



# Australian Plankton Survey Post

## The Australian Continuous Plankton Recorder Survey & National Reference Stations

Hi everyone once again. Thanks for taking the time to browse our newsletter. I would like to welcome a couple of new members of the Team. First is Julian Uribe, who is with us in Brisbane as a casual appointment. He has been volunteering in the Plankton Lab for a long time now and it is great to have him more consistently in the lab and be able to pay him. Julian makes an amazing contribution to the Team – he brings extensive plankton experience and infectious enthusiasm. He is doing some great work counting NRS zooplankton samples and will start counting AusCPR samples soon.

The other new recruit is Felicity McEnnulty (see the article about our team members on page 4). She was seconded from CSIRO to AAD for a couple of years and now is back with CSIRO and was looking for new challenges. Felicity has a background in identifying benthic organisms, but has shown considerable aptitude in quickly learning many of the plankton taxa. She is based with Claire in Hobart, giving us some critical mass there, which will help our QC and ensure Claire has someone to talk to! Welcome onboard Felicity and we are all impressed with your progress and motivation.

I would also like to take this opportunity to thank Mitch Lambert – he has volunteered his time to work with us to gain some work experience. He has been diligently using the ZooScan to process a backlog of samples from several different stations. Thanks Amelia Armstrong for training Mitch. The data he is generating will contribute to a paper Amelia is writing, comparing the size spectra of zooplankton from the NRS. Thank you Mitch for dedicating time to help us.

We also had a French intern for 3 months – Alicia Flochlay. Alicia is working with Lisa Gershwin and myself populating a database summarizing information on jellyfish from newspaper reports – quite a job considering the initial search identified 65,000 articles! Thanks Alicia. You can read more about her work on page 6.

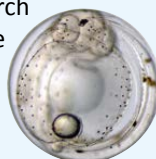
This is also a great opportunity to thank Frank Coman and Claire Davies for contributing to the 4-day UQ MARS3012 Oceanography Field Trip at North Stradbroke Island. We had 33 students this year and it was very successful. Claire was the skipper of the boat and Frank trained the students in deploying equipment from small boats to sample, nutrients, chl-a, and zooplankton biomass and composition – this is very similar sampling to what happens at the IMOS NRS. The students compared data from their Moreton

Bay site with that from the more oceanic North Stradbroke Island NRS.

I would also like to mention the workshop on the IMOS Plankton Ocean Observing System (don't think of the acronym!) presented at the University of Western Australia. There was a good turn out, many questions, and I thoroughly enjoyed it. A number of people remarked that we were making strong progress. Thanks to Agi Gedeon for the invitation and organizing it. I would also like to thank Mark Tonks for doing a sensational job ensuring we are on-track with our ship deployments of the CPR. Negotiating with commercial shipping and ensuring the right CPRs and cassettes are loaded and unloaded smoothly is a time-consuming, thankless, but critical part of what we do. Well done Mark. Finally, thanks Anita Slotwinski once again for putting the Plankton Newsletter together.

Thank you for taking the time to read our newsletter.

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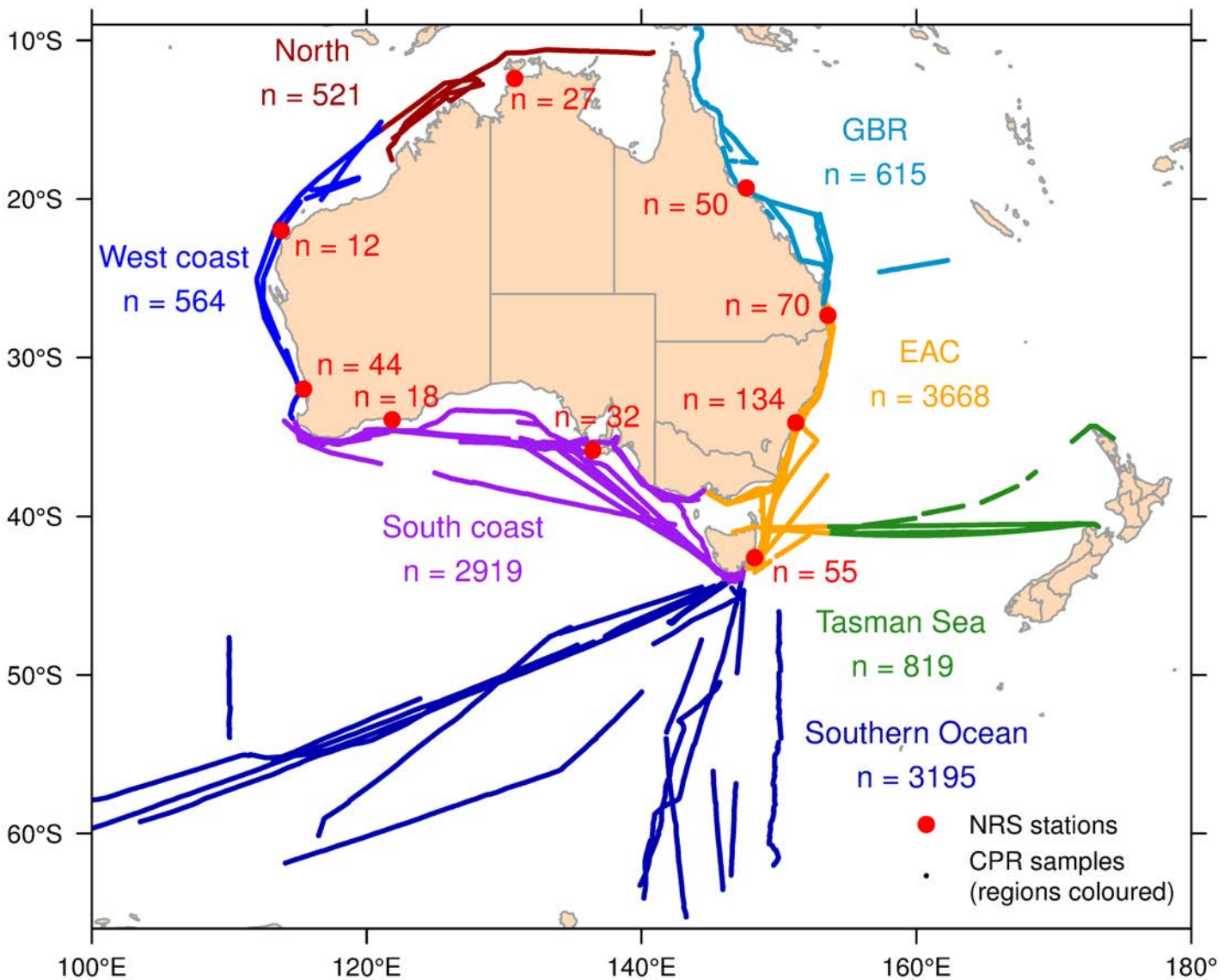
## Integrated Marine Observing System (IMOS) Plankton Data 2007 - August 2014

The **West Coast** route is only towed on an ad hoc basis.

The **North** route is towed on an ad hoc basis, as although there is a lot of ship traffic in the region, to date we have not been able to come across any regular traffic.

The **EAC** route is towed quarterly from Brisbane to Melbourne 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 is towed quarterly from Brisbane to Townsville. The Great Barrier Reef is an area likely to be strongly affected by warming and ocean acidification.



The **South Coast** route is towed quarterly from Melbourne to Fremantle. This route passes through a region of high endemism and is partly funded by the energy company BP.

The **Southern Ocean** routes below Australia are conducted by the SCAR SO-CPR Survey through the AAD and NIPR Japan, in conjunction with the AusCPR. Together with the EAC route, the Southern Ocean sampling provides an almost continuous transect running between the warm tropical waters and polar waters of the Antarctic.

The **Tasman Sea** route extends from Burnie, Tasmania to Nelson, New Zealand. This is an important area for fisheries and our survey links in with an existing mesopelagic acoustic survey.



## Shipping Companies that Support AusCPR

Mark Tonks

Since our last newsletter in December 2013 we have had continued success with the AusCPR sampling from 'Ships of Opportunity'.

The ANL Whyalla (formally the SCT Vietnam) has sampled from Sydney to Fremantle in January and March 2014. The 'MV Kweichow' from Swires Shipping also successfully sampled in January and March 2014 between Brisbane and Townsville before it was placed in dry-dock (South China) for a full hull sandblasting and repaint as well as overhauls of its lifting machinery. It's likely to return to our shores in late June where we will look to continue sampling.

After further consultation with Swires we were also able to gain the services of the 'MV Island Chief' to re-establish the Brisbane to Sydney route which we lost in 2013 when the ANL Windarra changed its rotation. In addition to this, the Island Chief is also sampling from Brisbane north to Elusive Reef, which is approximately 300nm, before its route takes it outside of the GBR as it heads north to Papua New Guinea. To date the Island Chief has sampled in March and April 2014 and will again sample in June. Dealing with these shipping companies has been an absolute pleasure.

The support of the company's managers, crews and Port Operations Officers have enabled us to easily and effectively collect plankton samples and their associated spatial and temporal data.

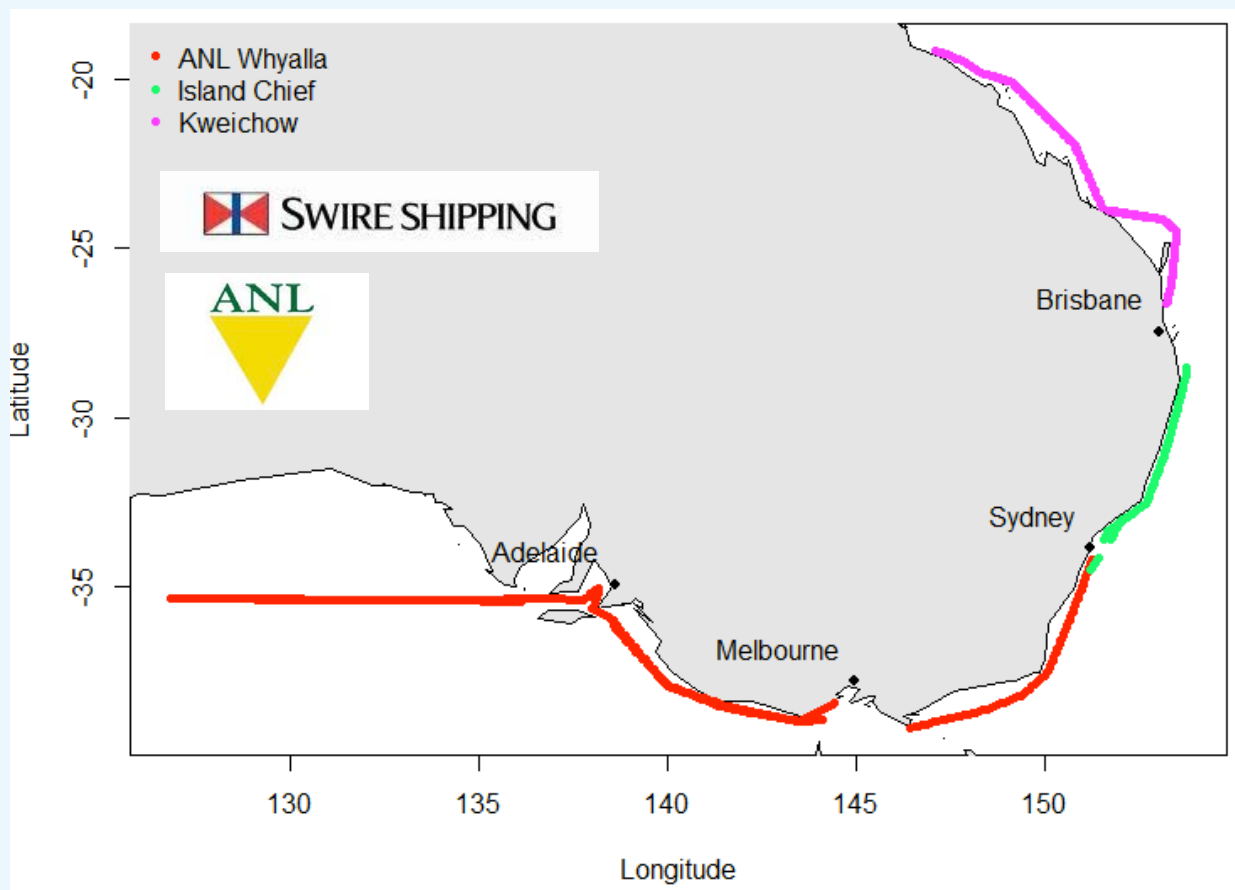
## New Team Member

Felicity McEnnulty

Hi my name is Felicity McEnnulty. I have recently joined the CPR group after three years working as the biodiversity curator of the marine invertebrate and fish collections at the Australian Antarctic Division. I will be responsible for the identification of zooplankton from the IMOS National Reference Stations and later CPR samples. Prior to 2011, I worked at CSIRO undertaking QAQC on deep-sea survey invertebrate data and liaised with museum taxonomists to facilitate identifications. From 1998 to 2005 I was a team member of the CSIRO Centre for Research on Introduced Marine Pests where I worked on invertebrate ids from port surveys and associate data management and analysis and lodgement of a representative reference collection at the relevant state museums, and provided advice to assist the management of marine pests in Australia. In my spare time I like walking on beaches and out in the bush, fossicking and knitting.



Felicity McEnnulty





## QLD Update

Frank Coman

There have been a couple of changes in the IMOS plankton team staff since the report for the last newsletter was put together. In November 2013 Claire Davies moved to Hobart and she is now based in the CSIRO Laboratories. Since arriving in Hobart Claire has spent some time setting up the laboratory, including a new dissecting microscope to count zooplankton, and has been counting both zooplankton and phytoplankton samples and training our new staff member, Felicity McEnulty. Immediately before Claire left for Hobart the Brisbane team held a one-day workshop to discuss how the team were going to operate into the future with Claire's move to Hobart as well as a range of other issues which are going to affect the team in the foreseeable future. This was a very productive workshop, and will ensure we are able to continue to deliver to IMOS. The team also combined a farewell BBQ for Claire with a plankton laboratory open day on the day before she left for Hobart. With only limited space available in the laboratory, invitations to the open day were restricted to other members of CSIRO Marine Research working in Brisbane, as well as students and collaborators from nearby laboratories. The open day was very successful, nearly 50 people attending. They learnt about our IMOS projects, the sampling methods and the analysis methods we use including microscope counting and zooscan. There were a number of requests for more open days in the future.

The Brisbane staff have continued to count CPR samples and also zooplankton and phytoplankton samples from the National Reference Station (NRS) project. Regular communications with plankton experts from around the world have assisted with difficult identifications. In November 2013, Mark Tonks, Julian Uribe, Alex Coughlan and Frank Coman all attended a phytoplankton identification workshop at the Sydney Institute of Marine Science. Instructors included Gustaaf Hallegraeff, Steve Brett, Penelope Ajani, Martina Doblin, Lesley Rhodes, Chris Bolch, Shauna Murray and Hazel Farrell. This course was particularly useful because it was targeted at the identification of phytoplankton using light microscopy.

Amelia Armstrong and Alex Coughlan both successfully completed their honours projects (1<sup>st</sup> Class) in our laboratory in 2013. This year Asia Armstrong is working in our laboratory to complete her honours on Manta feeding on Lady Elliot Island and we also have Kate Burgess working on her PhD, investigating manta ray feeding in Ecuador (see the Students' Page). We also have two interns working with our group; Julia Bennett from the USA. has been working on developing a photographic catalogue of plankton and Alicia Flochay from France has been helping to develop a database of jellyfish and human interactions (see the Students' Page). Andrew Foote has also come on board recently to help us archive the historical CSIRO plankton samples that had been sent up to Brisbane from Hobart.

Other training the group has been involved with has been an R-course at the University of Queensland in November 2013 and a manuscript writing workshop held in March 2014 run by Anthony. In September/October 2013 Frank attended the annual GACS meeting held in Plymouth.

## Visitors to the Lab

The Brisbane Lab hosted 33 students from the University of Queensland on April 10<sup>th</sup>. The students participated in a practical plankton session for their MARS3012 course.

Alex Litherland visited on May 5<sup>th</sup> from the Wynnum State School and Moreton Bay Environmental Education Centre.

## Facebook

Did you know that we now have a facebook page! Search for **Australian Plankton Survey** or find us here <https://www.facebook.com/pages/Australian-Plankton-Survey/325879294227720>

Follow us and have your feed kept up to date with current plankton research and news, as well as samples of our world renown plankton imagery.

## Art and Science

We are excited to be taking part in the annual Art and Science exhibition, in celebration of National Science Week, held at Ecosciences precinct, in Brisbane from 18-22 August. We will be exhibiting a dozen plankton prints and a video installation of footage we have collected. We will have these available for download from our website at some point in the near future.



## Jellyfish Impacts in Australia

Alicia Flochlay

Jellyfish blooms cause numerous problems. Jellyfish such as the deadly box jellyfish and peanut-size Irukandji can cause nasty stings. Jellyfish blooms are also causing a lot of problems for the fishing and aquaculture industries, especially salmon farms. Jellyfish become stuck in the nets, and when broken up, their stinging cells can kill salmon. Indirectly, jellyfish can decimate fish stocks as they eat fish larvae and plankton. Jellyfish are causing ingress problems, clogging intakes of vessels, power plants and desalination plants. Collectively these problems cause a huge loss of money. Problems with jellyfish might increase, as overfishing is removing their predators and global warming increases their growth rates.

Anthony Richardson, Lisa Gershwin, Claire Davies and myself are building up a database to figure out the impact of jellyfish on Australia. There is a paucity of data on the impacts on tourism and industry, and the financial costs and health effects. We hope to identify hotspots of jellyfish problems, seasons and environmental conditions when problems are greatest, and assess whether there is any longer-term change in jellyfish reports. To do that, we are performing a systematic search related to jellyfish using the ProQuest Australia & New Zealand Newsstand database. This database covers all of the national and most local newspapers in Australia from 1996 to 2014. Using a batch of key words, that include the keywords jellyfish bluebottle, Chironex and many more, we have found >63,000 articles. I am going through all of these articles and recording a suite of consistent information. We capture information on all stings, blooms, sightings, ingress events and fishing problems and include data on "where", "when", "which species", health impacts, and environmental conditions reported. We also record educational newspaper reports associated with jellyfish, such as medical research or safety information.

This study will allow us to map jellyfish impacts in Australia, and hopefully to better assess their social, medical and economic impacts.



Alicia Flochlay

## Plankton and Manta Ray

### Research continues in the lab

Katherine Burgess (PhD student, UQ)  
Supervisors: Prof. Mike Bennett, Dr Scarla Weeks, Assoc. Prof Anthony J. Richardson

I have just completed the first year of my PhD on the habitat use and feeding ecology of the giant manta ray *Manta birostris* in the eastern Equatorial Pacific. Manta rays eat zooplankton and in general, inhabit mid to low latitudes and live in a predominantly oligotrophic environment where areas of high prey availability are rare. This PhD project aims to look at small-scale zooplankton dynamics such as community composition, size spectra and biomass at a key aggregation site for giant manta rays off mainland Ecuador.

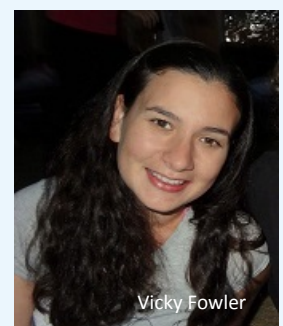
A pilot study was carried out on zooplankton samples collected during the first year of my PhD. Initial results have shown that there was a larger biomass of zooplankton when giant manta rays were feeding in comparison to when they were not feeding. However, more samples need to be collected from the eastern Equatorial Pacific, an area which so far has been poorly characterised in terms of zooplankton composition and dynamics, to investigate how zooplankton dynamics relate to the occurrence of the world's largest ray species in this region.

I will be heading out to Ecuador again from August to October where I will be intensively sampling zooplankton along with collecting interesting environmental data resulting from the extreme El Niño conditions that this part of the world is currently experiencing.

## Exchange Student

Vicky Fowler

Hi, I'm Vicky. I'm currently an undergraduate Biology student at the University of Exeter, UK. I have spent the past year on exchange at UQ in order to learn more about marine biology. During this time I took the oceanography course in which Anthony taught, this course piqued my interest in the work that plankton group do and I decided to get involved. I have been working in the Brisbane plankton lab for the past month, undertaking biomass sampling, zoo-scanning and learning more about plankton identification. I'm hoping that this experience will aid me in getting a PhD in marine biology upon completing my degree.



Vicky Fowler



**Honours: “The local foraging and oceanographic environment at a key aggregation site for *Manta alfredi*”**

Asia Armstrong (Honours Student, UQ)  
Supervisors: Dr Scarla Weeks, Assoc. Prof. Anthony J. Richardson

My research is focused on the reef manta ray aggregation site of Lady Elliot Island in the southern Great Barrier Reef. Most of the tropical and sub-tropical oceans are oligotrophic, with low nutrient, phytoplankton and zooplankton concentrations.

It is thus a challenge for large marine planktivores in the tropics to locate suitable forage areas of dense productivity and fulfil their energy requirements. My research is examining the food environment and oceanography of Lady Elliot Island to identify conditions that support the largest known aggregation (100s of individuals) of *Manta alfredi* in eastern Australia.

The research will analyse zooplankton dynamics during manta ray feeding aggregations; what oceanographic factors (e.g. tides, currents, temperature and salinity) drive changes in the planktonic community; and whether manta rays exhibit critical feeding thresholds in response to plankton density and distribution. This research will provide new insights into why tropical planktivores travel long distances and aggregate in large numbers in certain locations.

In February I went into the field for my first round of data collection. Preliminary sample analysis has revealed promising results in terms of zooplankton biomass around the island and further analysis into size spectra and taxonomic composition of the zooplankton community will involve the use of ZooScan equipment in the Plankton Lab at Ecosciences over the coming months.

My next field work is planned for June to coincide with the peak of the manta ray aggregation around the island. I am aiming for at least some of my sampling to overlap with manta ray feeding events.

Favourite manta prey include chateognaths (below) and large calanoid copepods (below right)



Asia Armstrong



Lady Elliott Island



*Manta alfredi*



2 mm  
A. Slotwinski, CSIRO © 2011



1 mm  
C. Davies, CSIRO © 2013

## Glass Houses

Julia Bennett, Marine Science; Prof. Meg Griffiths, Photography

**Background:** Humans have always been enthralled with the other worlds that circle above us in the night sky; the moon, stars, and galaxies far away. We are forever curious about things obscured from the naked eye. The perpetual fascination for the possibility of sustaining life on another planet leads to a disregard of resources available for the preservation of life on *this* planet. Similar to space in its otherworldly vastness and mystery, the depths of the ocean are as uncharted as the galaxy, despite covering more than 70% of the Earth's surface and containing 50-80% of all life on Earth (Facts and Figures of Marine Biodiversity, 2013). However, this immensity and abundance of life in our oceans is suffering greatly at the hand of anthropogenic pollution and exploitation, which threatens the delicate intricacies of marine life upon which more than 3.5 million people rely (The Living Oceans, 2013).

The vast marine environment undoubtedly has more to offer us than the charismatic mega-fauna we see at SeaWorld. The most important organisms to the sustenance of the oceans are phytoplankton, microscopic photoautotrophic eukaryotes responsible for the production of 45-50 gigatons of carbon biomass per year (Longhurst, 1995). The distribution of phytoplankton dictates biodiversity gradients and species richness around the world and is largely influenced by physical and chemical processes (Stomp, 2011). It is therefore crucial that we as humans understand the implications of our oceanic pollution in order to preserve these organisms, and furthermore the health of the vital marine ecosystem. The majority of the general public is either unaware or misinformed of the danger anthropogenic pollution poses to phytoplankton, and therefore to the intricate structure of the marine food web. It is important, in order to confront our modern environmental dilemmas, that the scientific complexities of climate change are made accessible to the masses. Art can be a powerful tool in building this bridge between science and general public, for both science and art are driven by the insatiable drive to discover (Wagner, 34). By communicating the multifaceted and technical problem of oceanic pollution in a visual manner, the viewer can gain a greater understanding and awareness.

The project involves the photographic exploration of various phytoplankton samples, using the microscope as a means of documenting and abstracting these miniscule organisms to appear as otherworldly planets. The samples are manipulated with plastics, metals, chemicals, dyes, and other agents to simulate an exaggerated portrait of the true environmental threat to phytoplankton due to anthropogenically introduced toxins.

The project's goal is to inspire awareness and understanding of the role phytoplankton play in the survival of the ocean as we know it, and the threat that we as humans pose to these organisms.

It aims to do this by creating a photographic body of work to be displayed and viewed by an audience in an exhibition setting at the University of South Carolina science center.



Julia Bennett



Phytoplankton *Ceratium longipes*

As a marine science major minoring in photography I have long been seeking a way to bridge these two passions in a way that is influential and compelling. While the creation of beautiful images is an accomplishment in itself, the most enduring photography happens when the work speaks to a broader audience, prompting questions, a fresh perspective, and conversation. The marine environment is suffering at the hand of human pollution, most severely at the microscopic level, which is the foundation for all marine life. If the awareness to take action regarding the reversal of this pollution isn't prevalent then soon the largest food source in the ocean will disintegrate. I have already learned so much from the work that I have created thus far, and am deeply motivated to continue this project with the hope that it will make a small difference in the way people perceive their interaction with the delicate and vital ocean environment on a local and global scale.

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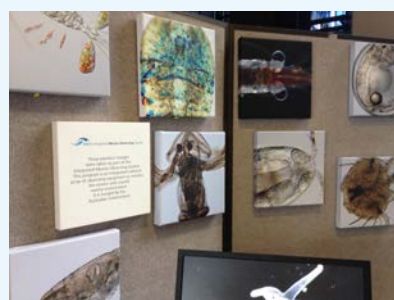
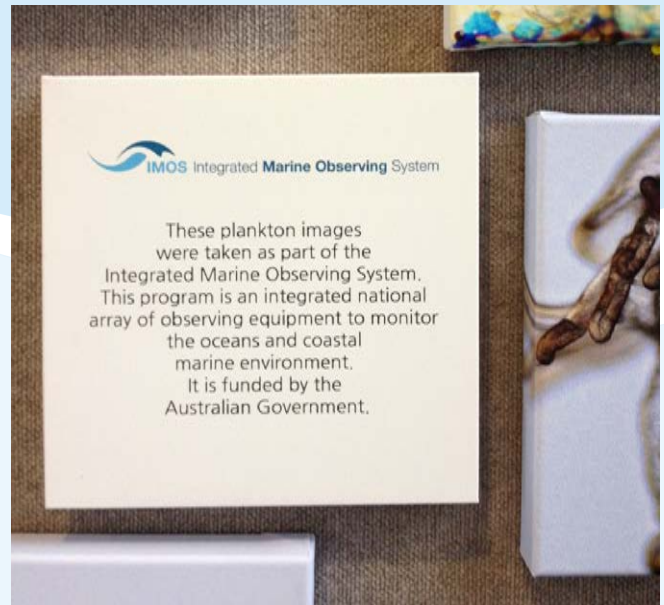
**'Invisible Worlds' -**

Julian Uribe-Palomino and Anita Slotwinski

The IMOS Plankton Team recently had the chance to exhibit some of their work visually during August in a Science and Art exhibition celebrating National Science Week at the Ecosciences Precinct, Dutton Park in Queensland. Julian and Anita exhibited prints and a video installation on behalf of the team.

The ocean teems with microscopic drifting organisms. These organisms produce half of the world's oxygen, yet few people have the opportunity to experience their microscopic beauty. This exhibit was the perfect opportunity to connect plankton and the general community in a relaxed environment through the presentation of these tiny creatures in 'big format'.

The photographic art-work presented intricate details of the planktonic organisms and their variety of colours, textures and structures. The video art-work was a collection of microscopic organisms from live samples collected off the Queensland coast.



Would you like your very own plankton gallery? Contact [Anita.Slotwinski@csiro.au](mailto:Anita.Slotwinski@csiro.au) for a free copy of these high res images and instructions on ordering your own canvas.

## Desert Dust could threaten coral and our food chain

[www.imos.org.au](http://www.imos.org.au)

Published article here:  
<http://aem.asm.org/content/80/11/3285>

A fungal bloom in Australia's coastal waters has been connected to the massive dust storm that started in Lake Eyre Basin and shrouded the entire east coast in 2009. Marine scientists have described the bloom as a 'rare, 'accidental', and 'serendipitous' finding. "This fungus is essentially a terrestrial organism that is extremely tolerant to salt, and this is rare," according to Australia's expert on phytoplankton Professor Gustaaf Hallegraeff from the Institute for Marine and Antarctic Studies, University of Tasmania. In 2009, after 10 years of drought, a cold front swept up about 16 million tonnes of dust from the deserts of Central Australia, and winds in excess of 100 km an hour spurred the massive dust storm—measuring about 500km wide and 5,500km long—to sweep across eastern Australia. An estimated 75,000 tonnes of the dust crossed the coastline and was recorded as far east as New Zealand. In his research findings to be published in June, Professor Hallegraeff suggests that Great Barrier Reef corals and other marine life could be susceptible to disease if more pathogenic strains of fungi develop from future dust storms.

"Dust that originates in deserts is well known to be a vehicle for the spread of microbial communities, and a concern for accidental spread of contaminants and diseases," he said.

The stroke of serendipity was that Australia's Integrated Marine Observing System (IMOS) started collecting plankton biodiversity data using a Continuous Plankton Recorder (CPR) a year before the dust storm. IMOS has developed the first long-term plankton baseline for Australian waters. The CPR was sampling the plankton in the water between Brisbane and Sydney about 3 weeks after the dust storm.

"So we unexpectedly collected massive concentrations of black fungal spores about 30km offshore just after the storm," said Professor Hallegraeff. The black 'oil-looking substance' that was collected and preserved in formalin for study, was also used to later culture the organism in the laboratory. CSIRO marine scientist and University of Queensland Associate Professor Anthony J. Richardson, who leads the CPR survey for IMOS, is particularly interested in how the fungi survives formalin.

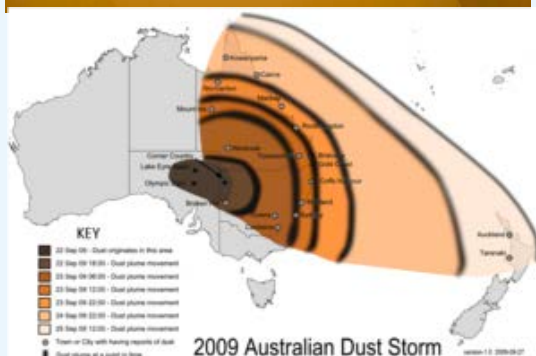
"This is sort of unheard of – formalin is supposed to kill everything." Both Richardson and Hallegraeff hadn't seen anything like the ocean fungal bloom before the 2009 storm, nor have they seen anything like it since.

"Imagine that a lot of this [fungi] is going to grow in the marine environment, and that it is going to do something different there – it is going to produce different chemicals compared to how it behaves on the land," Hallegraeff proposed.

"This is where we are at right now, trying to understand these fungal toxins. Fungal impacts have been well documented in terms of human health and agriculture, but broader impacts on marine impacts remain undocumented."

The scientists are particularly eager to understand the fungus in the light of climate change, as projections suggest extended dry periods, and hence increased potential for dust storms. Their initial research found no soft coral disease outbreak as a result of the fungal bloom, but a number of questions remain. How could this fungus affect fish? How could it affect corals? How does it affect algae (including the symbionts that support the coral)? Is there the potential for it to affect humans? We know that some fungal toxins may accumulate in filter feeders such as molluscs and oysters. So does that mean the fungus could reach the human food chain?

"We have no evidence yet. But now we are aware of it, we can watch for it," Professor Hallegraeff said. "The IMOS plankton survey will enable this kind of exciting research into the future. It highlights the value of sustained ocean observing for studying these unexpected events."



Above: Abundance of fungal spores in Brisbane – Sydney coastal waters on 16 to 26 October 2009, collected on CPR silks.

Left: Extent of the 2009 dust storm.

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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