Productive Coasts

Opportunities for Impact

Our Team

We are group of researchers passionate about the marine environment. Our purpose is to improve the health of the ocean for the benefit of all generations. We have diverse education and cultural backgrounds and complementary skills to tackle larger projects and problems.

Our research is conducted in partnership with government (international, national, state, local), industry (including water authorities), as well as indigenous communities.

The Productive Coasts team is passionate about promoting both ecological and economic sustainability. Our research values align with the values articulated in the UTS 2027 strategy, which supports the establishment of partnerships to drive economic, social and cultural prosperity of our community. UTS's Sustainability Policy affirms the principles of the United Nations' Sustainable Development Goals (SDG), which constitute 'the blueprint to achieve a better and more sustainable future for all'. Our work aligns with goals 6, 13, and 14.

Our Impact

Productive Coasts research focusses on examining processes that impact water and sediment quality, so that we can inform policy, investment and regulation, to deliver sustainable solutions to the global challenges of climate change and coastal development.

We have three main areas of impact:

1. Determining the concentrations of contaminants of emerging concern and the resulting ecological effects in estuarine and coastal ecosystems, so that people can safely swim, fish, and undertake their cultural practices.
2. Understanding the impacts of bushfire aerosols on aquatic ecosystems to assist with post-fire response and recovery efforts, as well as prevention and preparedness.
3. Investigating the development of harmful algal blooms in international and Australian contexts to design management strategies to keep people, wildlife and seafood safe.

We focus on delivering sustainable solutions to the global challenges of climate change and coastal development.

Team Leader

Professor Martina Doblin

I lead the Productive Coasts research program within the Climate Change Cluster (C3) in the UTS Faculty of Science.

My goal is to contribute to the science that will help address global challenges of biodiversity conservation and ecosystem health, food security, as well as climate variability and change.

For the ocean to retain its value and sustain its delivery of benefits to people in current and future generations, we need to develop solutions that consider environmental, social, economic and cultural values. This is why the Productive Coasts approach to research is collaborative.

I have over 20 years of experience as a marine researcher and love what I do!

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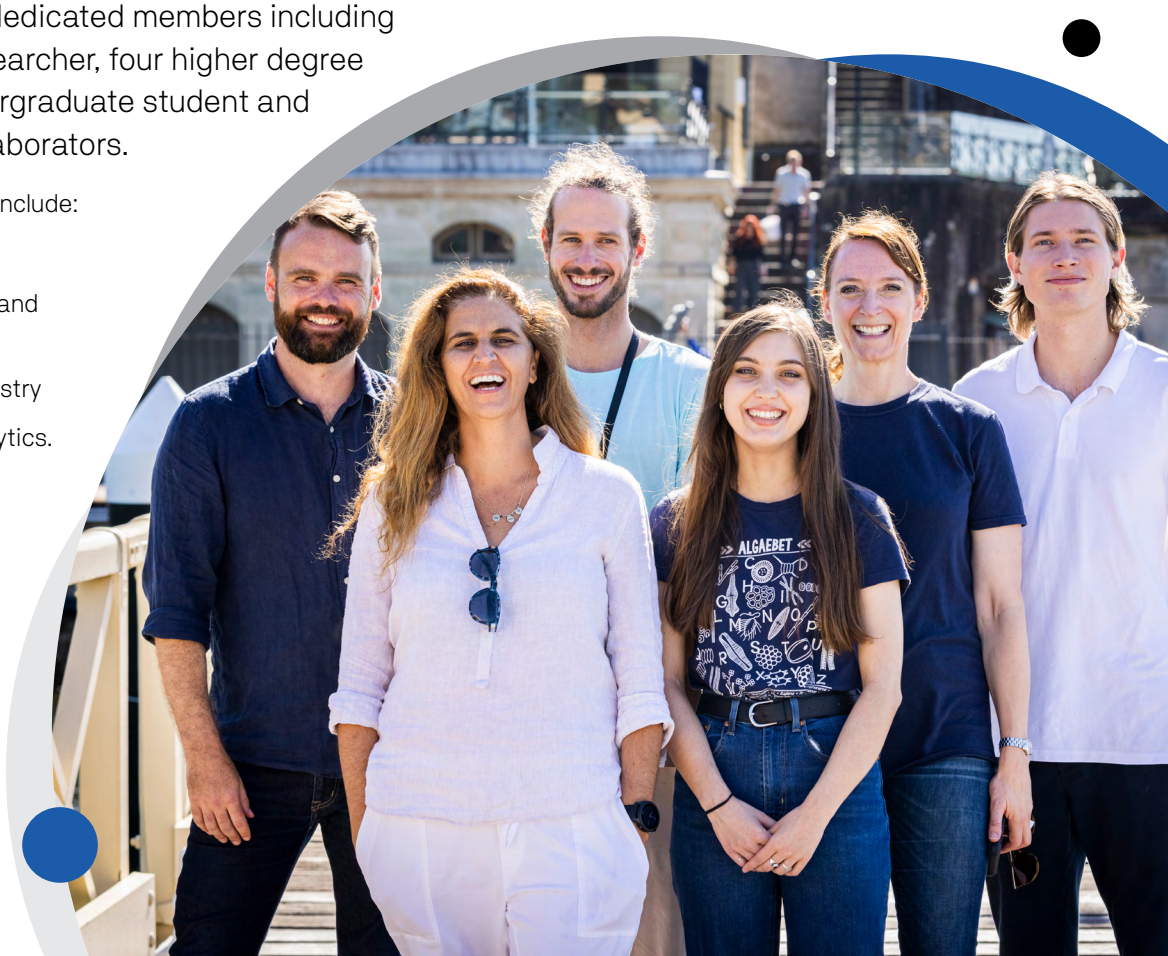
The Productive Coast Team

Our team consists of dedicated members including one post-doctoral researcher, four higher degree researchers, one undergraduate student and a wide network of collaborators.

Our core areas of expertise include:

- Microbial ecology
- Microalgal identification and characterisation
- Ecotoxicology and chemistry
- Environmental data analytics.



UTS2027

UTS 2027 has set UTS's vision for the next decade: to be a leading public university of technology recognised for delivering global impact.

UTS will establish partnerships in climate mitigation and adaptation to drive the economic, social and cultural prosperity of our communities. C3 will drive with UTS as a world-leading university by advancing knowledge and learning through research-inspired teaching, research with impact and partnerships with industry, the professions and the community.

C3 has a strong track record of forming industry links and using technology to develop innovative climate mitigation strategies, as well as delivering research excellence in the fundamental sciences relevant/linked to human and environmental health.

Facilities

Our team has access to an array of world-class facilities, from a high-end PC2 molecular biology labs to field-ready equipment, including:

Microbiological Analysis

Includes facilities for isolation, identification, and physiological studies of microorganisms sampled from natural and cultivated settings.

High Throughput Phenotyping Infrastructure

Includes multi-laser flow cytometers and cell sorters, microtitre plate bioimaging systems, and a wide range of analytical instrumentation.

Advanced Algal Cultivation Facilities

Includes an Industry 4.0 demonstration facility with fully robot controlled automated sensor and digital twin for advanced algal manufacturing.

Examples of Our Research Impact

1

Phytoplankton Traits

Response to a changing ocean

Phytoplankton are marine microbes that are responsible for almost 50% of the Earth's primary production, being the foundation of marine fisheries and aquaculture. They drive major biogeochemical cycles (e.g. carbon cycle), and are critical to the health of our planet. Our team, with the support of the Gordon and Betty Moore Foundation, set out to define the evolutionary rules that govern which combinations of form and function are possible for one type of marine phytoplankton. We established novel workflows for relatively rapid, semi-automated, quantification of traits in marine phytoplankton, statistical methods to visualise and model trait combinations. We applied these techniques to phytoplankton in an experimental evolution study. We revealed repeated, consistent patterns of evolutionary changes, suggesting that evolution is constrained in the studied marine phytoplankton (Thalassiosira). This work uncovered fundamental evolutionary constrains and interrelations between Phytoplankton functioning and the marine environment.

2

Contaminants of Emerging Concern

Safeguarding our waterways

Disposal of waste water into estuarine and coastal waters introduces a range of contaminants of emerging concern (CEC; e.g. antimicrobials, pharmaceuticals and microplastics) that negatively impact water quality. With a rising trajectory of CEC discharge, and limited knowledge of their risk to marine ecosystems, we were commissioned by the federal government to determine the concentrations of CEC in key coastal locations. We used a spatially structured design to sample water and sediments and are currently employing multiple methods to assess CECs. We anticipate this project will allow accurate identification of emerging contaminant concentrations in key locations. Our work on CECs strives to increase awareness of emerging contaminants amongst water authorities, EPA and local councils and deepen engagement with indigenous communities for whom water and sediment quality is fundamental to their cultural practices.

3

Mapping Microscopic Hero's

A citizen science initiative

Marine microbes play a major role in ocean health, forming the foundations of the ocean's food-web. Due to human-induced changes to ocean conditions, these microbes must adapt quickly. However, tracking the range of conditions microbes are exposed to and understanding their capacity to adapt, is a major challenge. Our team could not be in the oceans 24/7 to monitor and map out these microbes' experiences, so we developed 'Adrift', a creative visualisation method based on ocean simulations, in collaboration with the UTS design school and Otago University. Adrift is an intuitive and playful visualisation tool funded by Inspiring Australia Science Engagement Programme, designed to engage citizen scientists. Citizen scientists virtually drop microbes into the ocean and track the drift of these virtual microbes, and map the variations in ocean conditions. The project increased participation in ocean science, engaging 739 citizen scientists who contributed >5,975 simulations of virtual marine microbes (data accessed 6 April 2021). Data generated from Adrift has been recently published (**https://doi.org/10.1098/rspb.2021.2581**).

In an era of rapid environmental change, there is an indispensable need to understand how marine organisms, water quality and sediment quality are affected.

Responding to Change

With continued increases in surface temperatures and ocean acidification, organisms inhabiting the ocean are living in an increasingly unpredictable world.

In an era of rapid environmental change, there is an indispensable need to understand how marine organisms, water quality and sediment quality are affected.

In response we are pioneering the way we understand our oceans and the ecology within which are responsible for its health. We are dedicated to researching how future oceans will adapt and function, allowing us to develop knowledge that can inform policy, investment and regulation to deliver sustainable solutions to combat climate change and improve coastal development.

Our Approach

Due to the expertise of the productive coast's team we are able to develop and utilise leading-edge technologies to determine cellular and population level responses to climate change and environmental stressors.

Additionally, we are working to improve treatment of sewage and stormwater discharges to reduce contaminants of emerging concern in our oceans and waterways, which are essential for human health and our cities' sustainability.

We aim to provide evidence-based approaches that will increase the resilience of aquatic ecosystems to environmental change and enable the sustainable use of marine resources, enhancing human wellbeing and social equity, while reducing environmental risks.

Opportunities for Impact

Ongoing Opportunities for Collaboration and Practical Solutions. Welcoming support to create impact for our oceans and waterways.

1

$250,000
over 2 years

Accelerating Recovery of Climate Impacted Estuaries

Rehabilitation of Australia's waterways

Australia is known as a land of extremes, from droughts, to floods and fires. The intensity of the Australian climate directly threatens lives, communities, and infrastructure. With increasing occurrences of extreme weather events, such as the devastating recent bushfires and floods, it is clear that resources are required to improve prevention, preparedness, response and recovery strategies.

This project aims to use the NSW Department of Planning and Environment's long-term water quality database to identify the types of waterways where the impacts of bushfires and floods are greatest. Utilising this data allows us to prioritise these sites for rehabilitation. Rehabilitation of effected areas is essential in order to restore ecosystem health and thereby support the recovery of local communities. This project will be a continuation of a recent PhD project and support an emerging environmental scientist uncovering new insights to inform on-ground management of Australia's waterways.

2

$350,000
over 2 years

Water Quality Justice for Indigenous Australians

Gamay Indigenous Rangers.

Water quality directly underpins the health of all marine ecosystems. Chemical and microbial contaminants harm marine animals and plants, thereby jeopardising the success of restoration and conservation activities. Much of the contamination that enters coastal environments comes from stormwater, which is currently unregulated.

This project is a partnership with the Gamay Indigenous rangers who are both participants and beneficiaries this research. This study will identify key stormwater inputs that degrade water quality and determine how they threaten the success of Gamay conservation activities. This project will foster a relationship with the Gamay rangers, engaging them directly in planning and conducting remediation efforts. We aim to improve stormwater infrastructure to improve water quality for the community, which is fundamental to their cultural practices.

3

$375,000
over 2 years

Forensics to Understand Marine Turtle Strandings

Diving Deeper to Protect Endangered Sea Turtles

In recent years, unprecedented numbers of endangered sea turtles have washed up along the NSW coast. Upon a closer look these events have coincided with record rainfall and ocean heatwaves causing changes in ocean currents, sea temperature and water quality.

Currently, we know very little as to why these strandings occur. This project aims to assess if marine biotoxins play a role in sea turtle mortalities. Using state of the art mass spectrometry techniques we can chemically analysing archived liver, blood and tissue extracts for specific biotoxins. Identifying the drivers of sea turtle strandings enables us to inform government policy and reduce the threats, resulting in improved management and conservation of Australian marine turtles.

Further information

If your passion aligns with the Productive Coast Teams' there is opportunity to be involved via partial, full or similar themed funding.

For more detail about the content of this proposal, please contact: Dr Alex Thomson, C3 Industry Engagement Manager, **Alexandra.Thomson@uts.edu.au**

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