microscopy, cutting skills, estimating the Phytoplankton Colour Index, loading CPRs and using our database.

Aaron Helenius (UMelb): – Aaron is a 3rd year student and visited us from 30 Sep – 4 Oct. He learnt how to use the ZooScan under the guidance of Amelia Armstrong and Mark Tonks. He successfully scanned 25 samples from the Yongala NRS. He worked very diligently and very enthusiastically.

Phoebe Burrows (St Thomas Moore College): Phoebe visited us from 30 Sep – 4 Oct. She is a year 10 work experience student. Julian showed her how to identify some zooplankton, Sabina Perkins did some seagrass measurements work with her, Claire showed her how to cut silks, and Frank showed her how to load a silk. Afterwards she thanked the team and said she had an enjoyable time and learnt a lot.

Bob Crudgington (UQ): Bob visited the lab on 8 Oct. Bob runs a citizen science program on Moreton Bay (<http://saltmarsh.enviroed.com.au>) and is an enthusiastic scientist. He is keen to collaborate with us on a project on mysids repeating Jack Greenwood's work in Pumicestone Passage in the 1990s.



Above: Planktonic fish egg.

Update from Floreat, West Australian

James McLaughlin

After a bit of a lull here in WA, things have started to ramp up somewhat in recent months. In August, James McLaughlin participated on a transit voyage aboard the *RV Southern Surveyor* (SS2013_t03) from Broome, WA to Brisbane, QLD crossing the top of Australia. James was a co-principle investigator looking at the microbial productivity along the transit, sampling Timor Sea Kimberley coastal waters, the Arafura Sea, Gulf of Carpentaria, and the Coral Sea in close proximity to the Great Barrier Reef. During the cruise a CPR was towed for the majority of the transit and will provide zooplankton and phytoplankton species composition information over a vast spatial scale. Thanks to the crew of the *Southern Surveyor* for supporting this research and facilitating the deployment and retrieval of the CPR during the voyage.

Other news from WA is that logistics and planning for a new tow between Sydney and Perth aboard the *SCT Vietnam* is well underway. Members of the WA team had a tour of the vessel in mid September, meeting with the ship's crew to discuss specific aspects of towing the CPR. As a result the towing gear is set to be delivered to the ship early October in Fremantle. This tow route will be completed every second month with a start date of November 2013 probable at this stage. Many thanks to the crew of *SCT Vietnam* and DP World for their time and willingness to support the AusCPR survey.

Update from Hobart, Tasmania

Claire Davies

The IMOS plankton team will continue to have a presence in Tasmania with the relocation of Claire Davies from the Brisbane labs to the CSIRO Hobart labs. Claire will continue to count plankton samples from the NRS stations and the AusCPR survey and will also be on site to help with logistics of the sampling surveys from Hobart, especially from the new Marine National Facility, Investigator.

Claire has had a busy introduction to her time in Hobart, setting up a new plankton lab, attending the IMOS QC summit where she was running the working group on the BGC sampling data base and will be giving a presentation to TasIMOS about the work of the IMOS plankton group across Australia.

Claire is also looking to keep up our collaborations with the Tasmanian plankton community, within CSIRO, the AAD and IMOS, with long term supporters Kerrie Swadling and Gustaaf Hallegraeff. Kerrie currently has a student, Paige Kelly, who will be using NRS data in her Honours thesis looking at investigating recent distribution patterns in zooplankton and a commercially fished species (most likely Southern Rock Lobster) at Maria Island.

Phytoplankton Taxonomy Course

Julian Uribe Palomino

Some of the members of the plankton team have participated in the Phytoplankton Taxonomy Workshop held at the Sydney Institute of Marine Science (SIMS). The training course covered identification of some of the most common groups of phytoplankton such as diatoms and flagellates, with some emphasis in harmful organism.

Topics such as the importance of phytoplankton research, isolation and culture of phytoplankton cells, and the use of modern molecular techniques for micro-plankton identification were covered by lecture and practical session.

This intensive training was a great opportunity to gain some knowledge from researchers who have been involved in the identification and monitoring of phytoplankton species around Australia. including Gustaaf Hallegraeff (University of Tasmania), Chris Bolch (University of Tasmania), Steve Brett (Microalgal Services), Penny Ajani (Blooming Algae and Macquarie University), Shauna Murray (UTS) and Lesley Rhodes (Cawthron Institute, New Zealand).



Top right: Dr. Penny Ajani collecting an alive sample of phytoplankton at Mosman Bay Sydney for assessment at the SIMS microscopy laboratories

Middle: Participants of the Phytoplankton Identification Workshop at SIMS. First row: Ms. Alex Coughlan (University of Queensland), Dr. Gustaaf Hallegraeff, Dr. Chris Bolch (University of Tasmania), Mr. Frank Coman, Mr. Mark Tonks, Mr. Julian Uribe (Plankton Team). Top row: Dr. Steve Brett (Microalgal Services), Participant, Dr. Lesley Rhodes (Cawthron Institute, New Zealand) and Dr. Shauna Murray (UTS).

Left: Cells from the genus *Alexandrium* which includes harmful species.

Improving the National Reference Station Biogeochemical Database

Claire Davies and Margaret Miller

The IMOS National Reference Stations (NRS) are a network of water sampling sites and moorings at nine locations around Australia, collecting information about the physical, chemical and biological properties of the water to monitor oceanographic phenomena in Australian coastal ocean waters. They are part of the IMOS Australian National Moorings Network, coordinated nationally and distributed among several sub-facilities. The distributed nature of the different teams entering data has made it difficult to maintain comparability across datasets and analyse the data together.

Until recently, data from biogeochemical analysis of NRS water samples have been uploaded individually to the IMOS data portal by multiple analysts after analysis at centralised labs. The sampling field log sheets, containing the sampling metadata (dates, times, locations), were also uploaded separately to the IMOS web portal by the various sampling teams. Because the data and metadata streams remain separated, analysis across samples has meant time-consuming manual manipulation to combine individual data into time-series datasets. There were also slightly different standards used by each team (e.g. time and location recorded differently).

The IMOS Plankton Ecology Group is currently extending the plankton database to allow for the uploading and aggregation of all the biogeochemical data combining all the data into a single complete NRS Biogeochemical database. An easy-to-use web-based data entry and search interface is also being developed, so that laboratory analysts and field samplers can enter their data directly.

This new BGC database will integrate all the NRS data sets so that access is via a single repository. All data will be available and searchable via the data entry interface. The advantages are many:

- The delivery of data to eMII is streamlined with automatic, daily update of the webserver making the data immediately available. This removes the need for individual analysts to upload several Excel worksheets manually.
- Each group has been doing separate quality control checks according to their data, but these will now be standardized across the whole data set and will be fully documented.
- All sampling data are now linked to their metadata.
- Analysis across the data is now easily achievable; sample data can be queried across time, stations and taxa.
- Manual errors have been reduced.
- It will no longer be necessary to manipulate Excel spreadsheets.

Honours study: Effects of climate change on phytoplankton communities along Australia's east coast

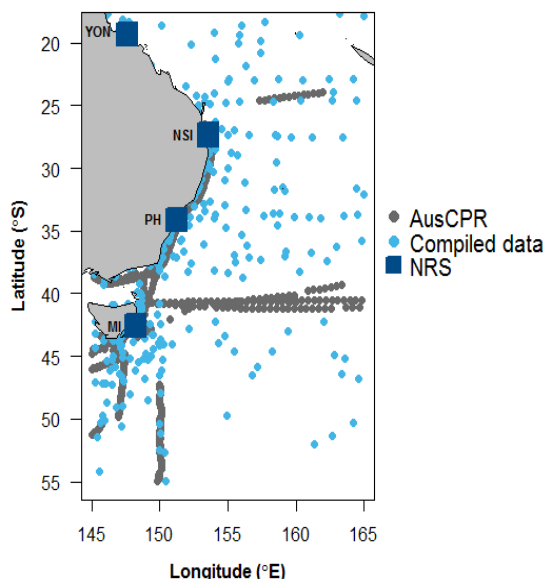
Alex Coughlan



Phytoplankton form the base of the marine food web and play fundamental roles in biogeochemical processes globally. The phytoplankton community is responding to a changing climate by altering their bloom timing and duration as well as shifting their distributions. Studies in the Northern Hemisphere have identified such changes, however paucity of data in the Southern Hemisphere has hampered similar investigations.

In 2013 Alex Coughlan conducted the first large-scale investigation of the effect of climate change on phytoplankton communities along Australia's east coast. Alex investigated long-term changes in species distribution, bloom timing and duration and species composition along the east coast and at the Port Hacking National Reference Station (NRS). A large phytoplankton species occurrence database was constructed as part of Alex's honours. The database consisted of 21,000 observations manually entered from historical published and unpublished literature, large databases and data from the Australian Continuous Plankton Recorder (AusCPR) and NRSs with data from Northern Queensland and down into the Southern Ocean since the 1940s.

The results indicated that Australian phytoplankton communities are responding to a changing climate with species observed shifting their distributions polewards along the east coast, phytoplankton blooms occurring earlier and the durations extending as well as changes in the relative abundance of species. This study has provided the first insight into the impact of climate change on Australian phytoplankton communities and facilitates similar investigations around Australia. Please contact us if you would like to contribute to the database which we plan to make a national dataset.



Plankton Toolbox Update

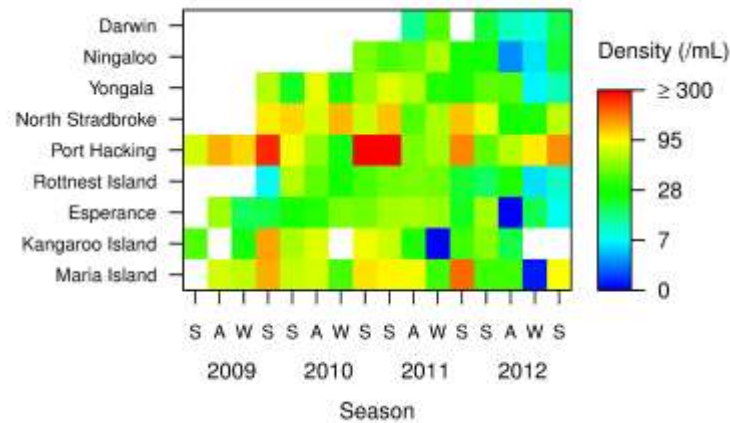
Wayne Rochester, Anthony J. Richardson

We have continued to develop our capability for analysing IMOS plankton data through our work on the Australian Zooplankton Taxonomic Guide and Atlas (IMOS, CSIRO, UTas), the plankton ecosystem assessment report called Plankton 2013 (IMOS, CSIRO Wealth from Oceans), a second global ecological status report (Global Alliance of CPR Surveys), CSIRO Wealth from Oceans strategic research on sustained ecological observing, and supporting student projects based on IMOS plankton data.

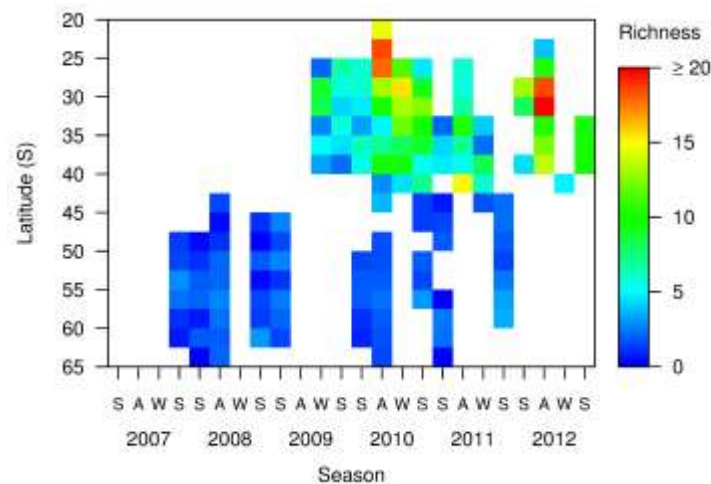
A number of these projects have involved integration of plankton data with oceanographic data, particularly those from IMOS data streams or repositories, including sea surface temperature, sea level anomaly, satellite chlorophyll measurements, bathymetry and NRS CTD and WQM temperature measurements.

Plankton 2013 provided a timely and important QA process for the IMOS plankton database and data. First, preparing the report required all major data types in the complex database to be queried in a variety of ways, thus road testing the ability of the database to support analysis of the data. Second, the summary maps and graphs and the data checking steps of the analyses that created them gave the database a good sweep for errors. We were pleased to discover that the database passed the test easily (requiring no modification to support any of the work) and that very few errors were detected during the analysis. Another outcome of this work was an improvement to the method for standardising NRS zooplankton abundances in the AODN data stream.

Because members of the AusCPR team often also work on CSIRO projects, we have had a number of opportunities to facilitate the application of IMOS data when working on those projects. With Keith Hayes in the CSIRO Wealth from Oceans sustained ecological observing project, we compared AusCPR plankton observations with phytoplankton indicators derived from satellite measurements of ocean chlorophyll. This analysis was a first step in the development of indicators of ecosystem state from sustained observations from platforms such as IMOS. Results from this work, combined with CPR summary statistics from our GACS report, enabled a simple and rapid parameterisation of phytoplankton distributions in the CSIRO Wealth from Oceans Northern Atlantis model (led by Trevor Hutton).



Above: Seasonal phytoplankton abundance in NRS samples

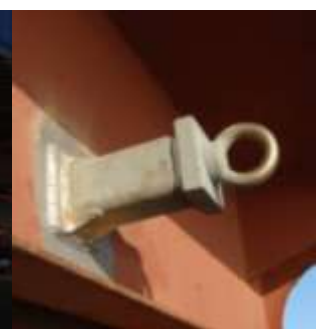
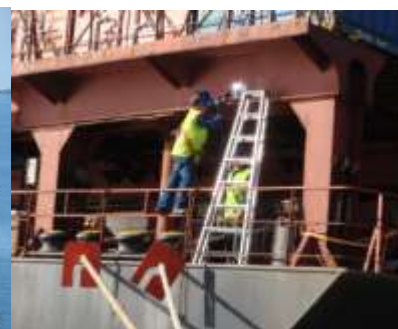


Above: Copepod species richness (average number of species per sample) by latitude and season in CPR samples

AusCPR welcomes SWIRES Shipping company

Mark Tonks

Over the last couple of months the AusCPR Team has successfully liaised with both the ANL and Swires Shipping Companies to co-ordinate the towing of Continuous Plankton Recorders (CPR's). The 'SCT Vietnam' (ANL), will be towing between Sydney and Fremantle, while the 'Kweichow' (Swires), will be towing inside the Great Barrier Reef between Brisbane and Cairns. We thank both of these companies for their assistance with the program and look forward to working with them over the coming years. Below are some pictures of the 'Kweichow' in Brisbane with a welder hard at work preparing to attach the tow point and the end product.



Australian Marine Science Association Golden Jubilee Conference

Mark Tonks

The 2013 Australian Marine Science Association (AMSA) Golden Jubilee Conference was held at Jupiter's Casino, Gold Coast, between the 7 - 11th July with over 500 people attending. Of great interest was the plankton symposium, 'Plankton: shaping the past, present and future'. The Australian Plankton Research Team (based at the Ecoscience Precinct in Brisbane) attended with Anthony Richardson, Frank Coman and Julian Uribe contributing to the oral presentations. Anthony presented Plankton 2013 – an assessment of the state of the oceans around Australia using plankton as indicators of ecosystem change. Frank gave an overview of plankton data observations associated with the IMOS program (from Australia's National Reference Stations and the Australian Continuous Plankton Recorder Survey (AusCPR)) and in particular how people could utilise this data. Finally, Julian spoke about a species of diatom (*Palmeria ostenfeldii*) and a potential symbiotic relationship with ciliates, of the genus *Vaginicola*, which inhabits the bench-like folds of the diatom's silica cell wall. Joining the Australian Plankton Research Team were two honours students from the University of Queensland - Alex Coughlan and Amelia Armstrong. They have been working closely with our plankton lab and are using data from National Research Stations and AusCPR. Alex's project is examining changes in phytoplankton communities along Australia's east coast associated with climate change while Amelia is looking at changes in the size spectra of zooplankton in the same region. Both students presented excellent posters that attracted considerable attention.

Claire Davies, a member of the plankton lab, deserves a special mention for her role on the organising committee, ensuring that the conference ran smoothly and was ultimately successful. The next AMSA conference (2014) will be held in Canberra so hopefully we will see you there!



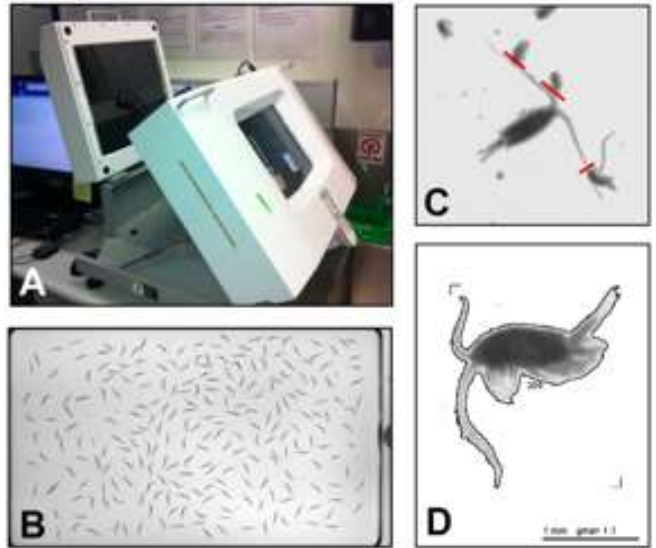
Above: IMOS stand at AMSA 2013

Honours study: ZooScan

Amelia Armstrong

I additionally described the seasonal trends at each of the NRS stations using the body size distribution data. North Stradbroke Island had a greater abundance of small bodied organisms than Maria Island, which has an increased dominance of larger bodied organisms. The Maria Island zooplankton community exhibited greater seasonality than the North Stradbroke Island community with an annual Spring bloom period identified. I found that body size measures were able to distinguish between community seasonality and latitude almost as well as taxonomic measures. This was unexpected as we had predicted body size to perform relatively poorly.

The ZooScan system was very useful and supported a relatively rapid analysis, considering the large numbers of organisms per sample. This study will be further expanded following honours to include additional NRS stations and describe Zooplankton community dynamics along the Australia's East coast. Many thanks to the CSIRO Plankton team for your ongoing support and assistance during my final year of undergraduate."



Above:

The ZooScan (A) is a waterproof scanner capable of high resolution (2400dpi) imagery. Zooplankton samples (B) can be scanned and touching particles digitally separated (C) to assist in rapid and accurate particle size measurements (D).

Below:

A selection of zooplankton taxa used to sort the samples and train the ZooScan's automated classification software.



The Team



Anthony Richardson

Position: Joint Leader AusCPR

Location: CSIRO, Brisbane, Queensland

I co-manage the AusCPR project, I help secure funding, guide research directions, develop relationships with other plankton surveys, and support and develop AusCPR staff. My research interests are marine climate change ecology, plankton ecology, pelagic ecosystem dynamics, and ecosystem modelling. In my spare time I love to spend time with my family.



Graham Hosie

Position: Joint Leader AusCPR

Location: AAD, Hobart, Tasmania

I co-lead AusCPR and lead the SCAR Southern Ocean CPR (SO-CPR survey). I set research directions, manage resources, develop relationships with other surveys and provide training and instruction. My research interests are community ecology of Southern Ocean plankton, krill ecology, Antarctic marine ecosystem dynamics, impacts of global change on marine biodiversity, biogeography, and building international research collaborations.



Frank Coman

Position: Deputy Leader AusCPR

Location: CSIRO, Brisbane, Queensland

My role involves liaising with ships that tow the CPR, the management of the North Stradbroke Island NRS sampling, zooplankton sorting of IMOS NRS samples, and plankton analysis of AusCPR samples. I am interested in plankton biology and ecology, climate change impacts on marine ecosystems and aquaculture. In my spare time I play sport, enjoy fishing, camping and photographing Australian wildlife.



Claire Davies

Position: Plankton Biologist

Location: CSIRO, Brisbane, Queensland

My job includes identifying and counting zooplankton samples from the NRS, and counting phytoplankton and zooplankton for AusCPR samples. I also manage the NRS and AusCPR databases, and am a boat driver for SE NRS sampling. My research interests include plankton ecology, climate change impacts and the feeding dynamics between zooplankton and megafauna. In my spare time I spend as much time in and out of the water as possible.



Anita Slotwinski

Position: Plankton Biologist

Location: CSIRO, Brisbane, Queensland

I analyse zooplankton samples from the NRS network and phyto- and zooplankton samples from AusCPR. I also manage the project website, communication materials, and the zooplankton species reference collection. My research interests are in marine plankton ecology, environmental change and species response, plankton taxonomy, photomicroscopy, and development of taxonomic guides for zooplankton. In my spare time I like to spend time with family and friends, cook, read and experiment with photography.



Mark Tonks

Position: Plankton Biologist

Location: CSIRO, Brisbane, Queensland

My tasks include counting zooplankton from the NRS network, phyto- and zooplankton identification of AusCPR samples, and management of project procedure manuals. I have worked for CSIRO for 19 years and spend 60% of my time working on plankton. My research interests include plankton ecology, bycatch sustainability and fish and crustacean ecology. I also enjoy playing a variety of sports including hockey, touch football and cricket.



Karl Forcey

Position: Technical Officer(CSIRO)

Location: CSIRO, Brisbane, Queensland

I am involved in the integration of marine instrumentation to CPR projects, data recovery and quality control, maintenance and repair of CPR units and provide technical advice. My research interests are underwater video systems, oceanographic instrumentation and AUV Gliders and other emerging technologies.



Wayne Rochester

Position: Quantitative Ecologist

Location CSIRO, Brisbane, Australia

My work involves the analysis of plankton data for ecosystem health assessment. My research interests are quantitative ecology, spatial ecology and natural resource management.



James McLaughlin

Position: Marine Biologist/ Biogeochemist

Location: CSIRO, Floreat, Western Australia

My job is helping to expand the survey into WA waters and the analysis of phyto- and zooplankton samples. I have been with CSIRO for 5 years and work 10% of my time with AusCPR. My research interests include marine phytoplankton dynamics and ecology, benthic and pelagic primary production, and ocean acidification. I enjoy spending time with my family, travelling and keeping tropical aquarium fish.

The Team...continued



Steve Edgar

*Position: Data Manager/Database Administration
Location: CSIRO, Brisbane, Queensland*

I help with oracle database support and am involved in managing marine data. My research interests are spatial analysis and processing of large datasets.



Julian Uribe-Palomino

*Position: Plankton Researcher
Location: CSIRO, Brisbane, Queensland*

My job is to identify and count zooplankton from the national Reference Stations. I am very interested in the response of planktonic communities in relation to spatial and temporal changes of environmental conditions and effects of natural events and human activities. I am also interested in biological oceanography, environmental modeling, bio-geography, remote sensing and GIS.



Margaret Miller

*Position: Data Manager/Database Administration
Location: CSIRO, Brisbane, Queensland*

I am involved in database design, maintaining the integrity and data quality of AusCPR data and the delivery of data to emll. My research interests are data management, ecological sustainability in tropical prawn trawl fisheries and tropical field ecology. In my spare time I enjoy being involved in my local Scout Group and enjoy sailing and canoeing when I get the time.

Brisbane Plankton Lab Open Day

Anita Slotwinski

The Brisbane IMOS Plankton Group hosted a lab open day on Thursday 14th November 2013. The lab was flooded with interested parties who were able to see phytoplankton and zooplankton under the microscope, learn about the IMOS and the AusCPR and NRS, see historic samples from 80 years ago, learn about the history of the continuous plankton recorder and how it works and see cutting edge plankton technology such as zooscan.

There were several competitions such as estimate the number of plankton in the jar, identify the plankton species competition and identify the plankton in the xmas tree!

It was a fun and informative way to show our colleagues just what we do and to showcase the unseen plankton world. The event was so successful that we have been asked to make this an annual event. So if you didn't make it this year, make sure you come along in 2014.



Australian Marine Zooplankton: taxonomic guide and atlas

<http://www.imas.utas.edu.au/zooplankton>

Kerrie Swadling

We're pleased to introduce our new website on Australian Marine Zooplankton, which was released at the AMSA national conference on the Gold Coast in July. We all know that identifying zooplankton can be a challenging task as traditional keys are generally designed for users with a high level of expertise. Our online guide provides quick identification to the major groups via an image-based key that includes many wonderful photographs taken by the Plankton Team (special mention must go to Anita for her photographic skills). For people wanting to explore their specimens in greater depth, we have added downloadable species-level taxonomic sheets that describe diagnostic characteristics, along with information on ecology and key references. The sheets also contain distribution maps, based on over 89,000 positive occurrence records from the Australian Zooplankton Database.

So far we have focused on holoplankton, as meroplankton cannot routinely be identified to species. Of the holoplankton, most of the sheets are on copepods, as they are abundant, robust and are relatively well described. However, we view the website as a collaborative effort and invite input from people to help us expand our coverage on any of the groups. If you have photos that you would like to include in the website please contact us, and we can work with you to produce taxonomic sheets if you have the interest.

While the website is primarily focused on identification aids, we have also provided information on sampling, general ecology and anatomy of zooplankton. If you have any feedback on those aspects of the site please contact Kerrie Swadling (IMAS/UTAS) or Anthony Richardson (CSIRO).

We would like to thank the contribution of Jason and the rest of the team...these sheets will be useful for students (high school and uni) postgrads, and experts alike. We are expanding our chaetognath sheets in collaboration with Pearce Buchanan (Murdoch Uni)



To reference the site

Swadling KM, Slotwinski A, Davies C, Beard J, McKinnon AD, Coman F, Murphy N, Tonks M, Rochester W, Conway DVP, Hosie GW, Richardson AJ 2013 Australian Marine Zooplankton: a taxonomic guide and atlas. Version 1.0 February 2013

To reference the taxonomic sheets

Richardson AJ, Davies C, Slotwinski A, Coman F, Tonks M, Rochester W, Murphy N, Beard J, McKinnon D, Conway D, Swadling K (2013) Australian Marine Zooplankton: Taxonomic Sheets. 294 pp.

If you would like to join the
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Visit the AusCPR website at <http://imos.org.au/auscpr.html>

Visit the NRS website at <http://imos.org.au/anmnrs.html>

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

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