ASPAB | Australasian Society for Phycology and Aquatic Botany

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# Phyto bytes

ASPAB Membership Newsletter

The Australasian Society for Phycology and Aquatic Botany (ASPAB) is a professional scientific society, formally established in May 1980, that aims to promote, develop and assist the study of, or interest in, phycology (the study of macro- and micro- algae such as seaweeds and phytoplankton) and aquatic botany (the study of aquatic plants) within Australasia and elsewhere. Additionally the society aims to establish and maintain communication between people interested in phycology and aquatic botany. To assist in promoting these aims ASPAB holds and annual conference, produces a newsletter biannually and maintains an email list for members (ASPAB-list).



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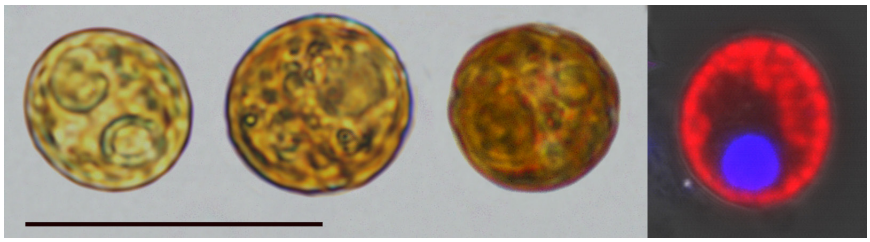
Australasian Society for Phycology and Aquatic Botany



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## Letter from the President

Greetings Aquatic Botanists,

I am sorry to be the bringer of bad news, Jo Kain, a committed long-term member and staunch contributor to the society has passed away, after a long life that included many contributions to phycology and especially to the functioning of our society. Until near the end she attended meetings and always had a good cantankerous question for a poor unwary student speaker (something for all of us to strive for). She will be remembered fondly.

We have a very exciting annual meeting coming at a very picturesque site (Magnetic Island, Queensland). The organization is coming along and new updates can be found in this newsletter, from our mailing list, and on our website. Mark it in your calendar, I think it will be great. I hope you can make it.

We have new members to the committee, and especially our outward profile. I thank Sergio Diaz for pushing our facebook presence (I don't want to say join facebook!), submit something (algal photos, projects), and our newsletter is being made by Charlotte Robinson and Belinda Martin. Thank you all.

The increased profile of the society, more facebook entries, regular newsletters is not only inspiring for old members, but hopefully will drive enthusiasm in new student members. Phycology/ Aquatic Botany is a very unique field, it contains people that are committed to understanding the role and evolution of aquatic photoautotrophs. Sometimes to the point of obsession (while keeping questions in a broader context- as we must do) and that makes for different interests, often very broad. Broad interests and knowledge are always good, phycologists by going to organism-centred meetings are exposed to research outside their narrow interests, always interesting and inspiring. I hope you continue to be part of our society. With this in mind, this is a good time to renew your membership (something we easily forget). It is not very expensive, a couple of cappuccinos, and is used for promoting students through our travel grants.

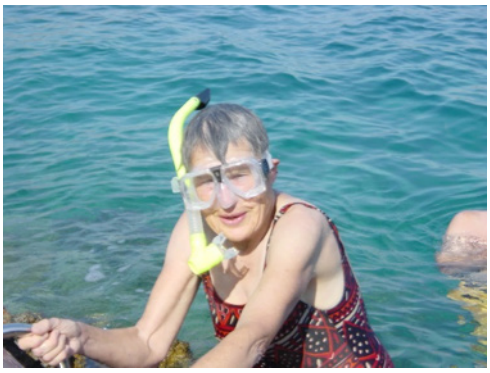
See you at Magnetic Island.

**Joe Zuccarello**

# Contents

# A life well lived: Joanna Jones (Kain) 1930-2017
## By Alecia Bellgrove





Passionate, dedicated, scrupulous, engaged, committed, analytical, independent, witty, argumentative, shy, organised. Jo was an amazing role model of a practising scientist and a mentor for phycologists of several generations.

Born in 1930 in Christchurch, New Zealand, to an English mother and a Kiwi father, Jo moved to London at the age of 2 and spent most of her life in the UK. Her father named her Dorothy Kain, but her mother never liked this and called her Anne. Being incredibly sensible and decisive, she decided to end the debate at the age of 10 and change her name to Joanna, after her favourite doll.

Jo's early education was disrupted with moves to 10 different schools, but when she eventually made it to University College London (UCL) in 1949, she became hooked on science and in particular, marine algae. She recently recalled that she was introduced to the algae by G E (Tony) Fogg, who started his first lecture with a Greek or Latin quotation which meant 'nothing is as foul as an alga' and then effectively proved this to be wrong. UCL did not run a marine field course at that time but Bedford College did and she was allowed to join them when they went to the Isle of Man. This left Jo in no doubt that the algae were the most interesting of the plants. For her undergraduate research project Jo studied the patterns of intertidal zonation around the Isle of Wight, where the tidal ranges differed from the open coast.

Whilst Jo was principally interested in the ecology of macroalgae, she was offered a PhD at UCL under the supervision of Tony Fogg, funded by the Institute of Seaweed Research, to investigate the growth of marine phytoplankton, so she took it and completed in 1957. In 1956 she was appointed 'Algologist' at Port Erin Marine Laboratory, University of Liverpool. It was at Port Erin that Jo first met Norman Jones, whom she later married at the age of 32 and had two children, Martin and Bidda. She remained at Port Erin Marine Laboratory for 44 years.

Jo did not have any undergraduate teaching obligations for the first 16 years of her academic career and was able to devote herself to research (half her luck!). From 1972 she was involved in teaching both a vacation intensive course and the honours course, in which the student numbers increased from 9 to over 30 per year during her time, increasing her access to potential PhD students. Jo successfully supervised 18 PhD students to completion, many of whom have gone on to become important phycologists in their own right, including Emeritus Prof Di Walker (UWA) and Prof Taejun Han (Incheon National University, Korea).

Jo's love of the ocean and adventurous spirit saw her as an early adopter of the mask, fins and snorkel (with a ping-pong ball valve) to snorkel in the early 1950's and allow her to discover a whole new world. Then when the aqualung became available in the late 1950s Jo of course jumped at the opportunity to give it a try. Jo was a pioneer of subtidal research when it certainly wasn't the done thing for a lady, and was barely being attempted by men. She was one of the first women to qualify as a first-class diver, which initially involved diving solo on a line until she later found a buddy in her husband Norman (**pictured above, middle, with Jo in SCUBA gear**) and then subsequently the Chief Diver at Port Erin Marine Laboratory, Mike Bates, kept her in sight. Together they trained many students to dive. Jo was so into diving and research that she even had a special maternity wetsuit made so she could continue her work when she was pregnant with her daughter Bidda!

Jo was less inspired by developing skills to identify different algal species and more excited by their biology and ecology. So she decided to focus her research primarily on just a few, easily identified and abundant species. Jo spent the first 20 years or so (until ~1980) donning the SCUBA gear to uncover the secrets of *Laminaria hyperborea*, the dominant kelp at Port Erin. Her research examined the growth and survivorship of gametophytes and sporophytes of this species, and the various influences

*Continued next page*

of light, depth, latitude, grazing, competition and anthropogenic pollutants. Jo then switched her research focus to the reds for the next two decades, where she was primarily interested in understanding the phenology of a few key species. For example, Jo was fascinated to discover that the critical length of the photoperiod that controlled the phenology of *Delesseria* differed with the life-history phase. During this latter period, Jo also collaborated on a number of research projects that explored the commercial cultivation and economic potential of a suite of red, green and brown macroalgae.

By 1991, at the age of 61, Jo had officially retired; but of course, that didn't stop her from continuing to follow her curious mind into various research projects, and she was supported to do so at Port Erin Marine Laboratory. Following Norman's death in 1997, Jo migrated to Canberra, Australia in 2000, to be closer to her daughter and family. She was now 70 and had recently given up diving. So the ever practical Jo, arranged herself a Visiting Fellowship at the Australian National University, and chose an intertidal project monitoring both a brown crust (which turned out to be *Colpomenia bullosa* crust masquerading as *Ralfsia verrucosa*) and *Hormosira banksii* in some high pools on the south coast of New South Wales for 12 years.

Jo published 61 papers during her working life and then a further 19 following her official retirement in 1991 (**the full list of Jo's papers is available in the appendix**). Her last paper was published in 2015 and presented at the ASPAB conference in Hobart. She already had cancer at this stage.

Jo was a passionate and active phycologist and gave generously to her discipline. She joined the British Phycological Society as a student, attended a total of 44 annual meetings over 47 years, Jo had also become a member of the Australasian Society for Phycology and Aquatic Botany (ASPAB) in 1981, only a year after it was founded, and, after migrating to Canberra, attended all meetings until 2015. She became Treasurer of ASPAB when she arrived in Australia and diligently served in this role for 15 years until retiring due to illness in 2015. It was with great disappointment that Jo was unable to travel to attend the 2016 meeting in Warrnambool. Jo also actively participated in international phycological meetings, including an unbroken run of 14 International Seaweed Symposia. In the 1980s and 90s she was the UK representative on the European Commission Management Committee (COST 48 and 49) encouraging cooperation in the production of marine algal biomass, and organized three workshops. Jo was a staunch supporter of student participation in conferences and workshops and argued vocally for ASPAB to generously dish out Student Travel Grants each year.

Jo was extraordinarily organised and practical, but once she'd considered the options and then decided on the way to do something, you'd be hard pressed to get her to change her mind. She could usually be found with her little waist pack on, complete with all manner of handy items that one might at some stage be looking for. [When recently reading Enid Blyton's Famous Five to my son, I amused myself thinking that Jo would have made a good addition to the little adventurous team, with a pocket knife, box of matches, piece of string, sewing kit and safety pins always on hand.] I'm sure that it was this no-nonsense approach to life that enabled Jo to have such a long and successful scientific career. When I asked her recently how she'd ventured into science and SCUBA-based research at a time when there were many more obstacles than open doors for women, she matter-of-factly told me (almost as if it was a silly question) that she had supportive parents and that she just never thought that she couldn't do what the boys and men were doing! In the words of Jo's daughter: "Growing up with her as a role model, she taught me that being female is never an excuse to not try something – it's merely a matter of how determined you are to succeed."

Jo was diagnosed with terminal oesophageal cancer in 2015. She died peacefully in her home in Canberra on Friday 21 July 2017 at the age of 87, with her reading glasses on and her iPad by her side. Jo decided it was time to go, so she did. She'd had a good life and contributed much to science.

She will be remembered

She will be missed

Vale, Jo

**Acknowledgements**
Special thanks to Bidda Jones for assistance in preparing this article and for the photos from her family collection. Thanks also to Di Walker for some words to encapsulate Jo. A recent biography prepared by Jo was used in preparing this article.

# Have you paid your 2017-2018 Membership Fees?

Membership Fees are due for all existing ASPAB members for the period 1 July 2017 – 30 June 2018.

| Membership Type | Fees $AUD | Fees $NZD |
|---|---|---|
| Full Member | 33.00 | 30.00 |
| Student Member | 11.00 | 10.00 |
| Retired Member | 11.00 | 10.00 |

**For Australian Members:** Please deposit the appropriate amount to the Australian ASPAB bank account, using your NAME as a reference, and email Brooke Sullivan (sullivanb@student.unimelb.edu.au).

**Australian Bank Account Details**

Bank: Bendigo Bank
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Account Name: Australasian Society for Phycology and Aquatic Botany
Account: 154989180

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**New Zealand Bank Account Details**

Bank: ASB
Account Name: Australasian Society for Phycology and Aquatic Botany
Account Number: 12-3066-0228909-00

**For International Members:** Please email Judy Sutherland (aspab.nz@gmail.com) for instructions regarding payment via PayPal.

# ASPAB Committee: Position Available

ASPAB is looking to fill the position of **Treasurer of the Australian Chapter**.

The duties of the Treasurer are to collect and receive all monies from members of the (Australian) Chapter on account of the Society and shall make all payments ordered by the Executive Committee. At the Annual General Meeting, following his/her term of office, the Treasurer shall submit a balance sheet, audited by an Auditor elected at the previous Annual General Meeting. The role requires approx. 2 hours a week and will involve maintaining records of membership and qualifications for student grants, participation in the evalution of student grants and maintaining hard copy records.

For **more information on the role** of Australian Chapter Treasurer, please contact Brooke Sullivan (sullivanb@student.unimelb.edu.au). Please **submit your expressions of interest** for the position to the ASPAB Secretary Jenn Clark (Jennifer.Clark@uts.edu.au).

# Social Media Competion

**Do you have an amazing photograph to share?**

Participate in the first **ASPAB Photography competition**, to promote our society, and **win a wonderful prize**! It is really easy!

Submit a photograph related to any of these topics: **In the Field**, **Macroalgae**, **Microalgae**, **Seagrass**, **Weird and Wonderful Finds**.

How do I win? Simple, the photographs will be published on our Facebook page and Twitter account, just share the posts with your friends and get as many likes as possible! Find the **rules in the appendix of this newsletter** and stay alert for more news on our website www.aspab.org, Facebook and Twitter.
For more information, contact ASPAB Student Representative Sergio Diaz at sergio.diazmartinez@vuw.ac.nz

# Microorganisms Facilitate Uptake of Dissolved Organic Nitrogen by Seagrass Leaves

**By Bonnie Laverock (Auckland University of Technology) & Flavia Tarquinio (Edith Cowan University)**
Co-authors: Jeremy Bougoure (University of Western Australia), Annette Koenders (Edith Cowan University), Christin Sawstrom (Edith Cowan University) & Glenn Hyndes (Edith Cowan University)

*Posidonia sinuosa* seagrass leaves incubated in seawater containing the $^{15}$N-labelled amino acids DON source. ( Photo: Flavia Tarquinio)

Dr Bonnie Laverock is a postdoctoral researcher in the School of Science, Auckland University of Technology. Flavia Tarquinio is currently completing her PhD at Edith Cowan University.

Seagrasses are highly productive marine plants that have specific interactions with their 'microbiome': the bacteria, archaea, microalgae and viruses that inhabit their internal and external tissues. For example, it has long been known that nitrogen fixing (diazotrophic) bacteria inhabiting seagrass roots and rhizomes play a key role in providing 'fixed' nitrogen (N) to the plant[1]. This relationship could contribute to the health and productivity of seagrass meadows, which are widespread in highly oligotrophic environments poor in inorganic nutrients. However, very little is known about what role the leaf microbiome could play in the plant's N uptake. Seagrass plants are able to take up dissolved inorganic nitrogen (DIN) directly, but may be less efficient at absorbing organic N, such as proteins and amino acids, through their leaves[2]. Since the pool of dissolved organic nitrogen (DON) may exceed the DIN pool in some marine environments[3], we asked the question:

**Can the seagrass leaf microbiome support plant N uptake, through the transformation of DON?**

To answer this question, we incubated seagrass leaves (*Posidonia sinuosa*) with seawater containing $^{15}$N-labelled amino acids, as a source of DON. We removed the leaf microbiome from some leaves, and used high-resolution mass spectrometry imaging (NanoSIMS) to measure the accumulation of $^{15}$N in the seagrass tissues, in both the presence and absence of microorganisms. **We found that $^{15}$N accumulation was greatest in seagrass tissues with an active microbiome, compared to leaves removed of microorganisms.** Using a time course of NanoSIMS imaging, we observed the 'movement' of $^{15}$N from leaf surface microorganisms (at 0.5 hours) to the sub-cellular components of seagrass leaf tissue: from the outer cell wall (0.5 hrs) to the vacuole (6 hrs) to the cytosol and chloroplasts (12 hrs). In contrast, in leaf tissues devoid of microorganisms, the level of $^{15}$N enrichment did not differ from control (unenriched) samples, and remained the same throughout the course of the incubation.

Our research suggests that the maintenance of a stable microbiome on seagrass leaves could be pivotal for the N uptake, and therefore the continued health and productivity of seagrass ecosystems.

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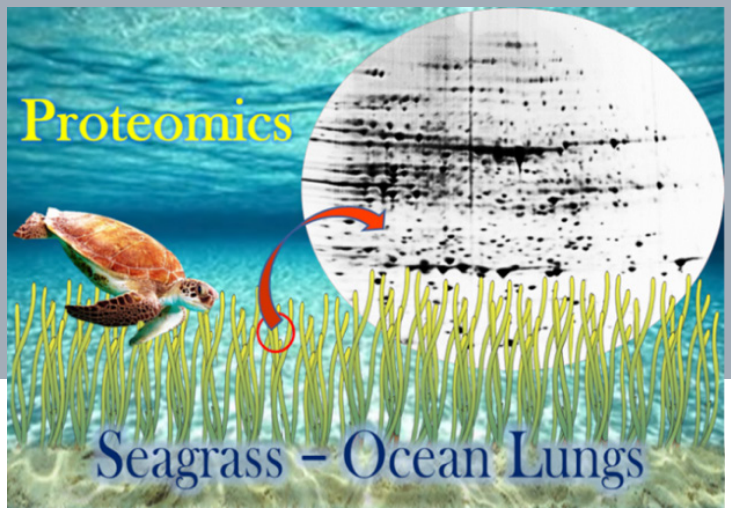
# Dots on the Gel: Unlocking Stress Adaptation of Seagrasses in the Ocean

**By Manoj Kumar**
**ARC-DECRA Fellow**
**Cimate Change Cluster, University of Technology Sydney**
**Manoj.Kumar@uts.edu.au**




**Seagrass proteome profiling using two dimensional isoelectric focusing (2D-IEF) - gel based proteomic approaches to unlock their adaptation mechanism to adverse environments.**

Seagrass meadows (the lungs of the ocean) are descendants of terrestrial flowering plants that have returned to the sea >100 million years ago[1]. Seagrasses are marine ecological engineers – they maintain biodiversity, sequester carbon and stabilise coastlines, and are rated the third most valuable ecosystem with a value of ~ US $29,000 $ha^{-1}$ $years^{-1}$ for nutrient cycling[2]. Yet, seagrasses are declining worldwide at an alarming rate, >7% per year due to global climate change and **Eutrophication and dredging are the major human activities limiting light to seagrass beds and that negatively impact the photosynthetic process of seagrasses, thus impeding their proliferation in the ocean[3].**

With the recent availability of the complete genome sequence of the seagrasses *Zostera marina*[1] and *Zostera muelleri*[4], molecular information based on systems biology (integration of transcriptomics, proteomics and metabolomics) is slowly emerging to answer critical questions: **How will seagrasses acclimate/adapt to changing ocean conditions and resist damages caused by human activities.**

I was awarded an ARC-DECRA postdoctoral fellowship, to undertake seagrass proteomics research at the University of Technology Sydney Climate Change Cluster (UTS-C3). Proteomics offer one of the best options for the functional analysis of translated regions of the genome and generate much detailed information about the intrinsic mechanisms of plant stress responses. I am largely exploring gel-based and gel-free quantitative proteomic techniques to identify protein biomarkers that could be used as early indicators to detect acute/chronic (a)biotic stress in seagrasses to monitor seagrass health.

Towards this, I have recently developed an efficient protein extraction method compatible with LC-MS/MS for seagrass proteome research. This method is basically a Borax/Polyvinyl-Polypyrrolidone/Phenol (BPP) based protein extraction that contains both ionic and non-ionic detergents in an extraction buffer. Proteins extracted with this protocol when processed for two dimensional isoelectric focusing (2D-IEF) using CUP LOAD methods result in a higher protein yield, and good quality 2-DE maps with a higher number of protein spots (so called **dots on a gel**) from Australian seagrasses (for details see reference 5). I have linked these dots to specific proteins with specific functions belonging to the Calvin-Benson and Krebs cycles, glycolysis, the glycine cleavage system of photorespiration, and the antioxidant system in seagrass *Z. muelleri*, revealing its acclimation/tolerance mechanism to high and low light conditions. These proteins, together with those from the inter-connected glutamate-proline-GABA pathway, shaped *Z. muelleri* photosynthesis and growth under altered light conditions (for details see reference 2). The partial findings of this research were presented at the 30th ASPAB conference held at Deakin University, Warrnambool (2016). With these breakthrough findings, I am progressing my research to characterize sub-cellular proteome and post-translational modifications in seagrasses using labeled quantitative proteomics approaches to provide better insights on the complex biological processes and phenotypic responses of seagrasses under the scenario of global climate change and anthropogenic perturbations.

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# Are We Finally Decoding the Biology of Coral Algal Endosymbionts (*Symbiodinium* spp.)?

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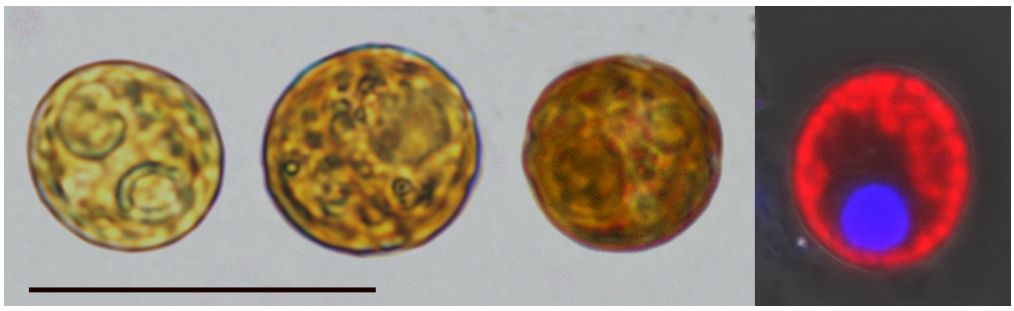
Dinoflagellates of the genus *Symbiodinium* are globally important microalgae, most notoriously for their role as endosymbionts of reef building corals. Not only does *Symbiodinium* photosynthetic activity regulate reef building coral growth, it also acts as the Achilles Heel to drive coral bleaching when growth conditions become unfavourable. Researchers have therefore not surprisingly attempted to unlock the biology and ecology of *Symbiodinium* spp. for over half a century now, but we are arguably only now beginning to decode and demystify what makes *Symbiodinium* such a successful genus. In order to do this, we as a community have had to re-orientate our persistent fields of focus[1]. What we thought we needed to know is fast changing.



**Composite image of *Symbiodinium* cells freshly isolated from four different coral hosts under 100x objective. Scale bar is 20 µm. Fourth cell is a confocal image with Chl fluorescence and DAPI stained nucleus in blue. (Images by Matt Nitschke, Postdoctoral Researcher, University of Aveiro and University of Technology Sydney)**

Much of our biological knowledge of *Symbiodinium* to date has stemmed from "model strains" maintained as cultures for decades; strains that arguably have restricted ecological implications depending on the questions asked. However, genetic diversity of the genus *Symbiodinium* is vast – amazingly, the type species that gave rise to this genus (*Symbiodinium microadriaticum*) has only just been validated after 55 years[2] – and current estimates indicate that hundreds of species (and thousands of genetic variants) likely exist. Knowledge obtained from model strains is unquestionably fundamental to identify the likely biological mechanisms that underpin ecological success, but applying this knowledge to such broad (phylo)genetic diversity has needed a new approach – adopting functional diversity: screening across variants for the key traits of interest. This is now driving the need to expand on the number of isolates in culture and adopt innovative high throughput platforms – such a challenge is not trivial given that cryopreservation is still not an option, contamination checks require routine molecular sequencing, and that we still do not understand how to maintain a large number of variants as successful free living cultures. Despite these challenges, *Symbiodinium* functional diversity in concert with molecular ecology is beginning to establish a more robust set of "rules at play" towards ecological (and evolutionary) success[1].

We need to strip our biological knowledge 'back to basics'. In efforts to better understand how Symbiodinium regulates coral health, many of us have focused on how *Symbiodinium* spp. responds to stress – this has meant a focus on characterizing 'second-order' traits, such as secondary metabolites, as opposed to the 'first-order' traits that are in fact the foundations for functioning considered "central"[1]. This is an important distinction since it is the first-order traits that functionally connect cellular performance to the immediate environment, notably resource (light and nutrient) availability, acquisition and usage. Understanding plasticity in resource acquisition has been largely overlooked for *Symbiodinium*, but needs rapid attention if we are to develop and apply models that explain competitive success over time, and in particular into the future as reef environments continue to rapidly change. Whilst we have always rested on the need to resolve second-order trait regulation, we are starting to realize that this is impossible without core understanding of such first-order traits.

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Such (re)-orientation of focus has arguably come to a head because of our explosion of interest in functional genomics, and the capabilities this brings to more innovative ways to understand and manage (reef) ecosystems[3]. Dinoflagellates such as *Symbiodinium* require that we think very differently about genetic control of the emergent traits regulating success compared to other model eukaryotes. What is clear is that second-order trait selection is a critical determinant for stress tolerance[3] but importantly (and excitingly) can be potentially inherited over time under persistent stress exposure[4]. However, how first-order trait expression must be altered (selected for) to meet this goal remains a blank canvas. This is critical to resolve since trading-off resources from first- to second-order traits may ultimately restrict the competitive ability of stress-specialist cells. Determining fundamental versus realized niche performance of *Symbiodinium* spp. now and into the future will be critical to understand just how such "super" symbionts can ultimately aid coral survival.

Clearly we still have a long way to go, but it seems that we are finally positioning ourselves to better resolve what makes *Symbiodinium* tick; not only through technological development and adopting new tools to examine *Symbiodinium*, but perhaps by starting to ask the 'right' questions. Need certainly drives innovation, and re-orientating our focus undoubtedly represents the drive for solutions desperately needed to aid the future survival of coral reefs.

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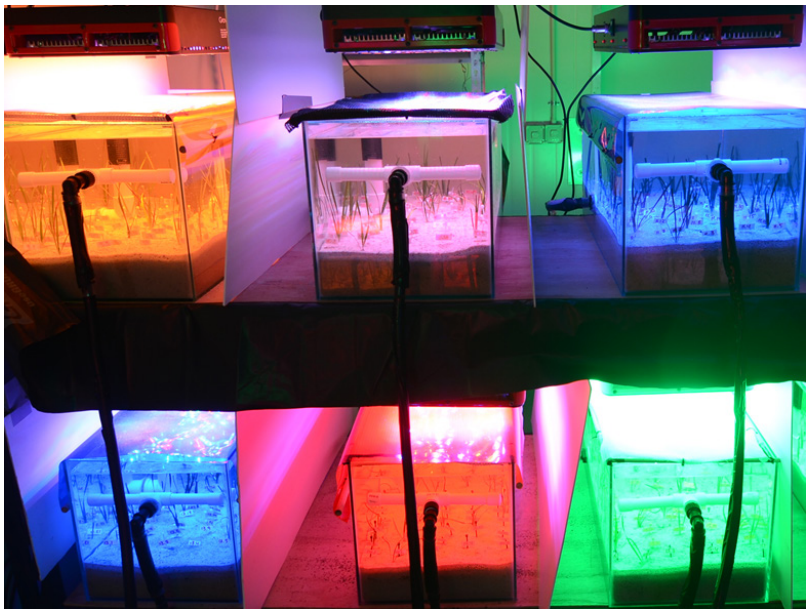
# Light Quality Impacts on Seagrass

**By Simone Strydom**
**PhD Student, Edith Cowan University**

Seagrass meadows provide important ecosystem services to the coastal zone but globally are threatened. Seagrass loss to date has mainly been attributed to anthropogenic activities that reduce light quantity, such as dredging, declining water quality from urban and agricultural run-off and eutrophication. However, light quality (wavelengths of light) is also altered by these anthropogenic stressors as well as natural events. The aim of this research was to start filling some major gaps in the light quality research arena, with particular focus on characterising light quality to which seagrasses are exposed and how they respond to changes in narrow light quality wavebands as well as a simulated dredging spectrum shift.



**Left:** Seagrass (*Posidonia australis*) seedlings growing under different light quality treatments (red, yellow, green, blue and full-spectrum). **Right:** Measuring light quality in the Swan River using an underwater hyperspectral radiometer developed by In-Situ Marine Optics

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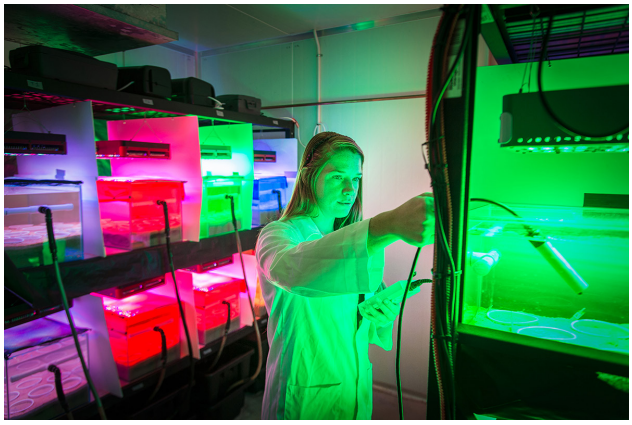
The field work demonstrated that the quality of light to which seagrasses are exposed varies along a natural gradient but the nature of the shift is also dependent on time of year. Additionally, human impact such as dredging can expose seagrasses to spectra outside of the natural range detected in this study, and the magnitude of this shift is dependent on depth and TSS concentrations. Results from light quality experiments demonstrated, for the first time, the seagrass responses to light quality across several plant scales as well as different life-history stages. *Halophila ovalis* and *Posidonia australis* showed different responses, likely due to their respective growth strategies, the former being a fast-growing colonising species, the other a slow-growing persistent species. Adult *H. ovalis* plants were negatively impacted by monochromatic blue (λ=451 nm), green (λ=522 nm) and yellow (λ=596 nm) light treatments, while seeds and seedlings performed better under red (λ=673 nm) and full-spectrum light (λ=400 – 700 nm, at 200 µmol photons $m^{-2}$ $s^{-1}$)[1]. Conversely, *P. australis* adults showed no significant responses to any of the monochromatic light quality treatments, while seedlings demonstrated a physiological acclimation to blue light. The adult experiment was performed over 9 weeks and it is possible that over a longer period adult plants might show a response. Nonetheless our findings indicate that this persistent species can resist changes in light quality for short periods of time (i.e. <9 weeks).

Following these experiments, we tested the interactive effects of light quality and quantity representative of a commercial dredging operation (15 mg $L^{-1}$ TSS, 50 and 200 µmol photons $m^{-2}$ $s^{-1}$). This simulated dredging spectrum experiment demonstrated a significant impact of reduced light quantity on *H. ovalis* photo-physiology and growth, but the only significant effect of light quality was on the concentration of the pigment antheraxanthin[2]. The lack of effect of light quality on growth indicates that: a) while seagrass are sensitive to changes in light quality, not all shifts induce negative biomass responses; b) the effects of altered light quality are less severe when a mixture of wavelengths are present; and c) in this species, reduced light quantity was more important than changes in light quality.

Overall, while there were some (positive and negative) responses to blue, green, yellow and red light, mass die-off was not detected for either the colonising or persistent species, suggesting that seagrasses have the capacity to acclimate to and/or tolerate extreme changes in light quality and maintain short-term growth at sufficiently high irradiances. However, sub-lethal responses were determined which may affect the ability of seagrasses to maintain resilience against other stressors. For example, processes that simultaneously alter light quality and reduce light quantity to sufficiently low intensities may impact the characteristics (i.e. carbohydrate reserves)



Simone Strydom testing the effect of light quality on seagrass (*Halophila ovalis*) seed germination

that assist seagrasses to remain resilient against other stressors, and any loss of resilience ultimately reduces the long-term viability of populations[3]. This work suggests that from a management perspective, changes in light quality may be less significant for persistent species than for colonising species such as *H. ovalis* which displayed stronger responses to altered light quality. Some specific suggestions for managing long-term light quality impacts on colonising species include: measuring downwelling irradiance [$E_d$ (λ)] in impacted areas (i.e. under plumes) to determine how acute the attenuation of red and blue wavelengths are, and to monitor several plant response variables as indicators. Particular focus should be given to colonising species occurring at deep sites (> 3 m) as the effects of reduced red light and shifts towards predominantly blue light will be more extreme. If conditions occur where red light becomes absent and minimum light quantity thresholds fall below 6 mol photons $m^{-2}$ $d^{-1}$ then management actions should be applied that will abate loss, for example, move the dredger to a different location or cease dredging periodically until light quantity rises above the threshold value again.

This work formed part of the WAMSI Dredging Science Node, which was designed to fill a very large gap in our understanding of how dredging activities effect the marine environment. This includes defining thresholds of indicator responses by corals, seagrasses and filter feeders to dredging-related pressures. Some of the results from the seagrass project (Theme 5.5) are described in this article; access to full-reports and of other Themes can be found here: http://www.wamsi.org.au/dredging-science-node/dsn-reports

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# Defining the Microbiome of a Key Marine Ecosystem Engineer, the Seagrass *Zostera muelleri*

**Valentina Hurtado-McCormick[1*], Thomas Jeffries[2], Tim Kahlke[1], Peter Ralph[1], Justin Seymour[1]**
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Seagrasses are the only flowering plant that have adapted to the marine environment, and seagrass meadows extend for thousands of kilometres of coastline within six global bioregions in both, temperate and tropical areas around the world[1,2]. Australia possesses the highest diversity of seagrass species and the most extensive seagrass beds (i.e. meadows) worldwide, which cover around 2,148,217 ha across a coastal region spanning 59,679 km[3,4].

Seagrasses are important for several reasons. They provide highly valuable ecosystem services, worth USD$3,801x$10^9$ $yr^{-1}$, which substantially exceeds the value of other highly valued marine and terrestrial habitats, such as coral reefs (USD$375x$10^9$ $yr^{-1}$) and croplands (USD$128x$10^9$ $yr^{-1}$)[5]. In addition, seagrasses play essential functions in global nutrient cycling, significantly contributing to carbon sequestration, the process by which excessive carbon dioxide is removed from the atmosphere. Today, more than 10% of all the carbon buried in the oceans is stored in seagrass meadows[6]. Moreover, seagrasses are considered key habitat forming species[7] and ecosystem engineers[8].

We know that microorganisms play critical roles in the development and growth of terrestrial plants, while within benthic marine systems, such as corals and sponges, we know that these relationships might respond to different environmental conditions and shift dramatically across particular microenvironments within the host. This framework progressively contributed to the development of the microbiome concept, originating from research in human-microbes interactions and firstly defined as the 'ecological community of microorganisms associated with a host'; it was later revised to include all their combined genetic material in a given (micro) environment[9,10].

Substantial advances in the fields of molecular biology and genomics have allowed us to explore the complex world of microbes within natural ecosystems, and despite considerable progression on microbial community analysis in a wide range of benthic marine organisms (e.g. corals, macroalgae, and sponges) and terrestrial plants[11,12,13], the relationships between seagrasses and microbes, and how they respond to the environment, are poorly understood.

Using DNA sequencing data, we described the composition of microbial communities associated with different microenvironments within the seagrass species *Zostera muelleri*, one of the three most widespread genera in New South Wales (NSW). We compared microbial dynamics at the plant scale with the changes driven by varying environmental conditions, and for the very first time we defined the core seagrass microbiome(s) (**Figure 1**). We found different bacterial communities associated with different parts of the plant, with conservation in the nature of the microenvironmental partitioning occurring across regional scales, whereby we analysed seagrass microbiomes from four different coastal and estuarine habitats in NSW. Like bacteria, microalgae also displayed partitioning in community composition between different seagrass microenvironments, with patterns conserved over regional scales and distinct and more diverse communities associated with seagrasses from fresh water habitats.

Our analysis of seagrass-microbes relationships and their potential role on seagrass function and health contributes to the imminent need of a new understanding of seagrass ecology to predict the influence of environmental change on these critical coastal ecosystems.

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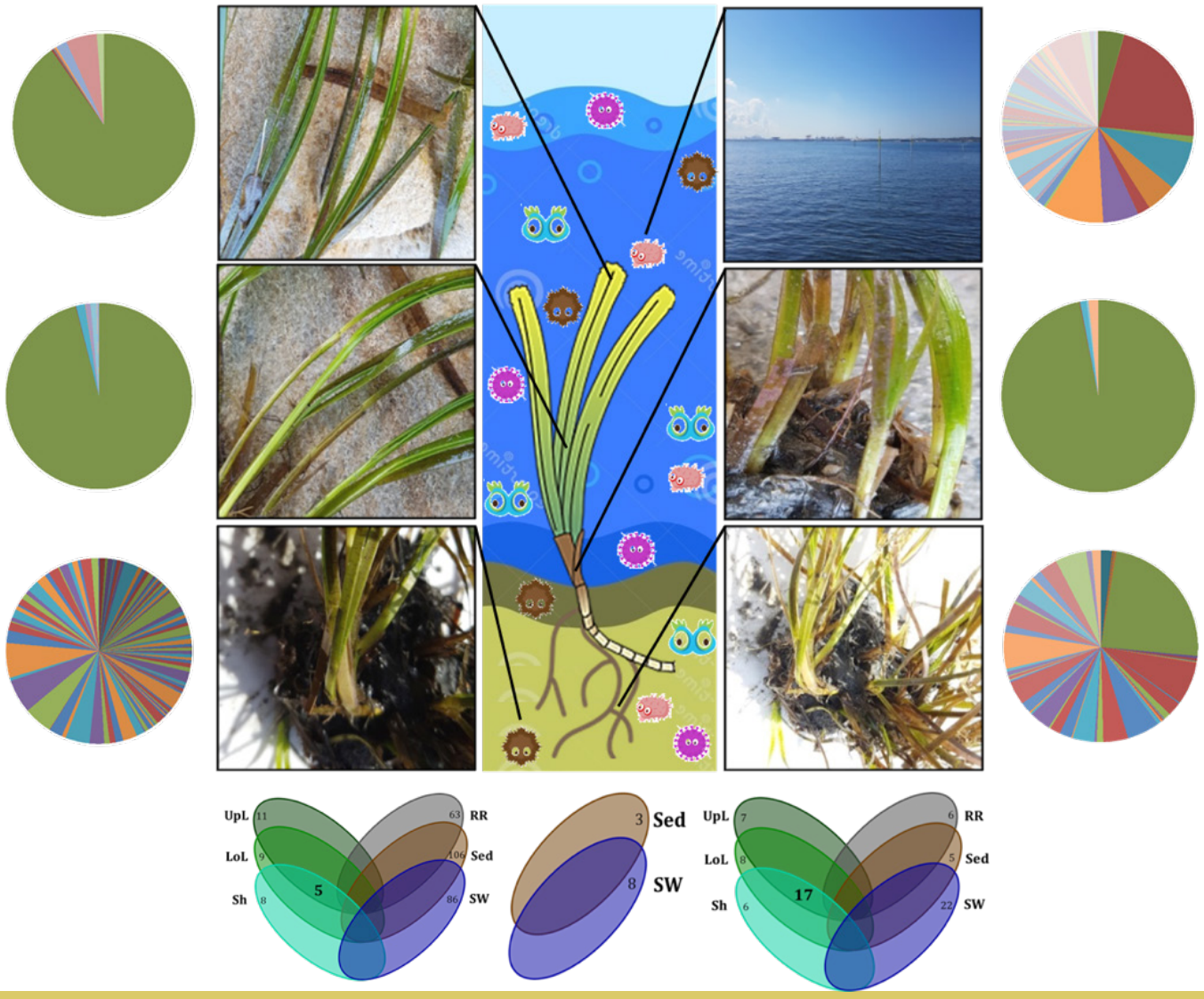


**Figure 1.** The *Zostera muelleri* microbiomes[14]. Samples were collected in four distinct coastal and estuarine habitats around NSW (i.e. regional scale), each influenced by varying environmental conditions and levels of human impact, taking plant tissue from upper (**UpL**) and lower (**LoL**) leaves, sheath (**Sh**), roots and rhizomes (**RR**) surficial sediment (**Sed**), and adjacent seawater (**SW**) (i.e. plant scale). Microbiomes were identified at the plant scale for bacteria, microalgae, and fungi (circle charts), and persistent members within each community were designated as core microbiomes (Venn diagrams).

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# Reconnecting Art in Science – Antarctic & Indigenous Perspectives

**by Dr Lisa Roberts, School of Life Sciences, University of Technology Sydney, with Professor William Gladstone, Interim Dean of Science, University of Technology Sydney**
**Editorial assistance, Barbara Cuckson, Rozelle School of Visual Arts, Sydney**

**Facebook: Living Data: True to Science, Clear in language, Engaging senses**
**Facebook: Euphausia Superba**
**Twitter: @roberts_lisa**
**Instagram: @livingdatakitchen**

Since ancient times the world has been explained through methods that we now call art and science; art understood as the subjective response and science as a problem-solving vehicle. In Aboriginal culture, these ways of discovery co-exist, in order to keep alive a traditional knowledge of how to live in harmony and not in conflict with nature. Today, art and science co-exist in the emergent global community of Antarctic researchers, and similarities in Antarctic and Aboriginal expressions of connection and understanding can be identified. The potential of these expressions of connection, combined with our present scientific information, provide the substance for a necessary and urgent reconciliation with nature at this time. There is today, an urgent need to pass on knowledge that is vital in order for us to adapt to untimely climate change.

There was a time in Western culture, exemplified by the work of Leonardo Da Vinci, when making art was a vital part of investigating how the natural world works; the whole person was involved in the creative process of growing and sharing knowledge. However, the gradual division of the concepts of scientist and artist arose as 'experts' in different methods worked separately and for different reasons. Art became regarded as the province of merely emotional reaction; science became more respected as the intellectual province of reason. More recently, and in the context of Antarctic culture, the lines of demarcation blurred once again, as the scientist again embraced art .

This was historically marked by the introduction of photography. Since 1897 photography had been used as a means of recording and communicating Antarctic explorations. In 1911 photographers demonstrated this new technology, both as an art form as well as a means of mechanical representation: the camera of Frank Hurley described Mawson's Australasian Antarctic Expedition and also Herbert Ponting depicted Scott's last expedition. We recognise art and science as co-existing in the emergent global community of Antarctic researchers, and identify similarities in Antarctic and Aboriginal expressions of connection and understanding. We acknowledge the potential of these expressions of connection combined with scientific information, for our reconciliation with nature in this time of urgent need to pass on knowledge that is vital for us to adapt to untimely climate change.

In 1987 the Australian Antarctic Humanities program was born, with three Australian artists chosen to accompany a scientific expedition to Antarctica with the Australian Antarctic Division (AAD). In the Foreword to the catalogue of their subsequent exhibition, Australian Minister Graham Richardson writes, "...Twentieth-century Antarctica has essentially been the province of scientists". No reference is made to the arts that distinguish Antarctic communities, as relationships grow through experience of generating new knowledge in a unique place. More work is needed to recognise the arts of Antarctic scientists and their potential to bring new audiences to science stories. Much of this material is ephemeral and exists in private collections around the world. Other works, like the musical, Antarctica (2016), produced by scientist Dana Bergstrom, is published and presented to bring climate science to a global audience.

The AAD maintains a website for networking within and beyond the Antarctic community, and its Arts Fellowship programme is one of several around the world that hosts artists in Antarctica. Others include the British and American Antarctic Artist's and Writer's programmes, and the New Zealand Community Engagement Programme. The Sur Polar programme (Argentina) has hosted many artists to create and present works in situ, with scientists and fellow artists involved in developing performances. It now presents recordings of performances around the world as video installations, with other art inspired by Antarctica and its science.

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Examples of the art works created through the Sur Polar programme are the video, New Species, by Andrea Juan, and Lorraine Beaulieu's installation, Drapeaux. Juan's work attracts attention to scientific predictions of new species in Antarctica with global warming, with spherical forms of complex patterns that suggest that fashion designs for humans have infiltrated natural systems. Beulieu's installation reveals the artist's naked body in embryonic form, arranged to resemble Antarctic bedrock as it would appear without ice: vulnerable and unprotected.

Sur Polar was the inspiration for Living Data, the program I created in 2012 to make and present responses to climate change. The term Living Data was coined by my PhD supervisor Simon Pockley to identify what he saw I was doing: interacting with scientists and other artists to bring scientific data to life. My main collaborator is scientist William Gladstone, Head of School of Life Sciences at University of Technology Sydney. Ongoing interactions with the Antarctic community open up opportunities for us all to reach new audiences. AAD Arts Fellows and Sur Polar artists regularly feature in our programme. Our installation, Oceanic Bliss, contributed to the 2016 Sur Polar event in Madrid, of international responses to climate change. Sur Polar continues to foster the sense of belonging that exists within the Antarctic community. However, its focus has shifted from Antarctica and its science, to Cantabria (Spain) and its archaeological evidence of human origins. Andrea's current work is to create, facilitate and present art that celebrates humans as part of nature, through experience and understanding of the place of our collective origins.

**Andrea Juan, Forgotten Words, Video installation (2016)**

In both Aboriginal and Antarctic arts we find clarity in language that reflects balance between art and science, and so it seems likely that Indigenous ways of knowing are specially recognised by people who have worked in remote places like Antarctica. For example in Chris Drury's digital print, Explorers at the Edge of the Void, lines of text are written over lines of an actual echogram that was generated in Antarctica to 'see' through glacial ice. The lines describe geological time. Written words evoke human presence: names of scientists and explorers whose collective knowledge builds an evolving big picture of human impacts on the natural world.

The first in-depth and sustained interactions between what we now call art and science, were practised by our ancient forebears, such as in stories passed down about best fishing practices. The painting, Broulee catch, by Indigenous Australian artist Guindri (a.k.a. Paul Davis) shows his continuing connection to the ocean, along the east Australian coast where whales journey to and from Antarctica. The painting shows relationships between seagrass, fishes and people. It could represent the whole Australian coast. It may also serve as an icon of connection, with its balance between what is known from experience and from science.

Recognition of multiple experiences of the same reality may bring together more people to share strategies for passing on stories we believe are true, as far as we can tell at this point in time, with all the evidence that's available. As the Age of the Anthropocene advances we see a shift towards collective, relational, interdisciplinary approaches

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**Guindri (a.k.a. Paul Davis), Broulee catch, painting (2017)**

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to making sense of our place in the world. In the field of climate art-science interactions the shift is happening through global networks like Living Data, that are mostly led by artists, with links to scientific, academic, commercial, and not-for-profit organisations. Living Data interacts with other programs that include Cape Farewell, London, led by artist David Buckland; Lynchpin, Hobart, led by artist Sue Anderson; and Climarte, Melbourne, led by lawyer Guy Abrahams.

The chief scientist on the ship that took me to Antarctica (V7 2002) was Dr John Church, from the CSIRO. As we travelled south he explained his research into rising sea levels. It was John who convinced me that climate change was real, and it was more than his data that opened me up to accept the reality. The day we arrived at the Amery Ice Shelf,

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I witnessed his response to news relayed by satellite phone, that George Bush and John Howard had refused to ratify the Kyoto protocol. This was the first time I had witnessed an emotional response from a scientist, to his data. Data collected from above and beneath Antarctic sea ice are essential for identifying and monitoring shifts in the normal cycles of climate change caused by our massive burning of fossil fuels, and for understanding human impacts on the mating behaviours of marine creatures.

Just as Aboriginal story-telling works through the voices of elders rendered through visual and performing arts, to share knowledge believed to be important for the survival of the community, so scientists share stories through the arts to make meaning of climate change data.

**William Gladstone, Full Moon, Photograph (2017)**

Our next steps?

Two projects:
Lunar time - An investigation of between lunar cycles and life beneath Antarctic ice and sacred springs of Australia.
Beware of Pedestrians telling stories: expect evidence and awe. Digital puppetry is used to relate Western science and stories from Aboriginal dreaming.

## Research Activities

# NSW Deep Green Biotech Hub: Brings NSW to the forefront of algae-based biotechnology innovation in Australia

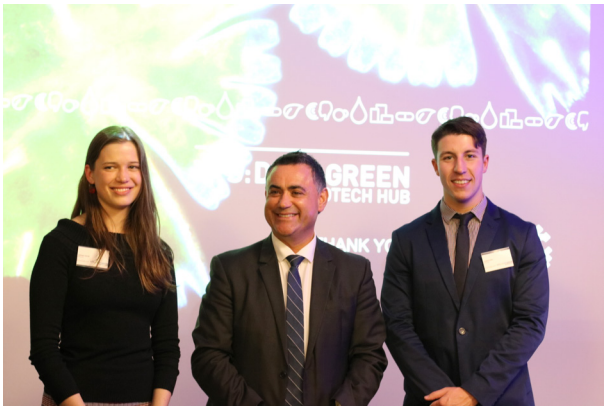
**by Dr Pavlina Sasheva Naydenova**
**Manager, Deep Green Biotech Hub**
**University of Technology Sydney**

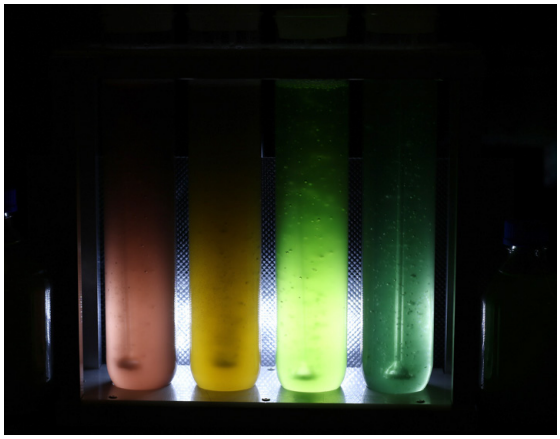
The NSW Deep Green Biotech Hub is located in the vibrant University of Technology Sydney (UTS) campus at Sydney's CBD-fringe and has the ambition to champion the bio-based economy in the state through algae biotechnologies. The Hub provides opportunities for students, entrepreneurs and industry to connect and advance ideas for algae commercialisation through various programs.

Established in 2016, the Hub was made possible through a 1-million-dollar grant through the Boosting Business Innovation Program of the NSW Government. Earlier this year, the NSW Deputy Premier and Minister for Regional NSW and Small Business John Barilaro announced additional support for the business innovation program at the Algae Showcase event hosted by the NSW Deep Green Biotech Hub.


The event took place at the Dr. Chau Chak Wing Building (UTS) on the 26th July and provided an opportunity for NSW-based businesses to network with NSW Government, researchers, investors and students. Displays involving technologies for different algae applications sparked conversations around new partnerships. Professor Peter Ralph, director of UTS: Climate Change Cluster and project lead of the NSW Deep Green Biotech Hub described several new opportunities to support early adopters of algae biotechnologies (which will be announced soon).

**Top:** Professor Peter Ralph, Director UTS: Climate Change Cluster and NSW Deputy Premier John Barilaro discuss algae applications at the Algae Showcase Event
**Right:** NSW Deputy Premier John Barilaro with Jarnae Leslie and Thomas King from UTS Bachelor of Creative Intelligence and Innovation at the Algae Showcase Event
**Bottom Right:** Display of microalgae, left to right *Porphyrdium*, *Chaetoceros*, *Chlorella*, *Spirulina*





During the event, the Hub provided a snapshot of recent activities that included a Sustainability Think Thank for the UTS: Hatchery led program STEAMpunk Girls, where they explored how algae fits into the Future Earth concept. Another larger engagement is occurring with the Faculty of Transdisciplinary Innovation through mentoring of undergraduate students from the UTS Bachelor of Creative Intelligence and Innovation (BCII) program was also presented. The BCII students presented their ideas around Food and Algae and explained how design thinking can be utilised for understanding people's perceptions towards new food trends.

For more information and future events, contact algaebiotech.hub@uts.edu.au or subscribe for the newsletter at **https://deepgreenhub.uts.edu.au**

# TeaComposition $H_2O$: The Mud, Microbes and Molecules Initiative

**by Dr Stacey Trevathan-Tackett**
**Postdoctoral Fellow, Blue Carbon Lab, Deakin University**

**Twitter: @BlueCarbonLab**
**Twitter: @stacey_teetee**
**Web: Blue Carbon Lab Website**

Earlier this year, the Blue Carbon Lab launched the global TeaComposition $H_2O$ initiative. TeaComposition $H_2O$ aims to assess the carbon sequestration capacity of marine and freshwater wetlands across the world via tea decomposition. In essence, we are sacrificing perfectly good bags of Lipton tea for science.

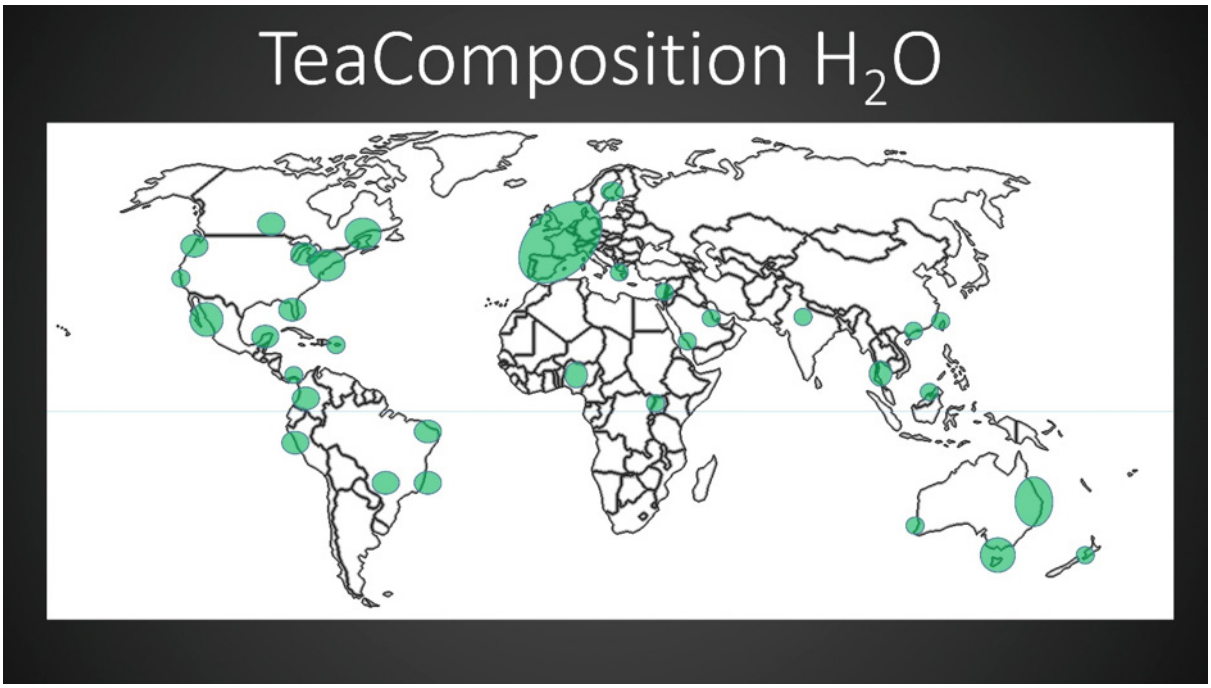
Born out of the terrestrial TeaComposition initiative led by Dr Ika Djukic (Environment Agency Austria), this wetland initiative is using green and red tea bags as standardised proxies for litter. Over the next three years, we will be tracking biomass and carbon decomposition as well as the microbial communities driving the decomposition process. At the moment, we span more than 30 countries (and growing) and a diversity of habitats (seagrass, mangrove, saltmarsh, inland wetland, lentic, lotic and macroalgal ecosystems).

This initiative is ideal for fellow ASPABers who already work in these marine benthic ecosystems, are interested in why some wetlands sequester carbon better than others and want to see how their wetlands stack up to others around the world.

**Top:** Sacrificial Lipton teabags.
**Bottom:** The study will involve collaborators and habitats across the globe.

If you are keen to learn more, please email me at **s.trevathantackett@deakin.edu.au** and checkout the official invitation at the **Blue Carbon Lab Website**.

Don't forget to check out our regular Functional Ecology guest blog **Insite/Out** and 140 character updates from our TeaComposition H2O colleagues **@BlueCarbonLab**, **@stacey_teetee** and **#TeaCompositionH2O**.




## Research Activities

# A Seagrass Restoration Network

**by Dr Elizabeth Sinclair**
**Senior Research Fellow**
**University of Western Australia**

A group of Australian and New Zealand marine scientists and managers converged on Deakin University's Geelong campus, to talk seagrasses in July 2016. The workshop was led by Deakin University's Craig Sherman and Gary Kendrick from the University of Western Australia.

The principle aim was to assess our capacity and readiness for seagrass restoration in Australia and New Zealand and generate momentum in developing long term nationally coordinated restoration programs.

Participants at the inaugural workshop in Geelong, July 2016.
**L-R:** Rod Connolly, Elizabeth Sinclair, Paul Maxwell, Adriana Vergés, Craig Sherman, John Statton, Fleur Matheson, Kor-jent van Dijk, Marnie Campbell, Michelle Waycott, Michael Rasheed, Andrew Irving, Simon Branigan, Gary Kendrick, Emma Jackson, Eric Paling.

[absent from photo: Brooke Sullivan, Chris Gillies, Jeff Ross, Peter MacCreadie, Steffan Howe]

Seagrasses have been declining globally at a scale similar to corals and mangroves and restoration is a challenge for current practices. The marine environment is also particularly difficult to restore, as both water and the sediment are constantly moving. However, recent successes by Australian researchers have demonstrated that seagrass restoration is possible, and scalable, and with the right resourcing can contribute to reversing the losses.

Restoration of our seagrass habitats has extremely important knock-on effects for coastal environments – improving recreational and commercial fishery stocks, coastal erosion control, water quality, and carbon sequestration.

Being able to share and promote restoration success stories, advances in techniques and create discussion around this is important for expanding small-scale restoration trials into larger scale restoration activities. The network will focus on:

1. How we can develop programs across regions to move seagrass restoration from small targeted activities with specific industry and government agendas to a nationally coordinated and integrated program for recovering and restoring our nearshore coastal habitats.
2. Is the science behind seagrass restoration mature enough, and what research is needed to move seagrass restoration forward so that it can be implemented nationally?
3. Developing a network of restoration scientists and practitioners that can communicate successes and learn from failures more broadly that can be integrated into the management framework and government policy for our coastal waters?
4. Are we ready to expand the research and practice in demonstration projects across temperate and tropical ecosystems and to work with other marine ecosystem restoration researchers (mangroves, kelp, shellfish, seaweed) for a multi-systems approach?

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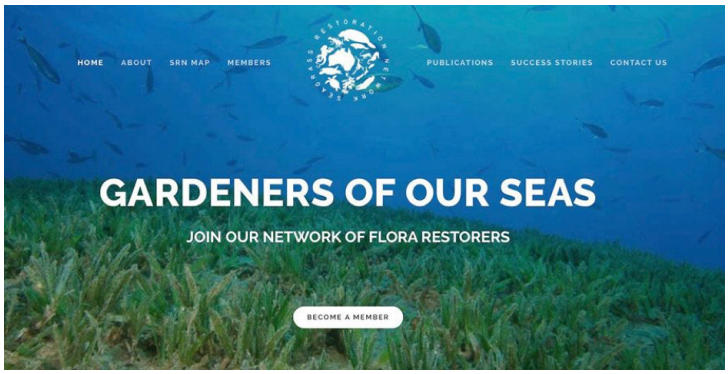



Screenshot of the homepage.

The first key outcome was to develop a website, using funds kindly made available through The Nature Conservancy and Deakin University, from which researchers across the region can share outcomes. Please join us if you are interested in restoring seagrass. For more information visit our new website: **www.seagrassrestoration.net**

**Or contact:**

Dr Craig Sherman (Deakin University, School of Life and Environmental Sciences, craig.sherman@deakin.edu.au)

Professor Gary Kendrick (University of Western Australia, School of Biological Science and Oceans Institute, gary.kendrick@uwa.edu.au)

# Visualising Phytoplankton along their Drift Trajectories

**by Martina Doblin**
**Associate Professor**
**Productive Coasts, Climate Change Cluster**
**University of Technology Sydney**

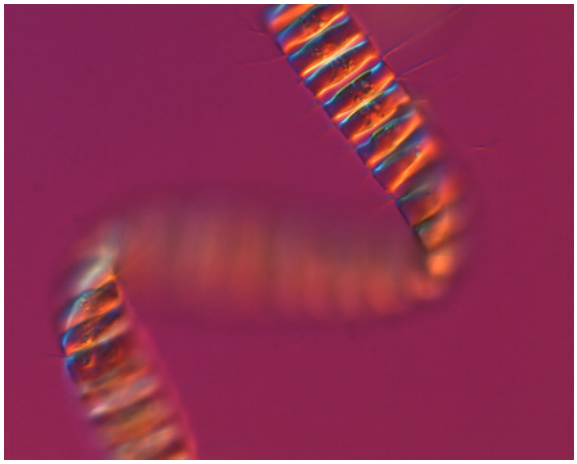
**Media Profile**
**Twitter: @MartinaADoblin**

ASPAB member Martina Doblin (University of Technology Sydney, UTS) is leading a Citizen Science project aimed at understanding how phytoplankton experience their ocean habitats. One of thirteen projects funded nationally by the federal government, it partners with the Bureau of Meteorology and Australia's Integrated Marine Observing System to give citizens the opportunity to examine ocean data in a playful way.

Drawing on the experience of visual information researchers at UTS, the project will build an interactive online portal to allow participants to visualise morphological and functional changes taking place in marine microbes (marmics) as they are transported by the ocean's surface currents.

**Associate Professor Kate Sweetapple, Associate Professor Martina Doblin, Dr Jacquie Lorber-Kasunic**

**Diatom form. Photo: Martina Doblin**



An exciting element of the project is the potential for participants to "bring their marmics to life" as 3D printed forms. Participants will be encouraged to exhibit their marmics and share their experiences as citizen scientists, to be documented for future projects.

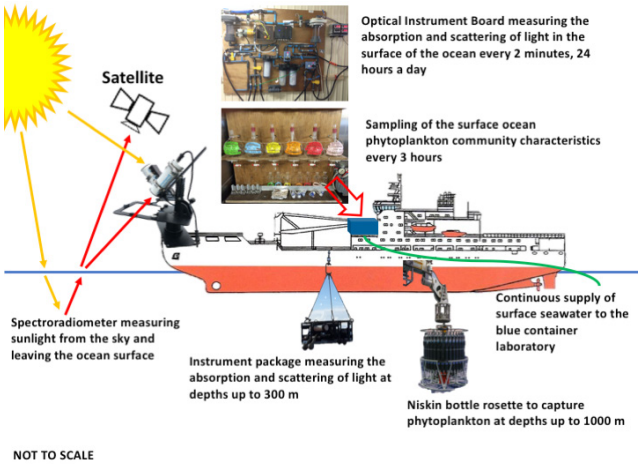
"I am really thrilled to be working with a great team of collaborators who are as fascinated with phytoplankton forms as I am. Apart from improving people's ocean literacy, we're going to have a lot of fun along the way." said Martina.

Just as ASPAB spans Australia and New Zealand, the collaborators on the project include A/Prof Kate Sweetapple and Dr Jacqui Lorber-Kasunic (UTS Faculty of Design, Architecture and Building) as well as Prof Nancy Longnecker (University of Otago, NZ).

# Antarctic Circumnavigation Expedition: Building an Unprecedented Dataset of Bio-optics and Phytoplankton Properties in the Southern Ocean

by Dr Charlotte M Robinson, Remote Sensing and Satellite Research Group, Curtin University

Members of the Remote Sensing and Satellite Research Group (RSSRG), Dr Nina Schuback and Dr Charlotte Robinson were lucky to participate in the 3-month Antarctic Circumnavigation Expedition (ACE) of the Southern Ocean. The Research Expedition funded by the ACE Foundation and Ferring Pharmaceuticals under the auspices of the Swiss Polar Institute, was carried out on-board the Russian Research Vessel *Akademik Tryoshnikov*. The expedition hosted 159 researchers from 22 projects over three main legs during the Austral Summer from December 2016 to March 2017, studying the biology, climatology and oceanography of the land, air and sea in the Southern Ocean region.


**Left:** Expedition Map. **Middle:** Project 1 team on board legs 1 (top left: Nina Schuback, David Berliner, Hazel Little, William Moutier, Tommy Ryan-Keogh), 2 (bottom: Nina S, David B, Hazel L, William M, Alex Olivier) and 3 (top right: Nina S, David B, Hazel L, William M and Charlotte Robinson). **Right:** The on-board sampling program.

Drs Schuback and Robinson were members of the 5-person Project 1 team, 4 of whom were on board for all three legs (**see team photo above**). Project 1, led by PIs Prof. David Antoine (Curtin University, Perth) and Dr Sandy Thomalla (CSIR, Cape Town; both not on board) set out to study the phytoplankton community abundance and composition, and bio-optical properties of seawater in the Southern Ocean. The work supports research at Curtin University and CSIR, as well as collaborators L'OCEAN France, Sherbrooke University Canada, Biospherical Instruments USA, UTAS Australia, CSIRO Australia, UMaine USA, CNRS-LOG France and CNRS-LOV France.

The on board sampling program was designed to exploit the unprecedented spatial extent of the voyage track utilising a number of autonomous instrument packages and high frequency manual sampling from an underway continuous surface water supply (**see sampling schematic above**). Like any voyage, this expedition was not without challenges: treacherous weather conditions, balancing the requirements of 22 different projects, typical instrument troubleshooting and navigating a 7 deck and 162 m research vessel serviced by a Russian-speaking ship crew. Despite the challenges faced, the team pulled together an unprecedented dataset of bio-optical properties (hyperspectral absorption, scattering, backscattering and above-water radiometry) and phytoplankton and particle characteristics (pigmentation, biomass, size, photophysiology; **see some of the incredible integers below**).

**Incredible Integers**

Team of **5**
**24** hr sampling
**15** instruments
Filtered **2** tonne of seawater
**29,000+** datapoints from each continuous instrument
**27** CTDs
**320** underway timepoints
**131** above water radiometry measurements
**320** measurements of particle size and photophysiology
**2,615** stairs a day to sample
**350** servings of meatballs each

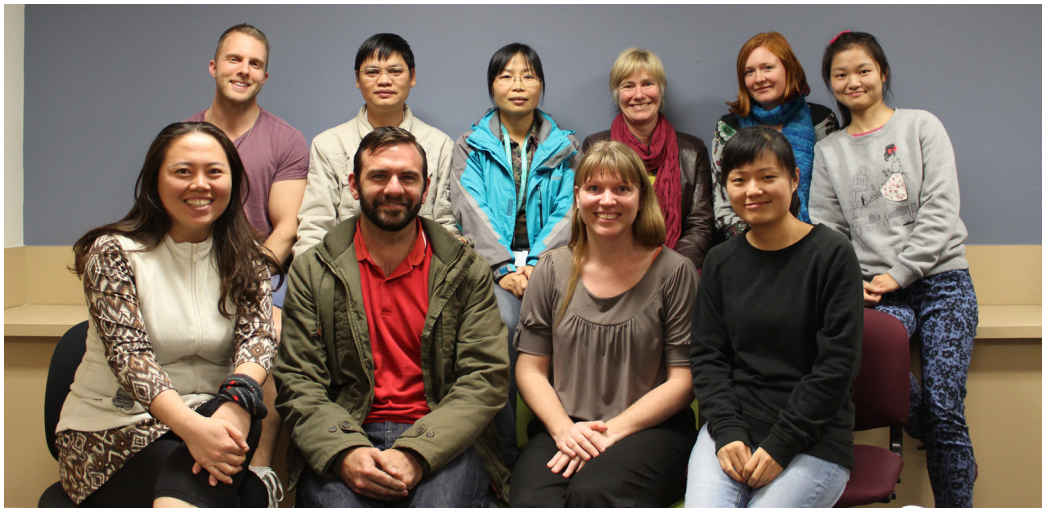
Sample processing and data analysis is well underway and the RSSRG group will update this **website** with developments. As part of the ACE agreement, all data will become publicly available via the Swiss Polar Institute after a 2-year embargo. In the mean-time, collaborators in this Project 1 team hope to develop a better understanding of the unique bio-optical properties of Southern Ocean phytoplankton communities in a bid to untangle bio-optical relationship uncertainties and identify drivers of satellite algorithm anomalies. Our improved understanding of bio-optics in the SO will be applied to satellite ocean colour observations to study the seasonal, inter-annual and decadal changes in SO phytoplankton.

# Algal Research by the Burford Group

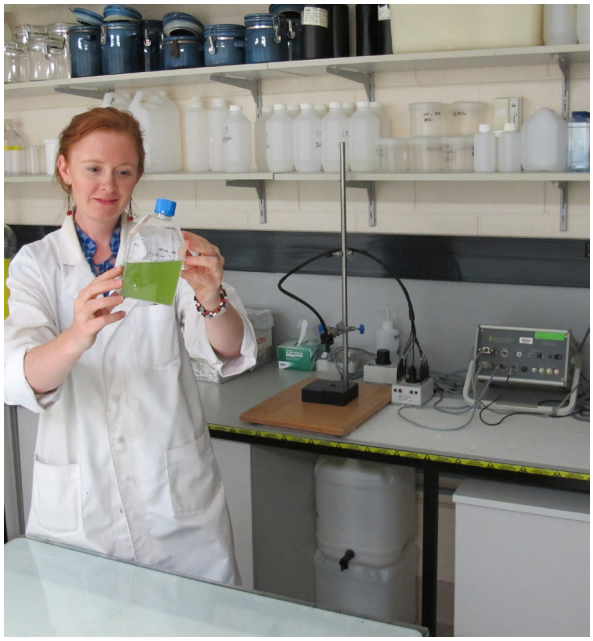
**by Michele Burford**
**Professor, Executive Deputy Director**
**Australian Rivers Insitute, Griffith University**

**Twitter: @michele_burford**
**Twitter: @TheBurfordGroup**

Prof. Michele Burford leads a group of researchers working on drivers of algal blooms at the Australian Rivers Institute, Griffith University. Much of the research has focussed on toxic cyanobacterial blooms in drinking water supplies in partnership with the southeast Queensland water authority, Seqwater. Postdoctoral Fellow, Anusuya Willis and Research Assistant, Ann Chuang, have undertaken physiological and molecular studies of the unique response of the toxic cyanobacterium, *Cylindrospermopsis raciborskii* to nutrients. It seems that this species thrives in low and variable nutrient concentrations rather than higher nutrient concentrations. Additionally, their work has highlighted that strains (= isolates) can vary considerably in their growth rates and toxin levels, even within water reservoirs. This effect has also been demonstrated in terms of response to light and temperature by Xiao Man, a PhD student in Burford's group. Man's work has shown that variability in strain responses can be as great as between-species responses, using *Cylindrospermopsis raciborskii* and *Microcystis aeruginosa*. Her work is highlighting the challenge of using laboratory studies as input to predictive models. Additionally it has shown the need to undertake more process studies in freshwater systems, as well as further characterization of the range of strain responses between and within systems.



**Top:** The Burford Group
**Bottom:** Postdoctoral Research Fellow Dr Anussuya Willis inspecting a *Cylindrospermopsis raciborskii* culture



In addition to the research on freshwater cyanobacteria, researchers have also been examining algal responses to freshwater inputs in estuaries and coastal environments. One study currently underway is in the Gulf of Carpentaria looking at the beneficial effects of wet season flooding on promoting benthic algal production, with flow on effects to fish and other species. These systems have extreme conditions, being hypersaline in the dry season, and then may be freshwater for weeks to months in the wet seasons, and provide a challenging environment for species to grow. This research is funded by the NESP Northern Australia Environmental Resources Hub.

Prof. Burford is also an invited member of the SCOR-UNESCO funded GlobalHAB committee. This program aims to foster international collaboration and information sharing on harmful algal blooms across the world, and is a follow on from the successful GEOHAB program. Prof. Burford leads the freshwater component of this.

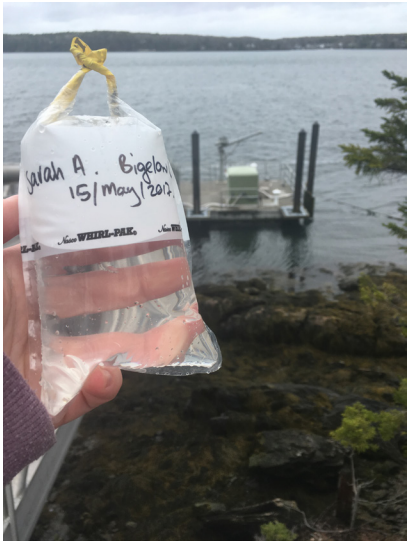
# Student Profile: Sarah Andrew

**PhD Student**
**Marine Biogeochemistry Lab, Research School of Earth Sciences**
**Australian National University**

**Left:** Sarah working with phytoplankton cultures in the laminar flow cabinet at the Bigelow Laboratory for Ocean Sciences.

Climate change is becoming an increasingly hot topic, with many scientists around the world seeking to quantify future expected changes in global carbon cycling, uptake and associated export. This year I have commenced the third year of my PhD at the Research School of Earth Sciences at Australian National University (ANU) and through the combination of funding received from ANU and the Phycological Society of America, I have been able to attend multiple conferences and workshops in order to broaden my knowledge of algae and their interaction with climate systems.

In May 2017 I left Australia for a research visit at the University of Southern California, where I worked with Dr. Feixue Fu and Professor David Hutchins for 4 weeks, learning new culturing methods and experiencing a completely different way of life to the freezing cold of Canberra. During my time abroad, I was also able to attend an Algal Culturing Workshop at the National Center for Marine Algae and Microbiota (NCMA) in East Boothbay, Maine. Attending this course provided valuable knowledge and tools to expand on my current PhD research as well as creating a great network of friends and phycologists that I hope to keep bumping into throughout my career. Before returning to Australia and my abandoned research, I was given the opportunity to present my research at the Phycological Society of America's 2017 General Meeting which provided insightful feedback and answers to minor issues that I was having with some of my research.




**Left:** Industrial scale algal cultures at the National Center for Marine Algae and Microbiota in East Boothbay, Maine. **Middle:** Collecting seawater for phytoplankton species isolation. **Right:** Incredible kelp forests at the Monterey Bay Aquarium.

Now that I'm back safely in Australia, I'm looking forward to attending the AquaFluo II meeting in December and completing the majority of my research into quantifying Rubisco content and activity in Southern Ocean diatoms in addition to measuring physiological responses in many multi-stressor experiments that I'm conducting. I would like to thank the Research School of Earth Sciences, the Australian National University, the Phycological Society of America and my supervisor Michael Ellwood for the funding and support this year.

In addition to my research into carbon cycling and the rate of photosynthesis in Southern Ocean phytoplankton, our Marine Biogeochemistry Lab currently has a range of projects and funding available for domestic postgraduate students interested in working with Southern Ocean phytoplankton (contact Michael Ellwood for more information).

# Algal Studies in Japan

by Joe Zuccarello
Associate Professor, School of Biological Sciences, University of Wellington

I was supported by the Japanese Society for the Promotion of Science on a research trip to Japan. I spent 2 weeks in Obama (that's right the ex-president), a town with a campus of Fukui Prefectural University in the lab of Mitsunobu Kamiya. The work was to study intra-specific physiological adaptation of some red algae. I am interested in diversity within species and if different physiological traits are associated with populations. So we collected samples from different populations around Japan (or they were already available) and tested their tolerance to temperature and salinity (easy measures to do in a culture chamber). Differences could be due to different selective pressures, and also indicate that they may respond differently to environmental change.

While there I went to the annual Japanese Phycological meeting in Kochi (Shikoku Island-, sort in the lower middle of Japan). It was inspiring to see such a large group of dedicated phycologists, unfortunately most talks were in Japanese which did not help me. **After the meeting we had a nice field trip to the coast, lots of nice intertidal algae (including this *Gloiopeltis* sp.).**

I also went to Okinawa, a slightly different feel from the rest of Japan (warm tropical for one, food a bit different but delicious), plus a large military presence (including USA troops). We did some nice coral lagoon collecting, besides estuary collecting (more later). **Here is a shot from one lagoon of some *Caulerpa* sp.**

I guess being fairly northern coral reefs, they may not be as directly impacted by temperature changes (well, it may take a bit longer).

Interestingly on Shikoku, I talked to a researcher that had been working for many years and had some nice underwater photos of kelp (the definition of kelp is large brown algae, though not everyone would agree) forests (*Sargassum* mostly) and in the middle of the kelp forest were nice large stony corals. He says they have arrived in the last decade or so. A country that cares so much about algae has a good record of community changes due to climate change. That 'before data' is missing (as least as comprehensively) in many other places (New Zealand!). I was there mostly to collect estuarine/river algae for my experiments. **The rivers in Japan are nearly all highly modified.**

**I have never seen so much concrete being used.** I guess with such high density of people, overflowing rivers would be a big detriment, but it is not like the more pristine New Zealand rivers. I needed to get used to looking for algae under concrete ledges.

Overall the trip research wise was great, it was great to be with phycologists (not a normal occurrence at my uni), and Japan is a wonderful place (a visit is worth it).

# Student Travel Scholarship Reports

Twice a year, ASPAB awards Student Members funds to support travel to conferences, workshops and laboratory visits.
For more information on this funding opportunity see https://www.aspab.org/fundingopportunities
This year, Belinda Martina, Daniela Aquvaque and Rendy Ruvindy were awarded funds during the March grant round.

## Belinda Martin

### University of Western Australia

I am a PhD student enrolled in the School of Biological Sciences at the University of Western Australia. My main area of research is in plant health and microbial functions in ecosystems. To date, this research has focused on rhizosphere environments, which is the zone of soil that is influenced by plant roots. My research in this area has included investigating plant-pathogen interactions and the role of plant root exudates in bioremediation of petroleum hydrocarbons. My current PhD research is in seagrass rhizospheres. The aim of my current PhD research is to gain a greater understanding of the interaction among seagrass roots, sediments and microbial communities in order to improve management of these essential coastal ecosystems

The ASPAB travel award has provided me with much needed funding to travel to and attend the 2017 Coastal and Estuarine Research Federation (CERF) that will take place on the 5 – 9 November in Providence Rhode Island, USA. My primary goal of attending this conference is to share my research with colleagues to not only draw attention to my work, but also gain insight and alternative viewpoints that will prove invaluable when I am preparing manuscripts and my thesis. Additionally, I plan to take the initiative to make new international contacts with leading experts in the field and with other graduates and early career researchers that I hope will offer possibilities for future collaboration. However, I must be honest and say, I am not looking forward to the cold weather!

## Daniela Aquveque

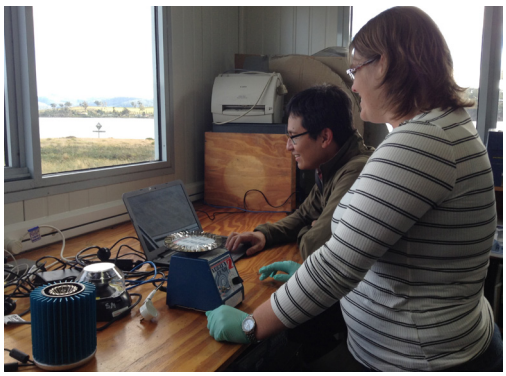
### University of Tasmanaia

I am a PhD student at the University of Tasmania, my study investigated the complex relationship between human activities and the aquatic ecosystem highlighting the importance of good management to protect aquatic systems. Sharing my work with the scientific community is essential, and participating in international conferences provides a great opportunity to show and discuss my research with colleagues worldwide, and build networks contacts within the international research community.

The upcoming, 15th International Conference on Environmental Science and Technology (CEST) in Greece, is focused on ecosystem management, environmental education and marine and coastal management. The main organizer is the Global NEST (Network of Environmental Science and Technology), an international scientific movement with 29 years of networking with 60 countries, which focused on innovative environmental issues. This meeting provides both the opportunity to broaden my network and discuss these more important applied elements of my research and how the techniques I have developed with seaweeds can be used to inform environmental impact assessment and management.

## Rendy Ruvindy

### University of Technology Sydney



Together with our industrial partner, Diagnostic Technology Pty Ltd, we are developing and validating a qPCR assay that can be used as an early-warning system for toxic Alexandrium bloom. The commercial version of this assay DinoDtec has been trialled successfully in several shellfish farms down in Tasmania. And thanks to ASPAB, I was able to present the results at the 11th International Conference on Molluscan Shellfish Safety in Galway, Ireland. This conference was a meeting point for regulators, shellfish farmers, and academics from all around the world, to discuss the progresses in issues such as phytoplankton monitoring, marine biotoxins testing methodologies, and other seafood safety issues. Through this conference, we were able to receive feedbacks about our kit from the end-user point of view. We also received interest from several representatives to try and integrate this method for phytoplankton monitoring.

# 31st ASPAB conference

## Australasian Society for Phycology and Aquatic Botany

7 – 10 November 2017,
Magnetic Island, Townsville

We would like to invite and welcome you to the 31th annual Australasian Society for Phycology and Aquatic Botany (ASPAB) meeting to be held on Magnetic Island off the coast of Townsville, Queensland, Australia.

The conference will cover all aspects of marine and freshwater botany. We welcome you and look forward to your participation.

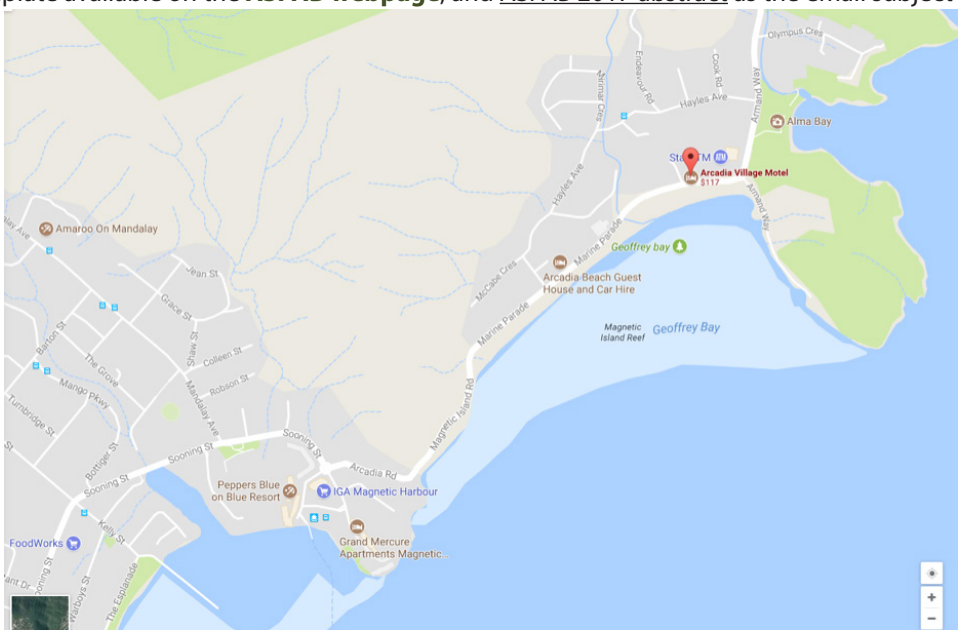
The ice-breaker is planned for the evening (5-7 pm) of the 7th of November and the presentations will be on the 8th – 9th, with an optional excursion on the 10th to visit the MBD algae production facilities (details to follow). The conference dinner will be held on November 9th and is included in the registration for all delegates. There will be an optional BBQ for delegates and accompanying persons ($20 pp) at the venue on Wednesday 8th November.

We are also hoping to hold another auction this year, as it was such a great success at the 2013 ASPAB conference in Sydney. In order to do this, we need some fabulous algae and/or science- related items to auction out! Any donations are welcome, including wild-card non-science related items (though for logistical reasons, maybe not your aunts old arm-chair type things). Please email me directly on marie.magnusson@jcu.edu.au with the subject heading ASPAB Auction if you have any items to donate and I will collate a list.

**REGISTRATION is due by 13 October 2017.**

| Registration | Early Bird (by 13 October) | Late Registration (after 13 October) |
|---|---|---|
| Full Member | $310 AUD | $340 AUD |
| Full Non-Member | $350 AUD | $380 AUD |
| Student Member | $200 AUD | $230 AUD |
| Student Non-Member | $240 AUD | $280 AUD |

**ABSTRACT submissions due by 20 October 2017.** Email abstracts as an attachment to marie.magnusson@jcu.edu.au using the word template available on the **ASPAB webpage**, and ASPAB 2017 abstract as the email subject heading.




**Venue:** The conference will be held at the Arcadia Village Hotel, 1-4 Marine Parade, Arcadia QLD 4819, Magnetic Island.

# Upcoming Opportunities

**31st ASPAB conference**

**Australasian Society for Phycology and Aquatic Botany**

7 – 10 November 2017,
Magnetic Island, Townsville

**Accommodation options:**

**The Arcadia Village motel** lies in conjunction with the Conference venue. The motel has 27 rooms with capacity to accommodate up to 84 people. The rooms are all en-suite and air-conditioned with a small fridge and a kettle. Each room has an outside seating area overlooking Geoffrey Bay.

**Standard room** for 2 people (1 king bed OR 2 single beds) – Conference rate of $100 per room per night for a 3-night minimum stay

**Family room** for 4 people (1 king bed and 2 single beds OR 4 single beds) – Conference rate of $120 per room per night for a 3-night minimum stay

Please contact the motel directly for bookings and mention you are an ASPAB conference delegate, as these rates are not available for direct bookings online. A number of rooms are held for delegates until 4 weeks prior to the conference, after that, availability cannot be guaranteed.

Arcadia Village Motel
7 Marine Parade, Arcadia
Magnetic Island Qld 4819
Ph: 07 4778 5418
Ph: 1800 781 504
motel@arcadiavillage.com.au
**www.arcadiavillage.com.au**

We have also secured a 15% discount for delegates at **Peppers Blue on Blue resort**, Magnetic Island. Pepper's is located in Nelly Bay, ca 2 km away from the conference venue, with buses leaving every 40 or 60 min. Please call Peppers directly for any enquires (details in picture below) and state you are an ASPAB conference delegate for the discounted prices.

As Magnetic Island is a popular holiday destination, there are numerous other options (holiday houses to share, camping, and backpackers) for accommodation available all over the island. Anything in Arcadia/ Geoffrey Bay or Alma Bay is an easy walking distance to the conference venue, and there are regular bus services should you wish to stay in a different bay as well. Bookings are available through e.g. **http://www.bestofmagnetic.com** or any of the regular accommodation sites (**stayz.com.au, booking.com, Airbnb.com.au etc.**). There is a small supermarket in Geoffrey Bay, and a Super IGA in Nelly Bay where the ferry arrives if you need to buy groceries etc.

**Getting there and around:**

Townsville has an international airport with direct flights from both major and regional airports. From Townsville, catch the ferry using Sealink **https://www.sealinkqld.com.au/magnetic-island/timetable** (passenger only) or FantaSea (car and passenger) **http://www.fantaseacruisingmagnetic.com.au/ferry/magnetic-island-ferry-timetable/**

There is a regular bus service on the island, as well as taxis, should you decide to stay in a different bay. Moke (topless convertible 4-seat cars) rentals are also available if you wish to travel island-style: **http://www.miwheels.com.au/**

**Staying after the conference:**

If you have some time to spare, Magnetic Island is a wonderful tropical island get-away, with beautiful beaches, snorkeling, bush-walking, and access to the Great Barrier Reef. To be tempted, check out **https://www.magneticislandtourism.com/**


## Calling all active fluorometry users in phycology and aquatic botany to a unique conference in Sydney, 4th-8th December 2017:

**AQUAFLUO II: "Chlorophyll Fluorescence in the Aquatic Sciences"**
**www.uts.edu.au/aquafluo.**

This unique meeting was last held 10 years ago in the Czech Republic to bring together users and developers of instrumentation that exploits (chlorophyll) fluorescence properties of aquatic organisms, through a blend of presentations, discussion forums and practical workshops. AQUAFLUO II is a timely revisit to key topics but also consider new questions from the rapidly growing user community, that is tracking accelerated expansion of chlorophyll fluorescence sensor technology and its application to ecosystem and food security.

We already have an impressive lineup of **Key Note Speakers** (Prof Paul Falkowski, Rutgers University; Prof Antonietta Quigg, Texas A&M University; Prof Michael Behrenfeld, Oregon State University; Prof David Kramer, Michigan State University), Contributing Speakers and Industry Exhibitors.

**Registration is now open:** http://www.uts.edu.au/research-and-teaching/our-research/climate-change-cluster/climate-change-cluster-2017-colloquium-2; however, spaces are deliberately limited to 150 attendees to ensure the focused and productive nature of our meeting.

Please see the **website** for further information and contact details.

# Joanna Jones (Kain) Publication List


1. Kain, J.M. 1958. Observations on the littoral algae of the Isle of Wight. J. mar. biol. Ass.U.K. 37: 769-780.
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## Appendix

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# Social Media Competition

**Guidelines for submitting entries to ASPAB photo competition**

- ASPAB members can submit entries to a twice yearly photo competition.

- Photos with caption (150 characters max.) must be submitted to aspab.contact@gmail.com by the due date. ASPAB will post the photos on Twitter, our Facebook page, Instagram and on the website.

- Entrys may include images from/of:
  - In the Field
  - Macroalgae
  - Microalgae
  - Seagrass
  - Weird & Wonderful Finds

- Competition will run on social media for a total of 10 days. The photo with the most likes over all three social media will be declared the winner

- Competitions will be held twice a year.

- Competitions in 2017:

  1. First competition will close on the 28th of February 2017 and entries will be launched on all platforms on World Seagrass Day, March 3rd (The first Friday of March). Competitions close on the 14th of March and winner will be announced on the 16th of March.

  2. Second competition will be held in September. Due dates will be announced later in the year. Suggestions of significant events that can be linked to the due date for the second completion are welcome.

- ASPAB retains the right to not award prizes if the number of entries are low or for any other reason deemed necessary by the committee.

- Prize: $50

- Rules

  1. This competition is open to the general public.

  2. The participant must be the owner of the photograph without any non-exclusive rights. The participant must declare if there are copyright attached to the picture or any other regulation. The photos must not have been previously published. The participant is responsible of the submitted material.

  3. Only one submission is allowed per person per contest.

  4. Minor modifications of the picture, such as cropping, contrast, etc. are allowed. If this is the case, a brief explanation of the post-processing must be included in the metadata. Major modifications are not permitted. If requested by the judges, the original material must be provided to verify the authenticity of the photograph.

  5. The winner will be selected according to the number of votes in all social media platforms (see above).

  6. The participant allows ASPAB to use the photographs for advertising and non-profit diffusion of the association. If the image is use in any sort of printed or digital media, ASPAB is committed to acknowledge the photographer. The photographer retains all rights to use the photograph for any other purposes.

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# Appendix

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7. The participant who break the rules or cheat will be disqualified

8. The judges' decision is final.

9. Any issue not considered in the previous rules will be considered and decided by the ASPAB

- Metadata to be submitted with the photo

| | |
|---|---|
| Title | |
| Photographer | First name, Surname, Insitution |
| File name | e.g. IMG4567.jpg |
| Species | |
| Locality of the sample | |
| Brief description | |
| Photo technique | |
| Date | |
| Post-process | |
| Other declarations | |