



# marinematters

ISSUE 39 | MAY 2023



Mark Rehbein joins the IMOS office as the Director of the AODN



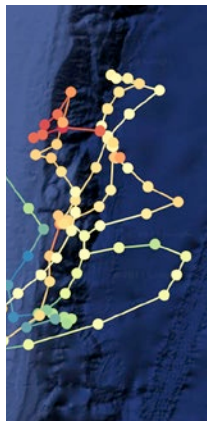
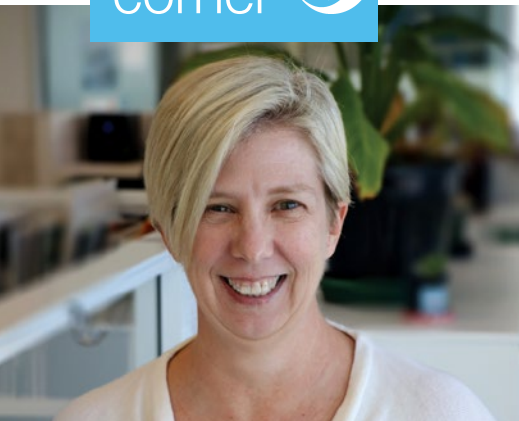
Meet the women scientists who are leaders in IMOS



A stunning image from the SOTS site wins prize

## High frequency radar observations of the Ningaloo Current





IMOS acknowledges the Traditional Custodians and Elders of the land and sea on which we work and observe and recognise their unique connection to land and sea. We pay our respects to Aboriginal and Torres Strait Islander peoples past and present.

## Welcome to the May 2023 edition of *Marine Matters*

This edition of *Marine Matters* includes several sections focusing on the people in IMOS. The people in our community are critical to the success of IMOS and the basis for our global reputation, so it is only fitting that we take time to stop and recognise their efforts. In this issue you will find features on our women in science, recognition of 10 years of service to IMOS, a student feature on Belinda Goddard and a farewell to Sebastien Mancini outlining his many years of service to IMOS and AODN. We are also welcoming several new faces to IMOS, including Mark Rehbein as the new AODN Director and our newest Node Leaders in Tasmania Myriam Lacharité and Karen Wild-Allen. Speaking of Nodes, we also welcome Graziela Miot da Silva as the new Deputy Node Leader in South Australia.

You can read about new data, products and outputs from several IMOS Facilities including Deep water moorings, Ocean Radar, Animal Tracking and more.

This is a bumper issue of *Marine Matters* and I want to thank everyone who has taken time to contribute and share your stories, updates and information with us. I hope you enjoy this edition of *Marine Matters*.

**Dr Michelle Heupel**  
IMOS Director



## Recognising 10 years of service to IMOS



### IMOS acknowledged members of the community who have made significant contributions to the IMOS program for over 10 years at our recent Annual Meeting.

The success of IMOS depends on the actions and activities of our community members, who play a significant part in the continued success of the program.

We thank the following people who have provided 10+ years of service in a leadership role in IMOS:

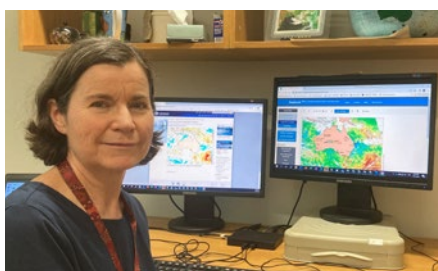
- Dr Helen Beggs, Bureau of Meteorology, leads the [Sea Surface Temperature Products](#) and [Sea Surface Temperature Sensors for Australian Vessels](#) sub-Facilities,
- Dr Ming Feng, CSIRO, leads the [Western Australia Moorings](#) sub-Facility,
- Dr David Griffin, CSIRO, leads IMOS [OceanCurrent](#),
- Professor Rob Harcourt, Macquarie University, leads the [Animal Tracking](#) Facility,
- David Hughes, CSIRO, leads the [National Reference Stations](#) sub-Facility,
- Dr Boris Kelly-Gerreyn, Bureau of Meteorology, Operator representative,
- Dr Edward King, CSIRO, leads the [Satellite Remote Sensing](#) Facility,
- Dr Randall Lee, Environment Protection Authority Victoria, leads the [Sensors on Temperate Merchant Vessels](#) sub-Facility,
- Dr Lyndon Llewellyn, Australian Institute of Marine Science, Operator representative,
- Professor Chari Pattiaratchi, The University of Western Australia, leads the [Ocean Gliders](#) Facility,
- Professor Anthony Richardson, CSIRO and University of Queensland, leads the [Australian Plankton Survey](#) sub-Facility,
- Professor Moninya Roughan, University of New South Wales, leads the [New South Wales Moorings](#) sub-Facility,
- Dr Eric Schulz, Bureau of Meteorology, leads the [Research Vessels Real-Time Air-Sea Fluxes](#) and [Southern Ocean Time Series Observatory](#) sub-Facilities,
- Professor Pete Strutton, University of Tasmania, leads the [Biogeochemical Argo](#) sub-Facility,
- Dr Bronte Tilbrook, CSIRO, leads the [Biogeochemical Sensors](#) and [Acidification Moorings](#) sub-Facilities,
- Dr Tom Trull, CSIRO, leads the [Biogeochemical Argo](#) sub-Facility,
- Dr Christopher Watson, University of Tasmania, leads the [Satellite Altimetry Calibration and Validation](#) sub-Facility,
- Professor Stefan Williams, the University of Sydney, leads the [Autonomous Underwater Vehicles](#) Facility,
- Mr Sebastien Mancini, University of Tasmania, led the IMOS [Australian Ocean Data Network](#).

# Celebrating the UN International Day of Women and Girls in Science

## Meet the women scientists who are leaders in IMOS.

February 11 was the United Nations International Day for Women and Girls in Science. It is a day to inspire girls to choose science, technology, engineering, mathematics and medicine (STEMM) subjects at school, and women to pursue a career in a STEMM-related field, as well as to recognise the achievements of women in STEMM.

We asked women who have leadership roles in IMOS about what they do in IMOS, what drew them into a science career, the rewards and any words of advice for girls and young women considering a career in STEMM.



**Helen Beggs** | At work at the Bureau of Meteorology

### Who are you and what is your role in IMOS?

I'm Dr Helen Beggs, a Senior Research Scientist in the Science & Innovation Group at the Bureau of Meteorology, and I lead two IMOS sub-Facilities – [Satellite Remote Sensing Sea Surface Temperature Products](#) and [Ship of Opportunity Sea Surface Temperature Sensors for Australian Vessels](#).

### What drew you into the world of science?

I have wanted to be a scientist since I was very young – around 9 or 10 – and was fascinated by Mathematics and Physics at Secondary School. I think it was the theory of special and general relativity which initially drew me to Physics in my early years of High School, and then after studying a Physics Honours Degree at University of Melbourne I developed a passion to work in Antarctica, so studied a Masters in Space Physics at La Trobe University as I was told that this was a sure way to get a job there. I wintered as Atmospheric and Space Physicist at Macquarie Island and then Casey Station, Antarctica, in 1987 and 1990. During my year in Antarctica, I decided that I would like to work on the Greenhouse Effect, so on my return started a PhD at University of Tasmania on air-sea exchange of carbon dioxide over the Antarctic sea ice

zone, which drew me into oceanography and a sea-going role at CSIRO Marine Science in Hobart. After moving to Melbourne in 2000, I joined the Bureau of Meteorology in 2003 as an ocean remote sensing scientist for the [Bluelink Ocean Forecasting Australia Project](#).

### What's the best part about being a scientist?

The travel and meeting interesting people! I have loved working in challenging and exotic places, such as Macquarie Island and Antarctica, and research cruises around Papua New Guinea and the Southern Ocean. Since starting a family I no longer wanted to go to sea, and swapped seagoing life on the Marine National Facility at CSIRO, for a desk-based research position at the Bureau of Meteorology as a satellite oceanographer. However, this has allowed me to travel to nearly every continent and around Australia for scientific conferences, and I love to visit new places and meet new colleagues. I have also derived great personal satisfaction from, in my own small way, adding to the body of knowledge.

### What would you say to young girls and women thinking about being a scientist?

These days it is much easier to juggle motherhood and science, with most employers supporting flexible working hours and working from home. However, being a research scientist is not always a 9 to 5 job and requires real commitment and passion to put in the hours to get the research done and publications written. If you can combine your personal passions with a career that pays the bills then that is a real bonus. Sometimes I feel very lucky that someone is prepared to pay me for what I love doing anyway! ■



**Rebecca Cowley** | CSIRO, project and data lead for the Ships of Opportunity XBT.

### Who are you and what is your role in IMOS?

I'm Rebecca Cowley, CSIRO, project & data lead for the [Ships of Opportunity XBT](#) sub-Facility and data lead for the [Deep Water Arrays](#) sub-Facility.

### What drew you into the world of science?

I was inspired by my high school chemistry teacher to continue in science. Having a background in sailing, I thought that marine science was interesting and took that path.

### What's the best part about being a scientist?

Learning something new every day, changing roles within the same job and meeting extraordinary and inspiring people. I started as a laboratory chemist and am now an ocean data analyst/quality control expert and programmer.

### What would you say to young girls and women thinking about being a scientist?

Follow your interest, do what you enjoy, not what you think you should do. Science is about adaptation and engagement and you can have a great career if you put the work in. ■



### Leanne Currey-Randall

AIMS, on field trip tagging shovelnose rays whilst 30 weeks pregnant.

#### Who are you and what is your role in IMOS?

I'm Dr Leanne Currey-Randall (Australian Institute of Marine Science), IMOS sub-Facility leader of the [Qld Acoustic Telemetry Array](#). My role involves enhancing tracking infrastructure in Queensland waters to better understand the large-scale movements of key fishes along the East coast of Australia. This involves working with collaborators to maintain underwater listening stations (acoustic receivers) and tagging animals (sharks, rays and bony fish) with transmitters. Detection data from tagged animals are then combined with environmental data to answer questions about connectivity, stock structure and the drivers of movement and migration.

#### What drew you into the world of science?

A touch tank at an aquarium when I was 7 years old sparked my interest in the marine environment as a whole – I was curious about all the ocean's amazing creatures and couldn't wait to get my diving certification. I knew early on that I wanted to do fish research in the tropics, and I am totally in my element on a boat with salty breeze in my face.

#### What's the best part about being a scientist?

Investigation and field work – finding answers to questions on the ecology and movement of marine fishes is enabled by field trips to interesting places. My most rewarding research projects have involved data collection by diving, fishing, and travelling to Pacific Islands, where I've met inspiring colleagues. As a scientist my aim is to

do research that helps the management of fishes and their environments by filling ecological and biological knowledge gaps for marine species.

#### What would you say to young girls and women thinking about being a scientist?

Know that you can do whatever you set your mind to and connect with people doing what inspires you. Doing good science is essential to finding the right answers and creating new questions to explore! ■



### Dr Michelle Heupel

Director of IMOS

#### Who are you and what is your role in IMOS?

I'm Dr Michelle Heupel the [Director of IMOS](#).

#### What drew you into the world of science?

I grew up fascinated by sharks and the ocean. I knew sharks weren't well understood and wanted to do something to help fix that. Becoming a marine biologist was the way for me to learn about sharks and help others learn more about them too. Now as Director of IMOS I get to help people understand more about the ocean, including and beyond sharks.

#### What's the best part about being a scientist?

There are many things. One of the best things is getting to learn things no one else knows. To be the first person to know something about an animal or a place is really exciting and energising. The second thing for me is getting to be out on the ocean and getting to work with animals I am so passionate about understanding and conserving.

#### What would you say to young girls and women thinking about being a scientist?

Go for it and never listen to anyone who tells you that you can't do it. I did it and you can too. ■



### Moninya Roughan

Professor of Oceanography at UNSW

#### Who are you and what is your role in IMOS?

I'm Moninya Roughan a Professor of Oceanography at UNSW. I lead the [NSW moorings](#) sub-Facility, and I also lead the NSW-IMOS oceanography team.

#### What drew you into the world of science?

I grew up with a love of the sea and a passion for mathematics. Oceanography combines the thrill of working on boats with the beauty of maths. I have always enjoyed the thrill of new knowledge and breaking new ground.

#### What's the best part about being a scientist?

I love the variety of the role. In a single day I could be working on a proposal, writing about new research, reading new papers or something from my team, dreaming up a new experiment, coding up a piece of analysis, building a mooring with hardware and shackles, coding up an instrument or bouncing around in the Pacific Ocean collecting data to analyse.

#### What would you say to young girls and women thinking about being a scientist?

In the words of my 8-year-old daughter 'Dream Big, Play Hard, Be strong'. ■



### Dr Cherie Motti and Dr Marina Santana

work together at AIMS developing a Marine Microplastics Monitoring Program.

#### Who are you and what is your role in IMOS?

Marine microplastics contamination has become an issue of national and international concern with risks to the environment and humans now being realised. Drs. Cherie Motti and Marina Santana, both scientists at the Australian Institute of Marine Science (AIMS), are working together with IMOS to develop a [Marine Microplastics Monitoring Program](#) to record spatial and temporal variations of microplastic levels in Australian surface seawaters. Cherie, the principal investigator of the project, has a background in natural products chemistry and has been working in the field of microplastics since 2014. Her research is focussed on developing, validating and streamlining sample processing and analysis methodologies, including QA/QC, to improve the accuracy of microplastic estimates in marine systems. Marina, is an oceanographer and, since 2012, has been investigating plastic and microplastic presence and distribution in the marine environments and their potential to elicit biological effects. She is the coordinator and data analyst of the Marine Microplastics Monitoring Program.

#### What drew you into the world of science?

Both scientists were drawn into microplastics research by their passion for the marine environment and a desire to inform the broader community of the microplastics peril. Their research is aimed at generating applicable information that can assist in the development and improvement of policies and efficient environmental

management strategies to mitigate marine microplastic contamination. For the past seven years, the complementary backgrounds of Cherie and Marina have been promoting systematic, sustained and scientifically robust observations on microplastic contamination and potential effects across Australian marine waters. For the Marine Microplastics Monitoring Program specifically, their observations on microplastic contamination, combined with physicochemical variables also measured by IMOS at the sampling locations (e.g., surface salinity, current and plankton community), is now being used to understand the potential sources and fate of marine microplastics, and is available to guide policymakers in their response to the issue and support assessment of the effectiveness of these policy responses.

#### What's the best part about being a scientist?

For both Cherie and Marina, the best part of being a research scientist is having the opportunity to work collaboratively with experts nationally and internationally to understand and solve critically important global environmental issues, such as marine microplastic contamination. For Cherie, now into her fourth decade as a researcher, science has been a rewarding career and she is still learning and discovering new things; and is constantly in awe of the up-and-coming female scientists she's had the pleasure and privilege to train. For Marina, a new PhD graduate, science has taken her around the world, from Brazil to Australia, and given her the opportunity to be involved in world class microplastics research, something she now tries to foster in other young researchers.

#### What would you say to young girls and women thinking about being a scientist?

At AIMS, they are both actively involved in science outreach programs aimed to encourage more young female students to consider science as a career. Their message is simple: science is an exciting field to be working in and can offer young women a rewarding career that will have real and long-term impact. For the young girls and women thinking about being a scientist they say, "go for it, we need as many people as possible working together for a more sustainable future!" ■



**Kerrie Swadling** | an Associate Professor at the Institute for Marine and Antarctic Studies

#### Who are you and what is your role in IMOS?

I'm Kerrie Swadling, an Associate Professor at the Institute for Marine and Antarctic Studies and I lead the [Southern Ocean Continuous Plankton Recorder](#) sub-Facility.

#### What drew you into the world of science?

I was always interested in animals when I was at school and grew up next to the beach in Melbourne. I spent many early childhood summers fossicking in rock pools at our local beach. A teacher at my high school suggested Marine Biology as a university degree and so I moved up to James Cook University in Townsville when I finished school. In my third year I took a unit on Plankton Ecology and absolutely loved it – all of these biological and ecological processes happening at the microscopic level!

#### What's the best part about being a scientist?

When I was younger I was able to study plankton in all sorts of different environments: the Gulf of Mexico, subarctic Canada and the Antarctic amongst others. Living in other countries and doing research is a very special thing to do. Because my focus is Antarctica and the Southern Ocean I get to work with colleagues from many countries, in particular France, Japan and China, as we all focus on the East Antarctic. The Southern Ocean covers a huge region and no one country can do all the science alone, so it is very important that we collaborate and

share resources as much as possible. Now that I am at the other end of my career, I get a lot of pleasure from working with young scientists who are just starting their working lives. It makes me happy when I can provide opportunities for them, such as getting berths on Antarctic research vessels and attending conferences.

#### What would you say to young girls and women thinking about being a scientist?

Don't hold back. Be flexible and prepared to move to different places/universities to follow your interests. Remember that careers don't necessarily follow straight lines so don't be discouraged if you take a few detours along the way. Finally, think about ways to broaden your career opportunities. Combining marine ecology with mathematical skills, geology, engineering or any other science could really open up your future. ■



#### Jodie van de Kamp

A Research Scientist in Environmental Genomics, at CSIRO

#### Who are you and what is your role in IMOS?

I'm Dr Jodie van de Kamp, a Research Scientist in Environmental Genomics, at CSIRO, and I lead the [IMOS Marine Microbiome Initiative](#) Facility. Marine microbiomes are the collection of all microscopic organisms living in our oceans. Microbiomes are the engines of our oceans, driving biogeochemical and nutrient cycles, they form the base of the foodweb, perform essential functions in climate regulation and can help to mitigate the impacts of pollution. It's incredibly important that we understand the marine microbiome so that we can better manage our marine environments.

#### What drew you into the world of science?

I was always going to study Law and Economics at University. Then in Grade 12 I signed up for Biology, purely because my friends were doing the class, and I was fortunate enough to be taught by a young, female teacher who was passionate about science. The fun and excitement that this teacher brought to our learning changed my career path and I decided to enrol in a Bachelor of Science in that very last year of school. At university, I continued to discover just how much I loved science, particularly genetics and molecular biology, the logic, the chance to use my mind to solve problems, and soon realised it was a research career I wanted.

#### What's the best part about being a scientist?

I see my science as a tool that can be applied to so many different questions

which means I've been able to have a really diverse and interesting career and been able to meet and work with a lot of really interesting people from all over the world. I have been involved in research on, the genetic control of flower development in crops, isolating novel microbes from Antarctic and sub-Antarctic environments to look for new bioproducts, microbial interactions with geological formations in caves, genetic control of pest fish species like carp, and microbiomes as indicators of ecosystem health.

#### What would you say to young girls and women thinking about being a scientist?

Do it! There are so many different pathways open to you in science and it's an opportunity to help solve the challenges facing our environment and society today. ■

## Farewell to the AODN Director, Sebastien Mancini



#### The IMOS community bid farewell to AODN Director, Sebastien Mancini who left IMOS in March.

Sebastien joined IMOS in August 2008. He worked as a Project Officer and then progressed to the Data Team Leader within the eMarine Information Infrastructure facility of IMOS (now known as the Australian Ocean Data Network – AODN), before becoming the AODN Director in 2018.

In his work with the AODN, Sebastien has contributed to the creation and improvement of a single integrative framework for data and information management that allows discovery and access of the data by scientists, managers and the public. Sebastien's ability to calmly navigate challenging situations stood him in good stead as

he led and managed AODN through the difficult COVID-19 period, keeping the IMOS data streams flowing despite a range of disruptions.

"Sebastien has made substantial contributions to the advancement and leadership of AODN over the 14 years he has worked with us. His energy, enthusiasm and passion for IMOS and AODN will be missed. We will miss him, but hope we will continue to intersect with him as he moves to the next stage of his career," said Michelle Heupel, IMOS Director.

We wish Sebastien all the best on his new career venture. ■



Sebastien Mancini with his IMOS colleagues at his farewell lunch.

## Mark Rehbein joins the IMOS office as the Director of the AODN



**IMOS Director Michelle Heupel is pleased to announce that Mark Rehbein has been appointed as the Director of the IMOS Australian Ocean Data Network.**

Mark has a Bachelor of Engineering (Hons) in Computer Systems and previously worked at the Australian Institute of Marine Science (AIMS). He has over 10 years software engineering experience specialising in marine data

management including applications to improve data accessibility and discovery, bespoke visualisation tools and web applications. Mark has a further 14 years' experience leading software engineering teams on corporate Intranet and research data themed projects.

Mark has handled a diverse set of data types collected by researchers, establishing various data management and data processing systems for these. One recent highlight was the implementation of a cloud based, low-cost, high throughput image processing system using machine learning.

While at AIMS, Mark has created and executed data strategy, put in place data management policy and procedures, and managed periods of technology renewal including the transition from on-premise to cloud computing environments. Mark's work on data discovery, access and

visualisation solutions has generated a significant online data presence for AIMS.

"I am very excited to welcome Mark Rehbein as the new Director of the AODN. Mark has an excellent background and expertise in data management and delivery and I look forward to seeing how his experience helps shape the AODN as we look to expand IMOS and enhance our data delivery," says IMOS Director Michelle Heupel.

Mark says, "I am passionate about the Australian marine data community and this opportunity allows me to make a difference in how Australia's marine data assets are accessed and used. I look forward to working with the IMOS facilities, partners, and others to enhance the uptake of data by our stakeholders."

"In my free time, I enjoy camping and hiking, especially in the mountains." ■





## Change of leadership for the South Australian IMOS Node



**We welcome Associate Professor Graziela Miot da Silva from Flinders University into the role of Deputy Leader of the South Australian Node.**

Graziela is a coastal geomorphologist/oceanographer with a BSc in Oceanography from the University of Vale do Itajaí (UNIVALI), Brazil, and a Masters Degree and Ph.D. in Marine Geology from the Federal University of Rio Grande do Sul (UFRGS), Brazil.

Graziela joined the School of Environment (College of Science and Engineering) at Flinders University in 2013 after a visiting position at the Department of Geology and Geophysics at Louisiana State University (LSU).

Graziela has worked extensively on barrier systems in Southern Brazil and conducted research on surfzone dynamics and sediment transport, beach morphodynamics and sedimentology, aeolian sediment transport, dune ecology, foredune dynamics and barrier evolution.

Graziela has applied and expanded the knowledge obtained from studying coastal systems in Brazil to the Australian sandy barriers, in collaboration with researchers from Australia and various parts of the world.

Dr Lachlan McLeay, of the South Australian Research and Development Institute (SARDI), remains as the Leader of the South Australian Node.

We thank the outgoing Deputy Leader Professor Charlie Huveneers, of Flinders University. ■

## Tasmanian IMOS Node hosts information session in Hobart

**The Tasmanian IMOS Node is re-establishing with new Node leader Dr Myriam Lacharité and Deputy Node leader Dr Karen Wild-Allen.**

Tasmanian marine stakeholders gathered in early February for an information session about IMOS, how the Tasmanian Node will operate, and how to better connect with the Node.

The Tasmanian Node will assist the IMOS office to better understand stakeholders needs and priorities for marine observations in Tasmanian waters. The Node will also strengthen the links between IMOS and the industries, managers and researchers who work to promote the safety and security of maritime operations in Tasmanian waters and sustainable management of Tasmania's marine resources.

Node leader Dr Myriam Lacharité is a Marine Spatial Analyst at the Institute for Marine and Antarctic Studies (University of Tasmania). Myriam's research focus is on applied marine science to support industry and government needs to manage marine resources. Myriam's interests include marine spatial planning, sustainable blue economy, marine policy, spatial analysis of marine ecosystems and uses, marine geography and mapping, marine spatial data, and ocean technology. Myriam has a PhD in oceanography from Dalhousie University (Canada).

Deputy Node leader Dr Karen Wild-Allen is a Principal Research Scientist and



Dr Myriam Lacharité



Dr Karen Wild-Allen

leader of the Coastal Biogeochemical Modelling team at CSIRO. Karen is an established multi-disciplinary project leader using models and observations to deliver scientific information and management solutions to the research community, marine industries, and the State and Federal governments.

As the Node has just restarted, if you would like to know more about the Node or be added to their Node mailing list please contact Myriam [myriam.lacharite@utas.edu.au](mailto:myriam.lacharite@utas.edu.au). ■

# Satellite Remote Sensing and AODN: New ocean wind speed and direction database covering Australasian coastal waters in km-resolution available on the AODN Portal

Written by Salman Khan

The IMOS Surface Waves sub-Facility, which is operated by CSIRO in partnership with University of Melbourne, have published a new wind data collection in the AODN Portal.

The [new collection](#) is a km-resolution ocean wind speed and direction database over coastal seas of Australia, New Zealand, Western Pacific islands, and the Maritime continent. It is obtained from Europe's Copernicus Sentinel-1 A and B Synthetic Aperture Radar (SAR) satellites from 2017 up till present.

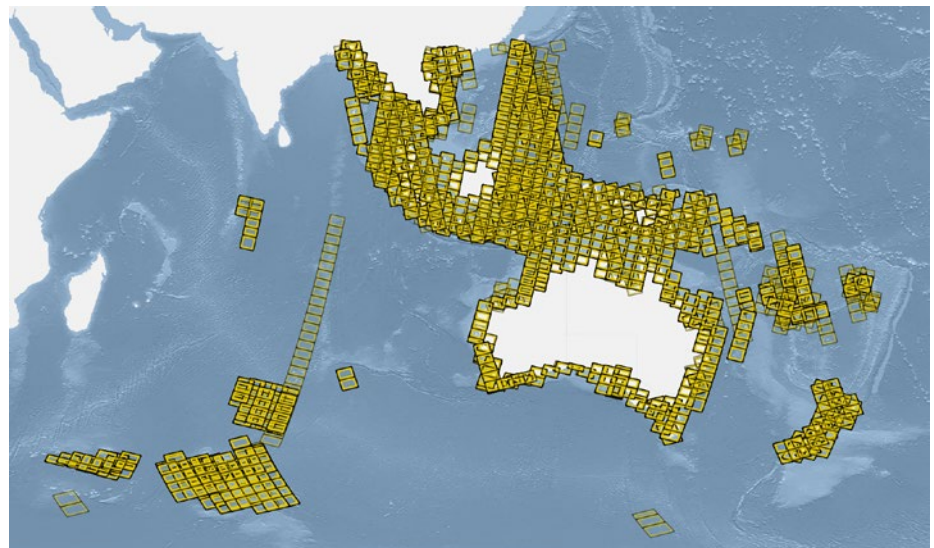
A SAR is a microwave radar sensor used to measure the reflection or scattering effect produced while imaging the surface of the earth in high resolution from an aircraft or a satellite. It can record measurements even at night, during cloud cover, and in most weather conditions.

Wind measurements by SAR go all the way up to the coast due to its high resolution, filling critical gaps in ocean wind speed and direction observations in coastal areas.

SAR ocean wind measurements are calibrated and validated against overlaps with offshore Scatterometer and Altimeter wind measurements. Both Scatterometer and Altimeter Ocean winds are already carefully calibrated against ocean buoys.

The new collection is a first of its kind in the region and captures the spatial variability of coastal ocean winds over a wide swath (250 km). SAR measurements over strong wind events, including tropical cyclones, reveals new insights into the structure of extreme wind fields.

These data are useful for offshore industry (oil and gas, fisheries, shipping, offshore wind), protection and management of coasts, habitats, and infrastructure, capturing of sub-mesoscale air-sea interactions, and improvement of forcing in numerical models.



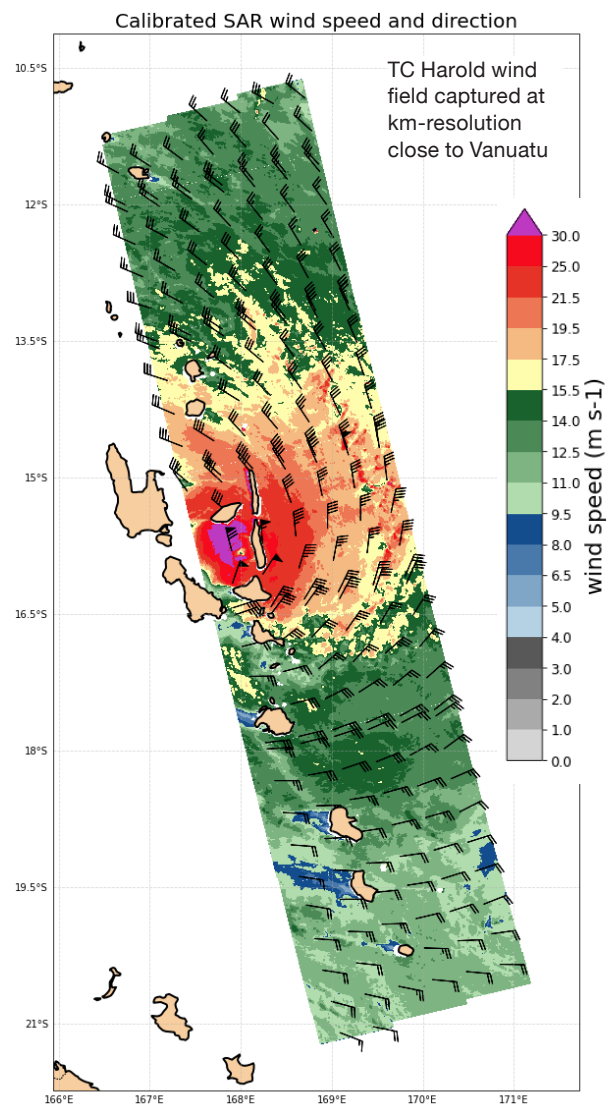
km-resolution Ocean wind speed and direction collection on the AODN Portal.

Data description published in *Nature Scientific Data*: <https://doi.org/10.1038/s41597-023-02046-w>

Metadata record available: <https://doi.org/10.26198/3rqa-2181>

A python Jupyter notebook to get started with using the data: [https://github.com/aodn/imos-user-code-library/blob/master/Python/notebooks/SAR\\_winds/SAR\\_winds\\_getting\\_started\\_jupyter\\_notebook/ausar\\_winds\\_getting\\_started\\_notebook.ipynb](https://github.com/aodn/imos-user-code-library/blob/master/Python/notebooks/SAR_winds/SAR_winds_getting_started_jupyter_notebook/ausar_winds_getting_started_notebook.ipynb)

For any questions or feedback about this collection or any other AODN Portal collection, please contact us at [info@aodn.org.au](mailto:info@aodn.org.au) ■



# FACILITIES

## Animal Tracking: Update from Queensland's IMOS Acoustic Telemetry Array

Written by Leanne Currey-Randall

**Better understanding of broad-scale movement patterns of marine animals along the Australian east coast is underway, made possible with the enhancement of IMOS' national animal tracking infrastructure in Queensland.**

Through a strong alliance with multiple collaborators, the Qld IMOS Acoustic Telemetry Array Project maintains 130 acoustic receiver stations and has supported existing arrays, resulting in 345 stations now spanning 16.7 degrees of latitude (near Raine Island to NSW border).

Since 2020, the project's extensive array coverage has increased detections of priority species moving through Queensland coastal waters, with more than 2.09 million detections. Project members have tagged 812 animals, including nine priority species of sharks relevant to bather safety, species of

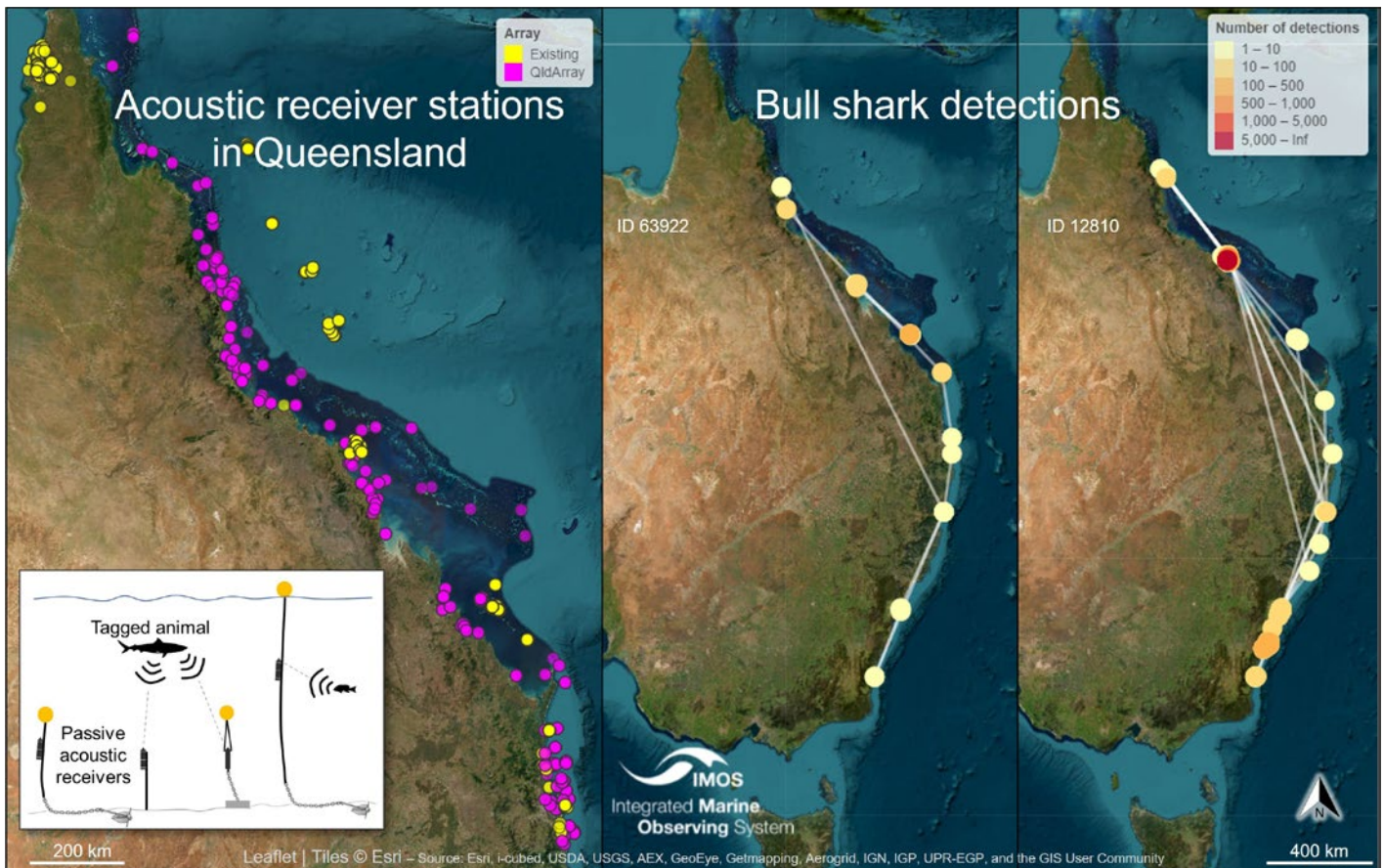
conservation interest, and important fishery species. Primarily 10-year tags have been fitted to these animals, contributing important information on regional connectivity along the entire east coast and crossing state boundaries, critical for spatial management of priority marine species and ecosystems.

By better understanding the extent and timing of movements of mobile species, the project aims to address questions such as how often sharks visit Queensland Department of Agriculture and Fisheries (QDAF) Shark Control Program monitored beaches, identify connectivity and species stock structure to apply to fisheries and conservation management, cross-jurisdictional boundary movements, and whether environmental conditions may alter movement patterns or distribution of species.

Without such an extensive regional network, many movements would remain undetected, and the array's coverage has identified movements of some species greater than previously recorded on the east coast of Australia (e.g. bull sharks).

The array supports or enhances projects with numerous collaborators, including QDAF Shark Control Program, QDAF Fish Aggregation Devices Program, James Cook University, Department of Environment and Science, Queensland, Biopixel Oceans Foundation, Parks Australia, University of the Sunshine Coast, and four student projects.

The Qld IMOS Acoustic Telemetry Array Project is funded by the Department of Environment and Science, Queensland, and is operated by the Australian Institute of Marine Science (AIMS). ■



Locations of acoustic receiver stations in Queensland, including new Qld IMOS stations (pink) and stations maintained by existing project collaborators (yellow) and in-water deployment setups (inset). Panels 2 and 3 show detections of two bull sharks recorded moving along the Australian East Coast.

# FACILITIES

## Ocean Radar: High frequency radar observations of the Ningaloo Current

Written by Yasha Hetzel

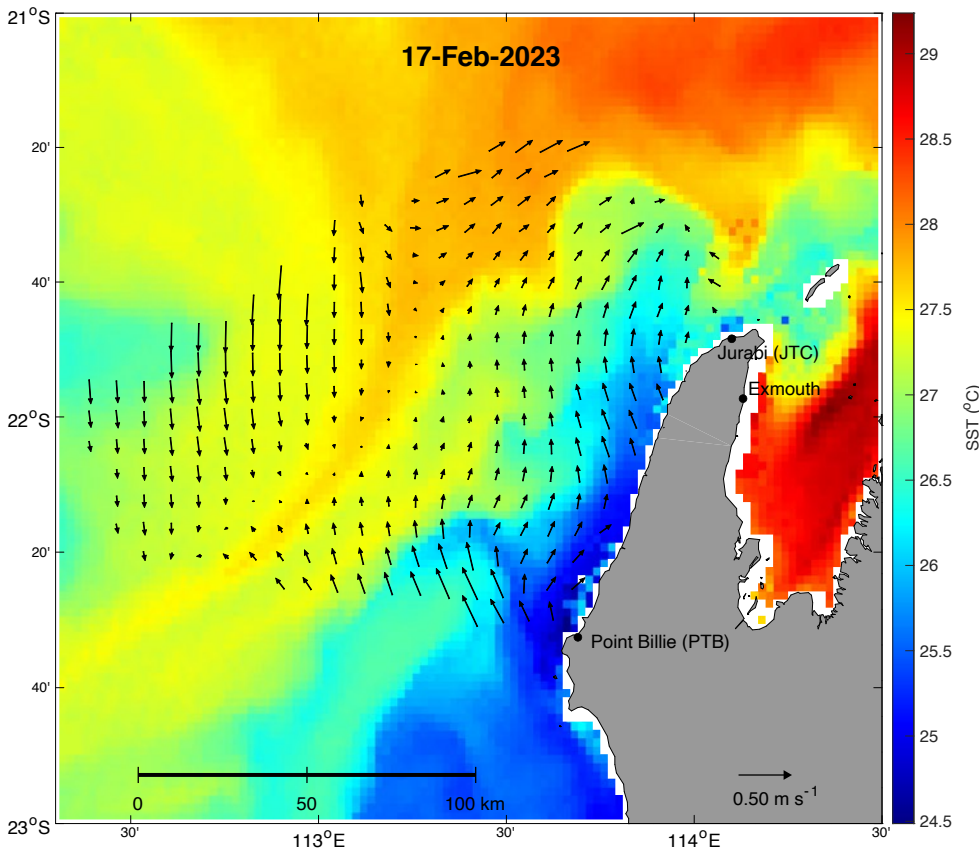
The corals of the Ningaloo Reef, between Point Coates and North-West Cape in the North-West of Western Australia have historically been spared from damaging coral bleaching events despite the last three years of La Niña conditions causing elevated water temperatures in the region. This can be attributed to wind-driven upwelling and northward transport of cooler water along the continental shelf – the Ningaloo Current (Taylor & Pearce, 1999). When southerly winds blow strongly over several days the Ningaloo Current forms north of Shark Bay and extends along the shelf past Northwest Cape. Satellite data indicate that the Ningaloo region may experience ~140 upwelling days per year (Rossi *et al.*, 2013) corresponding to periods when the Ningaloo current is active.

The Ningaloo current is easily identifiable in satellite SST images as a band of cooler water along the continental shelf (Figure 1). Limited current velocity measurements have been available through oceanographic shipborne surveys (Woo *et al.*, 2006), and by the IMOS mooring offshore Tantabiddi.

In 2021, the IMOS Ocean Radar Facility (operated by the University of Western Australia), installed a new High Frequency (HF) ocean Radar system at Ningaloo, providing a valuable new tool to monitor the Ningaloo Current and interactions with the Leeuwin Current that forms in this region. Recent HF Radar data clearly showed the Ningaloo Current flowing northwards on 17th of February 2023 (see Figure). Water within the current was 2-3 degrees Celsius cooler than

offshore with the equatorward surface current flow extending up to 100 km off the coast with speeds up to ~0.4 m s<sup>-1</sup>. The warmer water offshore is associated with the Leeuwin current.

The North-West Australia Ocean Radar system consists of a pair of sites with solar powered WERA phased array of shore-based antennae located at the Jurabi Turtle Centre near the NW Cape, and at Point Billie, near the southern end of the Ningaloo peninsula. The system provides hourly surface current measurements in near real time on a ~7km grid up to 150 km from shore, with the data available on the Australian Ocean Data Network (AODN). ■



24 hour average of near-real time (FV00) surface currents(vectors) for 06z 17 February 2023 measured by the IMOS North-West Australia Ocean Radar system offshore Ningaloo. The velocity data are overlaid on (2km) daily IMOS L3SM multi-sensor nighttime satellite sea surface temperature (SST) data with both available through the AODN.



The IMOS Ocean Radar system at Ningaloo.

Yasha Hetzel, University of Western Australia.

# FACILITIES

## Satellite Remote Sensing: IMOS deployments all set for crucial next phase of the new SWOT satellite mission

Written by Christopher Watson and Benoit Legresy

**SWOT has provided a stunning glimpse of what it will see over the world's oceans, lakes, and rivers.**

The [Surface Water Ocean Topography \(SWOT\)](#) satellite has delivered its first exciting glimpse of data over the ocean and inland waters with 10 times the resolution of previous measurements. Scientists now eagerly await the mission entering its 90-day calibration and validation phase, with a host of ocean-based instruments being deployed at key sites around the world.

Launched in December 2022, the SWOT mission has had a slightly extended commissioning phase while the mission engineers worked on the main instrument. SWOT's new radar interferometric instrument known as KaRIN has since delivered its first exciting glimpse of what it can see over the Gulf Stream in the North Atlantic Ocean.

The spatial resolution of SWOT measurements of topography over the ocean are more than 10 times finer than what can be achieved from the current constellation of satellite altimeters. These measurements will provide a completely new way of looking at the ocean, helping scientists understand and predict our complex ocean systems. The measurements also promise to be a game-changer over inland waters.

The satellite is now entering a special 90-day calibration phase where certain tracks around the globe are covered every day. One of these few tracks crosses Bass Strait (over Melbourne and Port Phillip Bay, across Bass Strait, over Tasmania and Hobart) providing daily coverage over April/May/June when it will then shift to cover the global oceans once every 21 days.

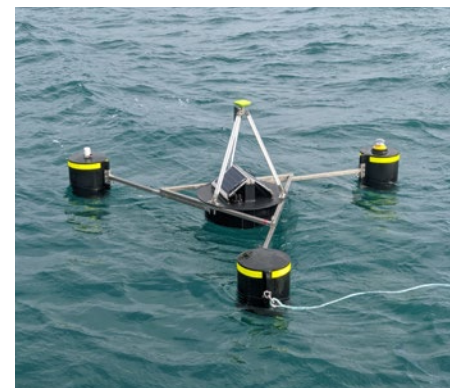
The IMOS Satellite Altimetry Calibration and Validation sub-Facility in Bass Strait has ramped up its capability in recent time to assist with the international SWOT validation effort. With investment from IMOS, CSIRO and the University of Tasmania, as well as a contribution from the French Space Agency (CNES), the site in Bass Strait will have an important role over the validation phase.

The Bass Strait team have had to develop new instrumentation to keep pace with the advanced satellite technology. With a focus on a 80 x 50 km region in Bass Strait off the north-west coast of Tasmania, a suite of instruments supported by IMOS have just been deployed and set to record continuously over the SWOT validation phase.

In the water, CSIRO have developed and deployed new moored sensors to measure water pressure, temperature, salinity, currents, wave characteristics,

and sea surface height. On the surface, the University of Tasmania have developed GNSS equipped buoys capable of measuring precise sea surface height twice a second for months at a time.

"It's an exciting time for Bass Strait team – the start of the validation phase marks the transition in a pretty intense period for us. It's great to successfully deploy our instruments and we look forward to contributing to understanding these exciting measurements from SWOT" say Dr Christopher Watson and Benoit Legresy, leaders of the [IMOS Satellite Altimetry Calibration and Validation Facility](#), and respectively Senior Lecturer at the University of Tasmania and Group Leader at CSIRO. ■

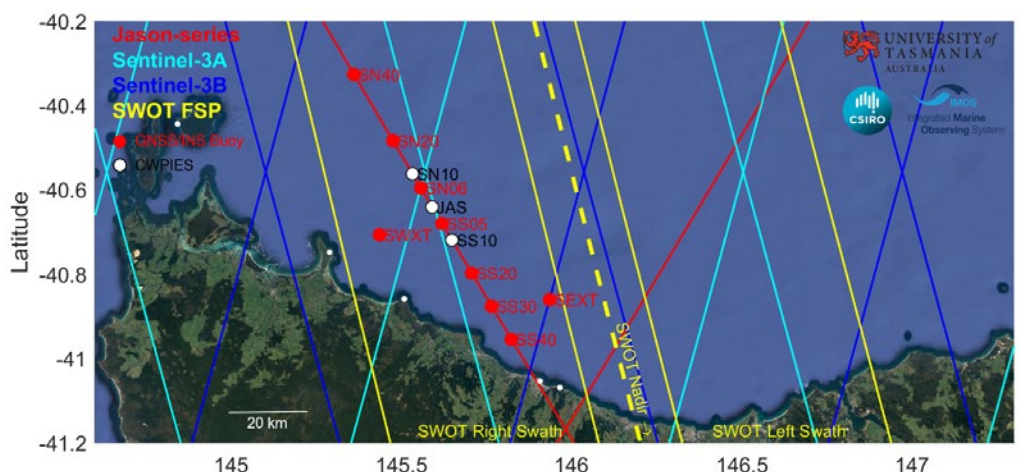


GNSS equipped buoy just deployed in Bass Strait.

Jack Beardsley, UTAS/CSIRO



Deployment of moored ocean sensors by CSIRO.



IMOS instrument deployment locations in Bass Strait for the SWOT calibration or 'fast sampling' phase.

# FACILITIES

## Deep Water Moorings: Stunning and rare image from the Southern Ocean Time Series wins photographic prize

Written by Ruth Eriksen

Each year, RV *Investigator* returns precious surface water samples from the IMOS Southern Ocean Time Series (SOTS) site, located in the Sub Antarctic Zone (see map). Once unloaded in Hobart, preserved samples are analysed for phytoplankton community composition by microscopy, to determine the depth distribution and seasonal cycle of major phytoplankton groups such as the diatoms, dinoflagellates, flagellates, coccolithophorids and other organisms in the 5 to 1000  $\mu\text{m}$  size range.

The fantastic organism in the image below was collected from a Niskin sample at 125m depth at the SOTS during a recent voyage on RV *Investigator* and photographed at the Central Science Laboratory (CSL, University of Tasmania), using a Hitachi Scanning Electron Microscope. SOTS receives tremendous support from the CSL and we would like to acknowledge Drs Karsten Goemann, and Sandrin Feig for on-going technical excellence and support. The image titled “The anonymous little warrior” was submitted to the Micropaleontological Society 2022 image competition by Ruth Eriksen, CSIRO, winning first prize.

“The exact taxonomic name of the organism is uncertain – there are very few published records of a complete organism, usually only fragments remain unless samples are handled particularly carefully. This beautiful specimen popped up at the end of a long day on the electron microscope. For years, I had seen hints of what this anonymous little warrior might look like: a lonely shield, a few scattered barbed legs, perhaps lost after a fierce battle, scattered through my deep-water samples. I have approached a few experts in this armoured group and am yet to find a name – we think it sits in the Taxopodia, and the genus *Sticholonche* which is known from the deep waters of the Equatorial Pacific. *Sticholonche* are rarely reported in bottom sediments, or the fossil state and it is suspected that the siliceous skeleton is rapidly dissolved. I always hold my breath in search of more to clarify its taxonomic position.” ■

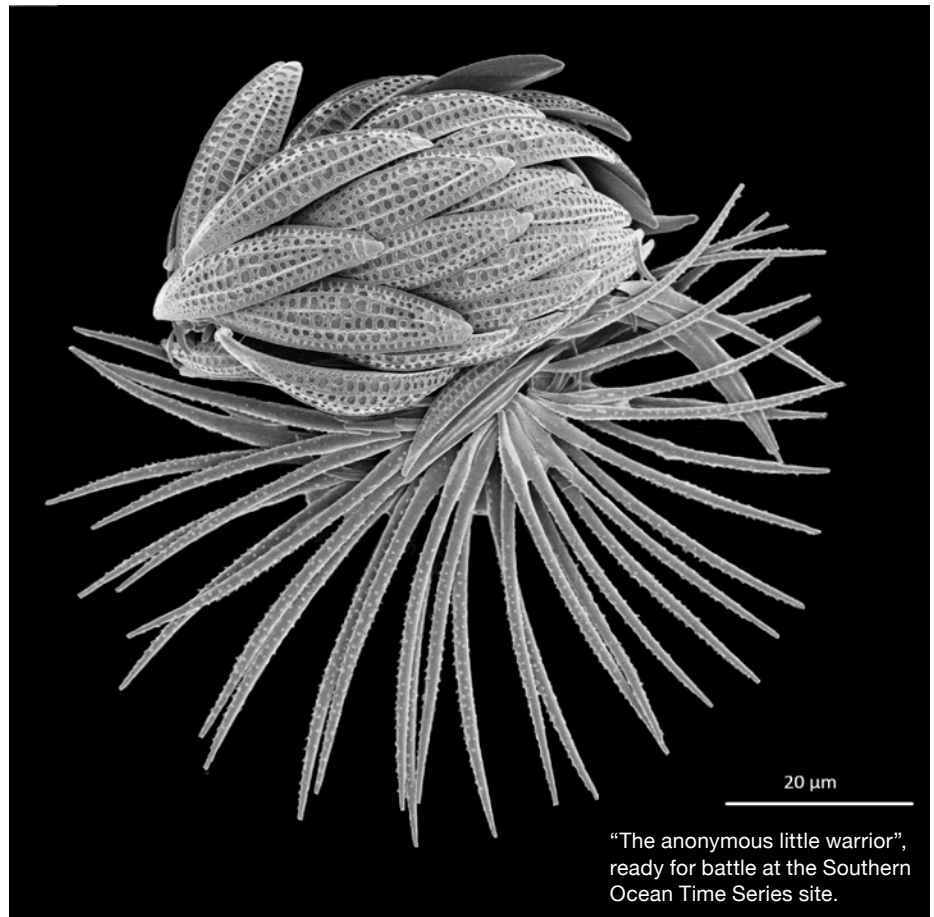
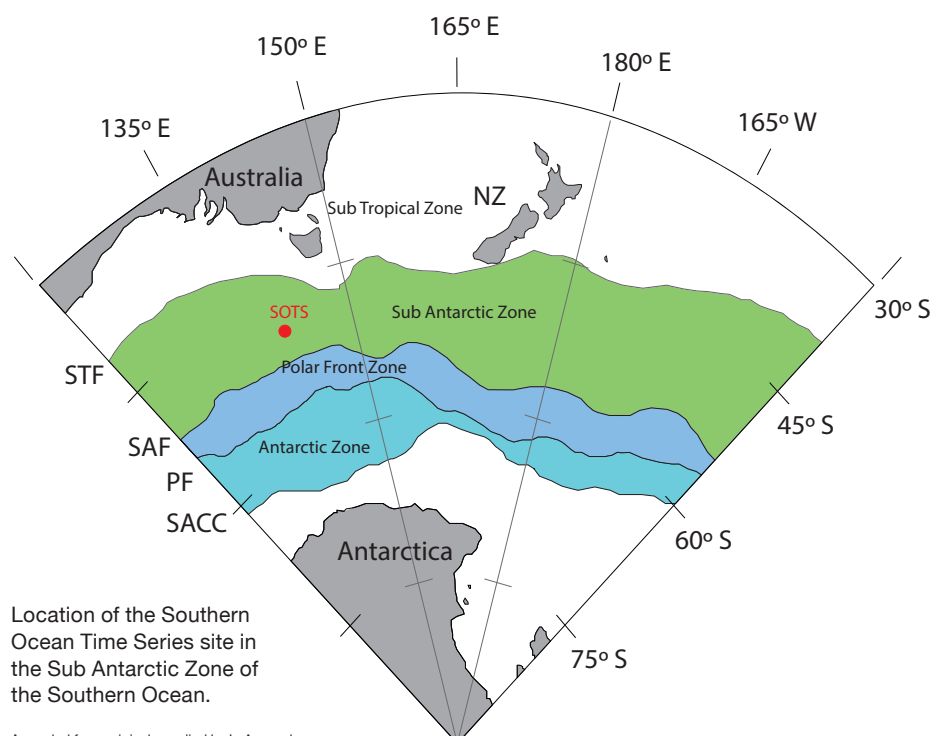


Image by Ruth Eriksen, CSIRO taken at the Central Science Laboratory, University of Tasmania



# FACILITIES

## Deep Water Moorings: New hourly-depth gridded time-series product from the IMOS East Australian Current deep water moorings

Written by Rebecca Cowley

**CSIRO have produced a new hourly- and depth-gridded product of currents, temperature and salinity from individual instrument files collected over five 18-month IMOS deployments in the East Australian Current (EAC) off Brisbane, Australia.**

The EAC is the complex, highly energetic western boundary current of the south Pacific gyre that flows along the east coast of Australia. Due to its broad geographic reach and close proximity to the coast the EAC affects the climate and marine environment from 15oS to 42oS. Between 15oS and 30oS the EAC is a coherent jet that meanders in an east-west direction onto and off the continental slope and, south of 30oS the EAC is predominantly a series of eddies.

In 2012, given the important dynamical constraint that the EAC jet places on the downstream circulation and properties of the coast and the Tasman Sea, IMOS and

CSIRO Oceans and Atmosphere (now part of CSIRO Environment) established a comprehensive deep water mooring array in the EAC jet at approximately 27oS. The EAC deep water moorings consisted of an array of six full-depth current meter and property (CTD) moorings from the continental slope to the abyssal waters off Brisbane (27oS). The time coverage of the mooring array was 2012-2022 (with the exception of approximately 2-year gap from 2013-2015 where no moorings were in place).

To create the final gridded products, individual instrument files are screened to remove data flagged as 'bad'. Temperature, salinity and velocity data is interpolated onto a common time grid (daily) and common depth grid (10m to 400m and 20m from 400m to bottom) using linear interpolation, between good instrument data records, for each deployment.

Deployments are concatenated together to give one time-continuous dataset for each mooring site. Periods where an instrument fails or data are missing are filled with missing values, and the final variables are TEMP, UCUR, VCUR and PSAL. Additional variables in the file are the '\*\_FILLED' variables (eg, 'TEMP\_FILLED'), and these are created using a SOM (Self Organising Maps) neural network machine learning algorithm to fill the missing periods of data.

The method is fully described in Sloyan, B. M., Chapman, C. C., Cowley, R., & Charantonis, A. A. (2022). Application of Machine Learning Techniques to Ocean Mooring Time-Series Data, *Journal of Atmospheric and Oceanic Technology*. <https://doi.org/10.1175/JTECH-D-21-0183.1>

The product is now available via the [AODN Portal](#). ■



Thomas Moore, CSIRO

## Belinda Goddard

Macquarie University & Sydney Institute of Marine Science

### PROJECT TITLE:

Where do Yellowtail Kingfish (*Seriola lalandi*) go to spawn and how do they recruit to the coast?

Yellowtail Kingfish (*Seriola lalandi*) are a large, highly mobile pelagic fish and one of Australia's most iconic fish species. In New South Wales (NSW) alone, ~100 tons of kingfish are harvested commercially each year and an estimated 100,000 kingfish are caught recreationally. Past studies have identified two genetically distinct Australian kingfish stocks, namely the "Western Australia" and "Eastern Australia" stocks. However, kingfish movements, connectivity and habitat use across their respective ranges are not well known. Due to increasing concerns about the status of the Eastern Australian kingfish stock, the species has been identified as a management priority in NSW.

Spawning sites of kingfish in Australia are unknown, preventing scientists and managers from predicting how future climate and oceanographic changes may impact recruitment to the coast and

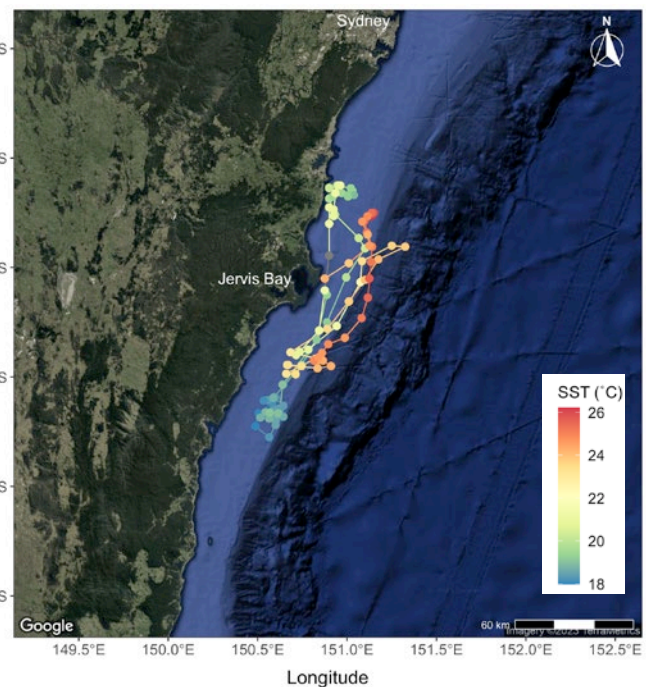
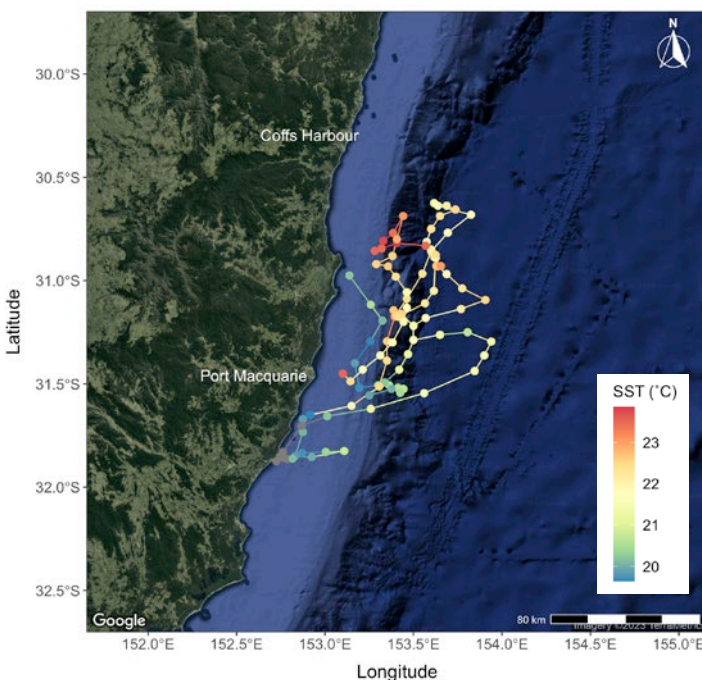
fishing opportunities. As part of [Project Kingfish](#), Belinda's research focuses on filling this knowledge gap. Belinda is using a combination of IMOS acoustic tracking data, tag recapture, otolith (fish ear bones) microchemistry and oceanographic data sourced from IMOS to determine kingfish spawning habitats and predict future recruitment hotspots.

Thanks to active engagement and collaborations with expert recreational anglers, spawning sized kingfish (>95 cm total length) are being satellite tagged and tracked over multiple months and across a large portion of their range, spanning NSW coastal and offshore locations, Victoria and South Australia.

Project Kingfish is enabled by funding from the NSW Recreational Fishing Trusts awarded to the Sydney Institute of Marine Science and the Victorian Recreational Fishing Grants Program awarded to Deakin University.

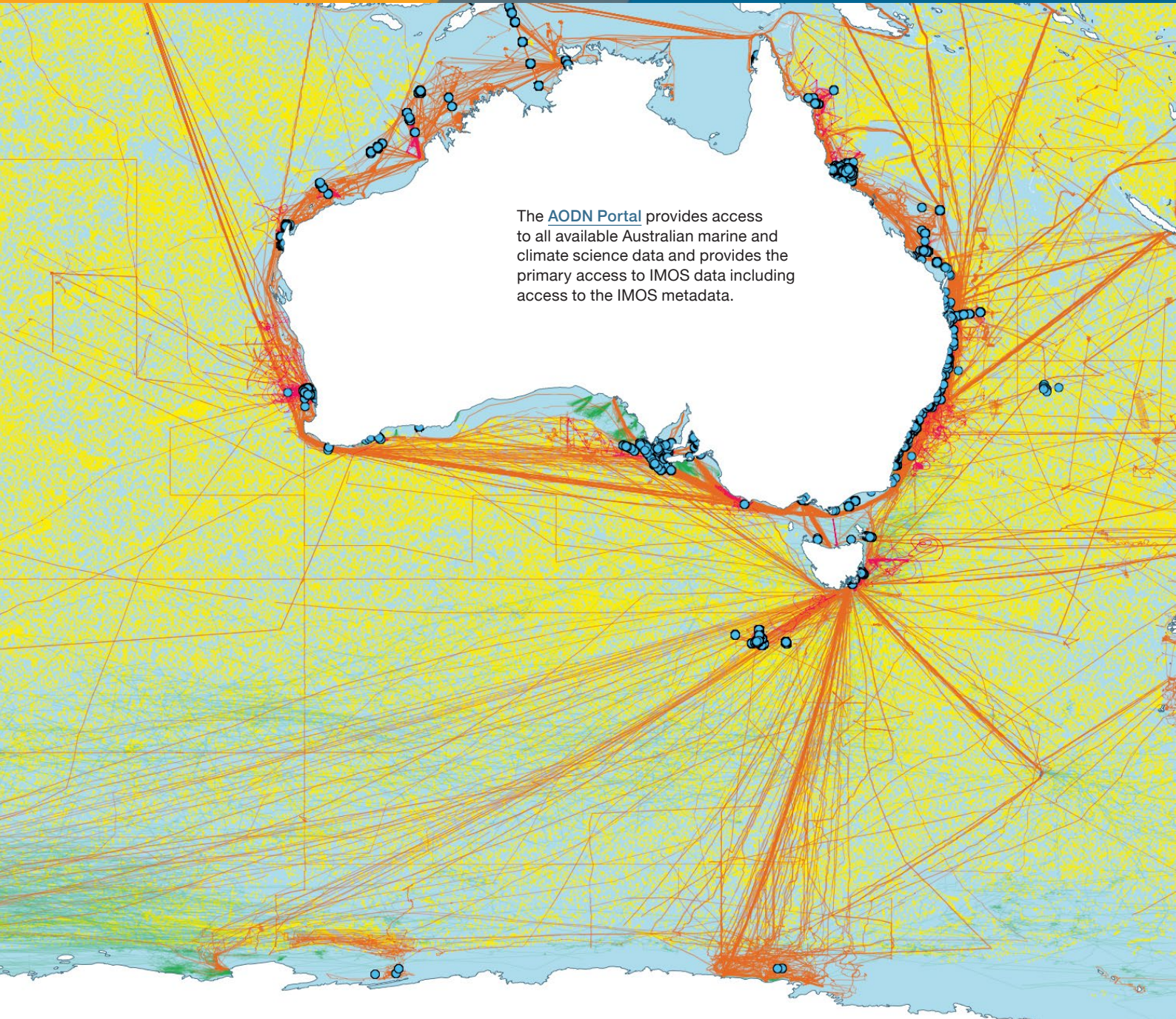


Belinda releasing a satellite tagged kingfish caught off Lord Howe Island.



Examples of two kingfish satellite tracks overlaid with SST data using the remora R package.





The [AODN Portal](#) provides access to all available Australian marine and climate science data and provides the primary access to IMOS data including access to the IMOS metadata.

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**Thanks to:** Helen Beggs, Rebecca Cowley, Leanne Currey-Randall, Michelle Heupel, Moninya Roughan, Cherie Motti, Marina Santana, Kerrie Swadling, Jodie van de Kamp, Graziela Miot da Silva, Myriam Lacharité, Karen Wild-Allen, Salman Saeed Khan, Yasha Hetzel, Christopher Watson, Benoit Legresy, Ruth Eriksen, Rebecca Cowley and Belinda Goddard.



**NCRIS**  
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Australia's Integrated Marine Observing System (IMOS) is enabled by the National Collaborative Research Infrastructure Strategy (NCRIS). It is operated by a consortium of institutions as an unincorporated joint venture, with the University of Tasmania as Lead Agent.

For more information about IMOS please visit the website [www.imos.org.au](http://www.imos.org.au)