IMOS Integrated Marine Observing System

marinematters

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New network of coastal buoys delivering wave data around Australia

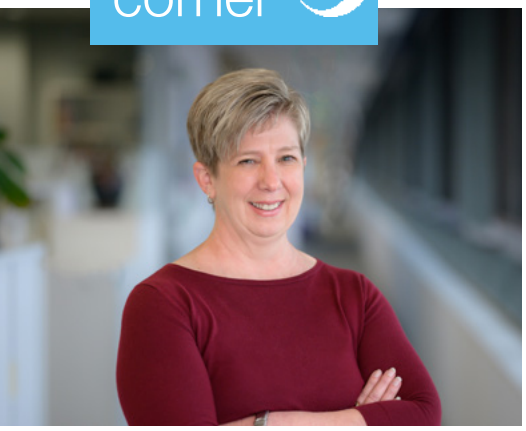
Partnering with Traditional Owners to Strengthen Marine Science

Introducing the IMOS Environmental DNA sub-Facility

Building Near Real-Time capability into Australia's National Reference Stations

Credit: Daniel Ierodiaconou, Deakin University

director's corner



IMOS acknowledges the Traditional Custodians and Elders of the land and sea on which we work and observe, and recognise them as Australia's first marine scientists and carers of sea Country. We pay our respects to Aboriginal and Torres Strait Islander peoples past and present.

Welcome to the December 2025 edition of *Marine Matters*

It is a pleasure to share these exciting updates to the program. In keeping with our regular updates on our Indigenous Partnerships work. Along these lines I'm thrilled to have a story from Uncle Bob in this issue. This is a great piece related to working with Indigenous communities and concepts around Free, Prior, Informed Consent (FPIC) to help expand our knowledge and understanding.

There are a range of new additions to IMOS which are highlighted in this issue. We're excited to have the opportunity to expand the program as part of the NCRIS step-change funding. In conjunction with marine microbiome sampling we have now established an environmental DNA (eDNA) Facility to expand our biodiversity sampling. As part of the CoastRI 'no regrets' funding we are establishing estuarine moorings capability to help measure and monitor water quality and the coastal wave buoys have gained great momentum at a national scale. In addition to these new installations, IMOS has expanded collection of pCO_2 data to include the RSV *Nuyina*.

In conjunction with new observing capability there are a range of other new data products and information initiatives that we are sharing here. The new microplastics report cards are getting great reviews. A first-of-its-kind seal data to guide Southern Ocean management and conservation has been developed via the Global Ocean Observing System. Analyses and integration of IMOS data continue and expand. As you'll see in this issue, IMOS data have underpinned the National Climate Risk Assessment as well as other key reports. New analyses of echo sounder data, CPR data are revealing new insights through integration and aggregation of IMOS data. Finally, the AODN continues to work to connect data streams and create new outputs for our community. They are currently working to compile a national-scale seagrass dataset to ease access to and discovery of these data while also underpinning assessments such as State of the Environment Reporting.

As always, I want to thank everyone who has taken time to contribute and share your stories, updates and information with us. Your efforts and engagement exemplify the relevance and success of IMOS.

There are many other exciting updates in this issue beyond this quick summary, and I hope you enjoy this edition of *Marine Matters* as much as I do.

Dr Michelle Heupel
IMOS Executive Director

Partnering with Traditional Owners to Strengthen Marine Science

Written by Bob Muir

As IMOS builds and expands our approach to observing sea Country, we are looking to grow partnerships with Sea Ranger groups and organisations, and working to ensure First Nations priorities are reflected in the data we collect and share.

The IMOS Indigenous Partnerships Coordinator, Tonya Grant, is hosted within the Indigenous Partnerships Team at the Australian Institute of Marine Science (AIMS).

IMOS recognises the experience and wisdom of the Indigenous Partnerships Team at our partner AIMS, and invited Bob Muir, Indigenous Partnership Coordinator, to share about how the AIMS Indigenous Partnerships Program works with First Nations peoples.

The AIMS Indigenous Partnerships Program is transforming how marine science is conducted in Australia. It's not just about research—it's about empowering Traditional Custodians to care for Country and ensuring their voices shape the future of marine conservation.

At the heart of this program is a commitment to respectful collaboration. By embedding Free, Prior and Informed Consent (FPIC) into every stage of engagement, AIMS ensures that Traditional Owners have the authority to guide, approve, or decline projects on their sea Country. This approach honours cultural knowledge and sovereignty, fostering trust and long-term partnerships.

Training and capacity building are key pillars of the program. Through vocational pathways, internships, and reef restoration training, AIMS supports Indigenous careers in marine science—building skills, confidence, and leadership within communities.

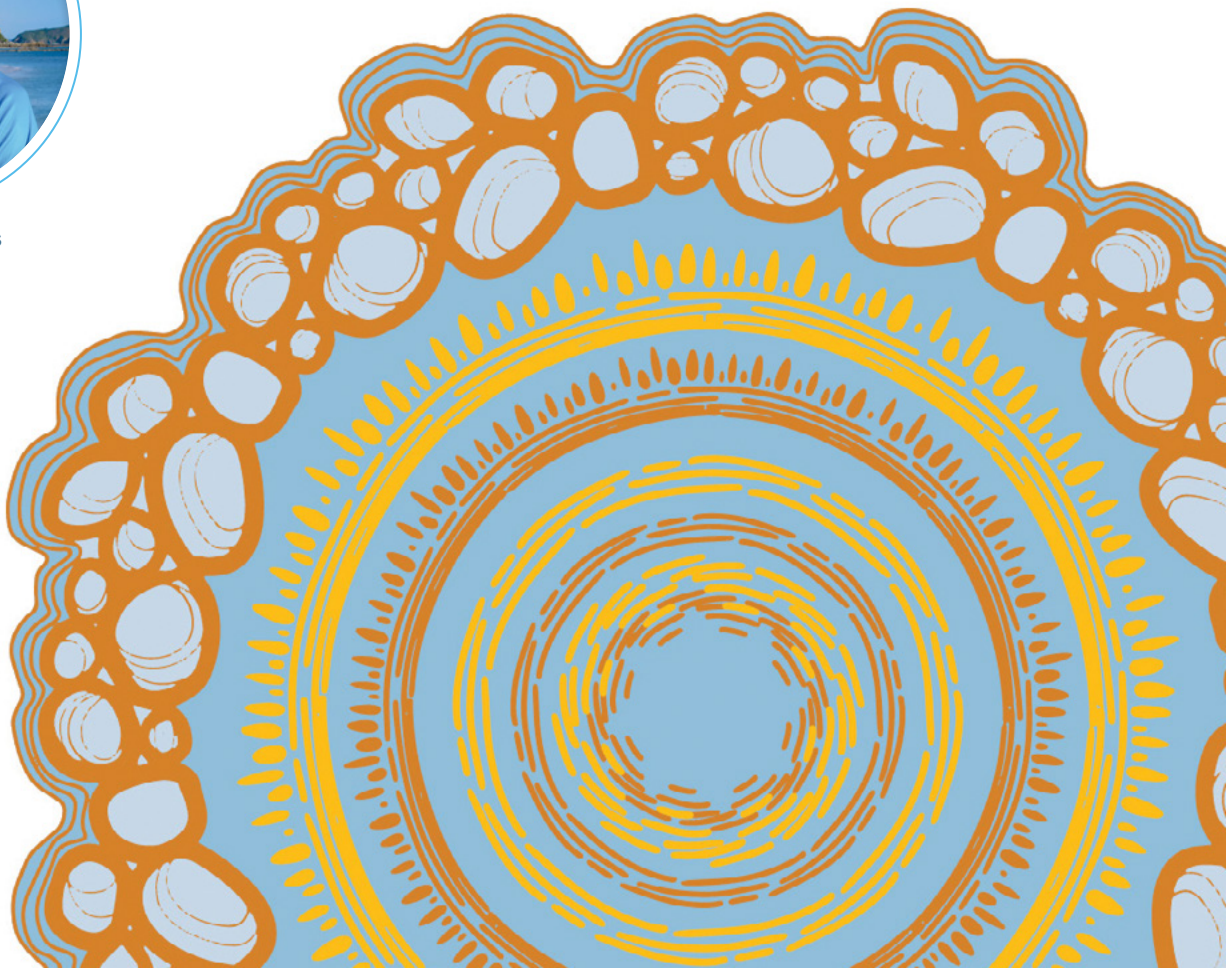
Projects like the collaborative Reef Restoration and Adaptation Program exemplify this model. They empower First Nations peoples to manage marine initiatives on their terms, reinforcing their right to make decisions about their Country and its future.

Looking ahead, AIMS has set an ambitious goal: by 2030, 90% of its science will be delivered in partnership with Traditional Owners. This vision reflects a broader shift toward inclusive, impactful, and culturally respectful marine science—one that recognises that caring for Country is a shared responsibility.

Together, we're building a marine science landscape that is stronger, more inclusive, and deeply rooted in respect for culture, Country, and community. ■

Gus Burrows, AIMS

Bob Muir, AIMS Indigenous Partnership Coordinator.



"Around the Campfire"
Designer: Tarquin Singleton, Yirrganydji. ingeous Studios.

The Global Ocean Observing System 2025 Status Report released

The flagship Global Ocean Observing System (GOOS) report shows advances in ocean observing for climate resilience, operational services, ocean health, and sustainable economies and calls on governments, funders, and partners to work together in strengthening the backbone for met-ocean information needed for a resilient future.

The GOOS report offers an interactive view of the global ocean observing system including:

- Latest status of global observing networks;
- Stories on the value of sustained ocean observations for climate, operational services and ocean health;
- News on strengthening and expanding our observing system;
- fresh insights on the progress and gaps in world's critical ocean observing infrastructure.

One of the three stories highlighting the value of ocean observations details how elephant seals are collecting first-of-its-kind data to support Southern Ocean management and conservation. The IMOS Animal Tracking Facility contributes data from tagged seals and turtles into the GOOS Animal Borne Ocean Sensors (AniBOS) network featured in the story.

The IMOS Fishing Vessels as Ships of Opportunity sub-Facility is a program of the Fishing Vessel Ocean Observing Network (FVON) that is also featured as an in situ emerging network.

Access the report here.

IMOS data informs the National Climate Risk Assessment

The Australian Climate Service (ACS), working with the Department of Climate Change, Energy, the Environment and Water (DCCEEW), recently delivered Australia's first National Climate Risk Assessment (the National Assessment).

The National Assessment has identified to what degree Australia's people, infrastructure, the economy, and landscapes are exposed and vulnerable to climate change now and over the rest of the century.

It provides a first national baseline of current climate risks, including new and emerging risks. It informs national priorities for climate adaptation and resilience actions through the National Adaptation Plan and provides a framework for other assessments of climate risks.

IMOS data informed 46 publications cited in the National Climate Risk Assessment, and three of the supporting technical reports (Natural Ecosystems: Marine; Antarctica and Climate Change; and Primary Industries).

The data came from marine observing infrastructure that covers the breadth of the IMOS program and included 23 Facilities/sub-Facilities:

- Argo Floats (Biogeochemical Argo Floats),
- Ships of Opportunity (Expendable Bathythermographs, Biogeochemical sensors, Australian Plankton Survey, SST Sensors, Air-Sea Fluxes),
- Deep Water Moorings (Southern Ocean Time Series Observatory, Deep Water Arrays),
- Benthic Monitoring (National Reef Monitoring Network, Understanding of Marine Imagery),
- National Mooring Network (Southern Australia Moorings, Western Australia Moorings, National Reference Stations, Acidification Moorings, Larval Fish),
- Animal Tracking (Acoustic Telemetry, Animal Tagging),
- IMOS OceanCurrent,
- Satellite Remote Sensing (SST Products, Ground Stations, Satellite Altimetry Calibration and Validation, Surface Waves).

Key climate risks to the Natural environment system: Marine and estuarine

The National Assessment summary reinforces that Australia's marine and estuarine environments are experiencing significant climate change impacts. Ocean warming and changing ocean currents and acidification are affecting biodiversity and ecosystem services. Coral reefs, such as those in the Great Barrier Reef and Ningaloo World Heritage areas, are particularly at risk. Seagrasses and mangroves are also impacted by warming, sea level rise and altered storm patterns. The poleward migration of the East Australian Current is intensifying the 'tropicalisation' of temperate ecosystems, posing high risks to coastal temperate ecosystems.

Planning for adaptation

The National Adaptation Plan responds to the findings of the National Climate Risk Assessment, providing guidance on how Australia needs to adapt to climate risks and build our national resilience to climate impacts. ■

Building a national seagrass mega-dataset

Written by Julia Scott

IMOS is producing a comprehensive national seagrass mega-dataset, which will soon be available through the new Australian Ocean Data Network (AODN) Portal.

Developed as part of the IMOS Data Uplift program and supported by the National Environmental Science Program (NESP MaC Project 5.9), the dataset aggregates more than 65 individual collections into a unified, cloud-optimised Parquet format. Covering over 3.2 million geospatial survey points from 1967 to 2025, it provides the most consolidated view of seagrass distribution along the entire Australian coastline.

Each record is tagged with enhanced metadata, including links to Australian Marine Parks and Commonwealth marine regions, along with a common spatial index to support subsetting and temporal/spatial analysis. The dataset is designed to underpin the upcoming State of the Environment Report, as well as ongoing research, conservation, and policy initiatives.

Seagrasses are recognised globally as an Essential Ocean Variable. They provide critical habitat, stabilise sediments, and store carbon. However, seagrass data has historically been fragmented across regions and institutions. By harmonising these datasets, IMOS and AODN are making essential information more accessible to marine scientists, managers, and decision-makers to track trends, identify threats, and guide conservation action. Additional datasets will be added before final release.

The initiative is a partnership with the NESP Marine and Coastal Hub, through the project *Making marine environmental data more assessment-ready* (Project 5.9). Tim Moltmann, Independent Chair of the Hub, says:

"Australia is fortunate to have world-class marine research infrastructure, institutions, and applied research programs. What we don't always do so well is the synthesis and analysis step, to turn high quality research data into information and products that can be used by governments and industries in routine assessments of the marine environment. Project 5.9 is investing into this gap, using the 2026 State of Environment Report as its primary use case.

We see this as a really exciting project given the impetus provided by the review of the Environment Protection and Biodiversity Conservation Act 1999 (the Samuel Review) and the Sustainable Ocean Plan. By combining the strengths of IMOS, AODN and NESP, we can provide decision makers with better information, faster – exactly what's needed in response to rapid changes in the marine environment." ■

Ocean Image Bank, Ben Jones

Introducing the IMOS Environmental DNA sub-Facility

Written by Julia Scott

A new Environmental DNA (eDNA) sub-Facility has been established, expanding IMOS' capability to monitor marine biodiversity across Australia's coastal and sub-Antarctic waters.

All organisms leave traces of DNA in their environment, in seawater, sediments, or even the air. Analysing this environmental DNA (eDNA) through a process called metabarcoding allows researchers to identify multicellular organisms and is revolutionising biodiversity and biosecurity monitoring.

The new IMOS Environmental DNA sub-Facility builds on water sampling already taking place through the IMOS Marine Microbiome Initiative, extending those collections to include larger marine life such as invertebrates and fish.

Samples collected from IMOS National Reference Stations and the Southern Ocean Time Series mooring will be analysed using advanced genetic techniques to map biodiversity patterns and track changes in marine ecosystems over time.

"Understanding biodiversity is critical to defining changes in ocean communities and ecosystems as well as underpinning sustainable use and management. Expanding IMOS to include eDNA sampling will provide sustained biodiversity observing to help meet current and future needs to understand ecosystem state and trends," said Michelle Heupel, IMOS Executive Director

Environmental DNA provides an efficient, non-invasive way to assess biodiversity and detect shifts in marine communities, offering valuable insights for research, management, and biosecurity. The data generated will help inform national priorities in biodiversity conservation and ocean health.

Miles Noel

> "Understanding biodiversity is critical to defining changes in ocean communities and ecosystems as well as underpinning sustainable use and management.

"We can't travel to the past, but IMOS data and samples are our time machine. With the new IMOS eDNA sub-Facility, we can revisit samples collected since 2012 and continue long-term monitoring into the future, uncovering how marine communities shift across seasons, years, and a changing environment," said Miwa Takahashi, CSIRO Research Scientist.

The eDNA sub-Facility forms part of the IMOS Biomolecular Observing Facility, which brings together the Marine Microbiome Initiative (that IMOS operates with our partner Bioplatforms Australia as part of the Australian Microbiome Initiative), Microbial Coastal Sampling, and Bioinformatics. Collectively, these sub-Facilities provide an integrated view of life in the ocean through the analysis of biological molecules in seawater.

By combining genetic information from microbes and multicellular organisms, the Biomolecular Observing Facility is building a long-term record of marine biodiversity and ecosystem function. These data are helping researchers understand how ocean life is changing over time, supporting evidence-based decision making in Australia's waters.

"Adding eDNA observing to IMOS will reveal a whole extra layer of understanding about our oceans," said Olly Berry, IMOS eDNA sub-Facility Lead. ■

Establishing a National Network of Estuarine and Coastal Moorings

Written by Julia Scott

IMOS is expanding its national observing capability with the establishment of a new Estuarine and Coastal Moorings Facility, led by the South Australian Research and Development Institute (SARDI). This initiative will deliver coordinated, near real-time monitoring of water quality in Australia's estuaries and coastal zones.

Australia's coastal and estuarine environments are under increasing pressure from climate change, sea-level rise, and coastal development. With more than 85 per cent of Australians living within 50 kilometres of the coast, and many major cities built around estuaries, there is a growing need for standardised, long-term data to support sustainable management of these critical environments.

"Australia's estuaries are the gateway connecting our rivers to marine and coastal systems. They contain critical habitats and ecosystems, often support busy ports, and host many of our major urban areas. Better understanding of estuarine water quality will help support our ecosystems, communities, oceans and coasts," said Michelle Heupel, IMOS Executive Director

The new network will consist of small to medium-sized buoys deployed in shallow waters and anchored to the seabed. Each mooring will record temperature, salinity, chlorophyll-a, dissolved oxygen, and turbidity, with the option to include additional sensors to measure pressure, currents, pH, or nutrients. The moorings will be serviced every two to three months to clean and calibrate sensors, replace components, and collect water samples for validation.

Data from the network will be integrated with existing IMOS observations and, where possible, combined with information collected by state agencies, industry, and other stakeholders. This coordinated approach will expand spatial coverage and provide a more complete understanding of coastal water quality and ecosystem health.

The IMOS Estuarine and Coastal Moorings Facility will play a key role in connecting Australia's coastal observations into the broader IMOS network, ensuring that decision makers, researchers, and communities have access to consistent, high-quality data to inform sustainable management of estuarine and coastal environments.

This new Estuarine and Coastal Moorings Facility represents one of the initial investments IMOS is contributing to establish the CoastRI program. CoastRI, a cross-NCRIS collaboration, is being developed to provide a national-scale coastal observing and modelling capability for Australia. ■

New pCO_2 system monitoring carbon uptake

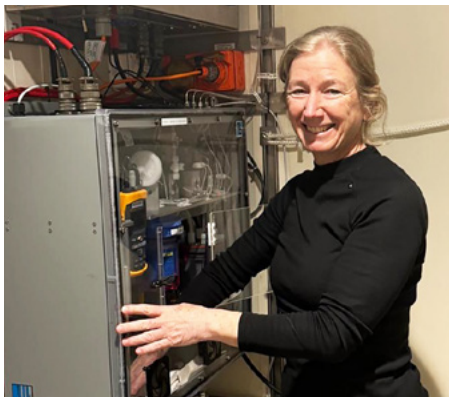
Written by Julia Scott

A new system measuring the partial pressure of carbon dioxide (pCO_2) in surface seawater has been commissioned through a collaboration between IMOS, CSIRO and the Australian Antarctic Partnership Program (AAPP).

The pCO_2 system is being deployed for the first time on Australia's icebreaker and research vessel, RSV Nuyina. Data collected will provide valuable insights into how much atmospheric CO_2 is absorbed by the ocean each year, contributing to understanding changes in ocean acidification and improving global climate models.

pCO_2 is recognised as an Essential Ocean Variable by the Global Ocean Observing System (GOOS) and as an Essential Climate Variable by the Global Climate Observing System (GCOS). These measurements are critical to national and international efforts to monitor and predict the ocean's role in the global carbon cycle.

"High-quality surface CO_2 monitoring has been implemented on RSV Nuyina beginning with voyage one as part of a collaborative effort among IMOS, AAD and CSIRO. The monitoring from the ship is helping to plug a major gap in Southern Ocean observations that are needed to constrain the ocean uptake of atmospheric CO_2 and resolve the global carbon budget," said Dr Bronte Tilbrook, IMOS Biogeochemical Sensors sub-Facility Lead and CSIRO Principal Research Scientist. ■



Bec Hewett, AAD

pCO_2 system, with V1 science coordinator Dr Patricia Miloslavich de Klein.

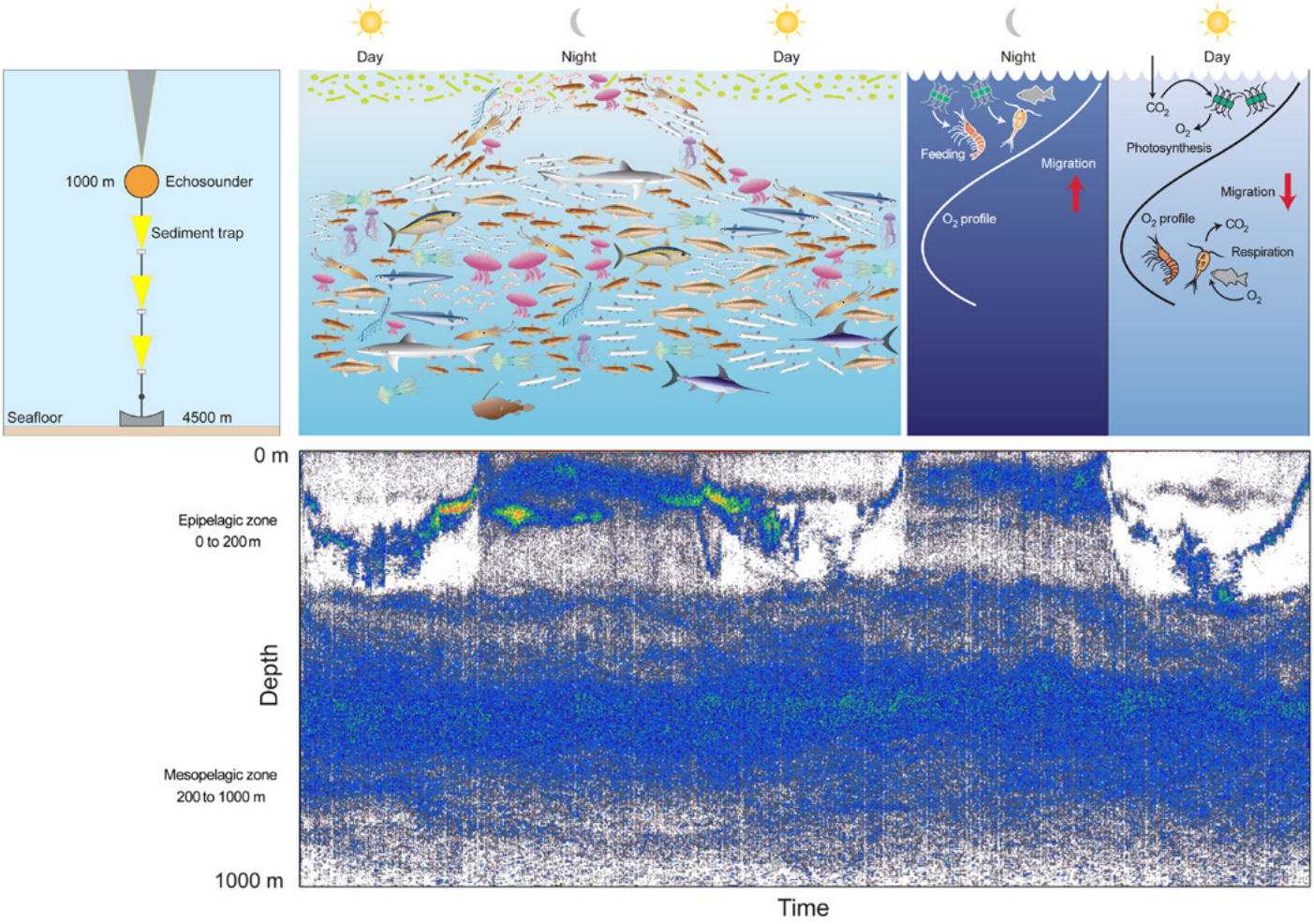
Mesopelagic monitoring in Subantarctic waters south of Tasmania

Written by Elizabeth Shadwick, Pete Jansen, and Haris Kunnath

A new collaboration between the IMOS Ships of Opportunity Bioacoustics and Southern Ocean Time Series (SOTS) sub-Facilities is making progress to improve understanding of the mesopelagic ecosystem in Subantarctic waters south of Tasmania.

Using an upward looking echosounder deployed 1000 metres below the sea surface on the SOTS sediment trap mooring, new acoustic observations were collected over a full seasonal cycle. These observations can be used to estimate abundance and improve understanding of migratory behaviours of mesopelagic organisms which are an important but poorly constrained component of the ocean biological carbon pump.

We are working together, leveraging expertise for instrument set-up and sensor calibration, as well as data quality control, from the Bioacoustics sub-Facility, to provide a new data stream from the SOTS sub-Facility, which will be delivered to the Australian Ocean Data Network for use and uptake by the community. The first year of data (see Figure below) demonstrates the value of these observations, with diel vertical migration showing the upward movement of a population during the nighttime followed by a redescent below the mixed layer with implications for the transfer of organic matter to the interior ocean, the quantification of which is a primary focus of the SOTS sub-Facility (Shadwick et al., 2025). ■



An upward looking echosounder deployed 1000 m below the sea surface provides year-round acoustic observations of diel vertical migration in the mesopelagic zone, the largest natural daily animal movement on earth based on their biomass. Example data from April 2024 show the nightly ascent and daytime descent of organisms, linking mesopelagic dynamics to biological carbon transport and improving understanding of the ocean's carbon pump. The top right panel was reproduced from Doney and Steinberg (2013) with permission.

Shadwick, E. H., Wynn-Edwards, C. A., Eriksen, R. S., Jansen, P., Yang, X., Woodward, G., and Davies, D. (2025) The Southern Ocean Time Series: A climatological view of hydrography, biogeochemistry, phytoplankton community composition, and carbon export in the Subantarctic Zone, Ocean Sci. 21, 1549-1573, doi: 10/5194/os-21-1549-2025

International collaboration through the IMOS Southern Ocean Plankton sub-Facility

Written by Luke Brokensha

In August, Luke Brokensha, a plankton ecologist who works in the IMOS Southern Ocean Plankton sub-Facility travelled from Australia to Cape Town, South Africa to contribute to a work program based on pelagic bioregionalization, and to support colleagues at the Department of Forestry, Fisheries and the Environment (DFFE), in the development of their Continuous Plankton Recorder (CPR) program.

In the first week, Luke attended a workshop on the Pelagic High Seas Ocean Ecoregionalisation of the Indian Subantarctic project (PHOCIS). This is a work package led through the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR). Alongside physical oceanographers, marine vertebrate ecologists, fish scientists and climate modellers, the IMOS Southern Ocean Plankton sub-Facility provided plankton data in the form of species distribution maps, and assistance with modelling key foraging areas for higher trophic levels.

The second week focused on inter-program collaboration, bringing together representatives from the South African, French and Brazilian CPR programs to align regional efforts and strengthen international partnerships.

These engagements focused on sharing expertise in plankton sample processing, data management protocols, and quality assurance practices, with the aim of building local capacity and ensuring methodological consistency with global standards. CPR data play a critical role in monitoring marine ecosystems, tracking shifts in plankton communities, and informing broader climate and oceanographic assessments.

Enhancing South Africa's CPR capabilities contributes to a growing global network of plankton observations, particularly in the Southern Ocean, where long-term datasets remain spatially limited and have historically concentrated on the Indian sector. This collaborative effort builds on existing relationships among participating nations and lays the foundation for continued data sharing and joint research initiatives that will advance our collective understanding of plankton health and distribution in the Southern Ocean. ■

Department of Forestry, Fisheries and the Environment (South African Government)

Attendees at the Continuous Plankton Recorder and Imaging Workshop, Cape Town, South Africa.

New report cards reveal baseline and shifting trends in Australia's marine microplastic pollution

Written by Julia Scott

The IMOS Marine Microplastics sub-Facility team has released a series of annual reports, detailing microplastic contamination levels in Australian marine waters for the years 2021 to 2024. These summaries provide a national overview of marine microplastic pollution trends across time and geographical location, and will continue to be produced annually.

Marine microdebris, particularly microplastics, which are plastic particles smaller than 5 mm, is a form of anthropogenic waste that enters the ocean through both accidental and deliberate disposal. These marine microplastics can be of various shapes (e.g., fibres, fragments, beads), colours, sizes, and polymer compositions (e.g., polyester, polyethylene, nylon).

As global plastic production and consumption continue to rise, the level of microdebris contamination in marine ecosystems is expected to increase. Furthermore, climate change and associated increase in frequency and intensity of extreme weather events, such as cyclones and floods, is also predicted to raise plastic pollution levels and transport in the marine environment. This has serious implications for marine animals, as marine plastics have been linked to entanglement, ingestion, gut blockage, health effects and even behavioural changes.

"The IMOS Marine Microplastics sub-Facility is helping us uncover the scale of plastic pollution in Australian oceans. We have produced these annual report cards to turn complex data into accessible insights, enabling both scientists and community members to explore the trends and understand what's happening," said Dr. Cherie Motti, IMOS Marine Microplastics sub-Facility leader.

The IMOS Marine Microdebris Monitoring New Technology Proving project was established in 2021 to provide long-term data on spatial and temporal patterns of microplastic pollution in Australia's waters. Initially a pilot initiative, the program transitioned into an official sub-Facility in 2023 – the IMOS Marine Microplastics sub-Facility, emphasising the need for ongoing national monitoring of marine plastic contamination.

The 2021 report card provides a comprehensive baseline, summarising microplastic concentrations and characteristics across all monitored sites between January and December 2021. Subsequent years build on this benchmark, offering year-on-year assessments that help pinpoint contamination hotspots, identify trends, and track changes in microplastic characteristics.

By making this data accessible, IMOS is contributing to efforts to determine potential sources, fate, and impacts of microplastics in Australian marine waters, thereby informing environmental management and policy at both local and national scales.

"Plastic pollution is a growing challenge in Australia's marine waters, but knowledge is our first line of defence. By tracking microplastic concentration trends, we can identify what's driving plastic pollution and measure the impact of mitigation efforts. It's about turning knowledge into action to help safeguard our oceans," said Dr. Marina Santana, part of the IMOS Marine Microplastics sub-Facility.

Read the Marine Microplastics reports ■

AIMS

Sample collection at Yongala Shipwreck (QLD), concentrating sample into the cod end.

Marina Santana, AIMS

New network of coastal buoys delivering wave data around Australia

IMOS is bringing together a national network of wave buoys to help understand the processes and changes driven by waves in the coastal zone.

A national network of wave buoys is being coordinated by IMOS, led by Dr Mike Cuttler and Professor Ryan Lowe at The University of Western Australia (UWA), with buoys deployed at sites around the country, with at least one new wave buoy in every state plus additional co-invested buoys from regional collaborators.

The 23 IMOS wave buoys will complement an existing network of offshore and nearshore wave buoys deployed around Australia, which are maintained by various federal and state government agencies as well as university research groups.

New IMOS wave buoys measure wave height, period, and direction as well as water temperatures in nearshore waters, with sites varying in depth from 10m to 70m. These small, solar-powered wave buoys are low-cost and relatively easy to deploy.

Moored to the sea floor they will collect critical near real-time data required to verify and improve marine forecasts, inform marine operations and recreation, and form the basis of an improved understanding of ocean and coastal processes.

The near real-time data is easy to view and download via a new national website – AusWaves.

Created by Dr Cuttler at UWA, the website collates data from IMOS wave buoys and merges it with existing websites created by the regional partners to present the first nationally consistent platform for the display of and access to quality-controlled near real-time wave data.

"The IMOS coastal wave buoy network is collecting spectral wave data in near real-time at a national scale. AusWaves presents this unique coastal wave data in a user-friendly manner, designed to meet the needs of a wide range of coastal stakeholders," said Dr Mike Cuttler.

Through unique visual displays and the ability to download wave and surface temperature data, this new website will enable wider uptake of the data around Australia.

Both real-time and delayed mode data are also available via the IMOS Australian Ocean Data Network (AODN) Portal as part of the 'Wave buoys Observations – Australia – near real-time' and 'Wave buoys Observations – Australia -delayed (National Wave Archive)' data collections.

Why is wave data important?

Australia has one of the longest coastlines in the world, and this dynamic intersection between land and sea includes numerous critical ecosystems and infrastructure. Our coastal zone is also where many of us live, work and play. Over 87% of Australians live within 50 kilometres of the coast, with further growth predicted in the coming decades.

Climate and human development are changing our coastal systems at an unprecedented rate and more data is needed for planning to avoid or mitigate changes and sustainably manage this precious resource.

The network of IMOS Coastal Wave Buoys is a key investment of the CoastRI initiative. Coastal Research Infrastructure, is a national initiative under Australia's National Collaborative Research Infrastructure Strategy (NCRIS) coordinated across 13 NCRIS capabilities. It aims to establish a coordinated, national-scale coastal observing and modelling capability to address the challenges posed by rapid coastal changes.

"By supporting IMOS Coastal Wave Buoys, CoastRI is enabling unprecedented access to high-quality data that's essential for forecasting hazards, guiding sustainable development, and protecting the ecosystems and communities that depend on our dynamic coastal zone," said Professor Daniel Ierodiaconou, Lead Scientist for CoastRI.

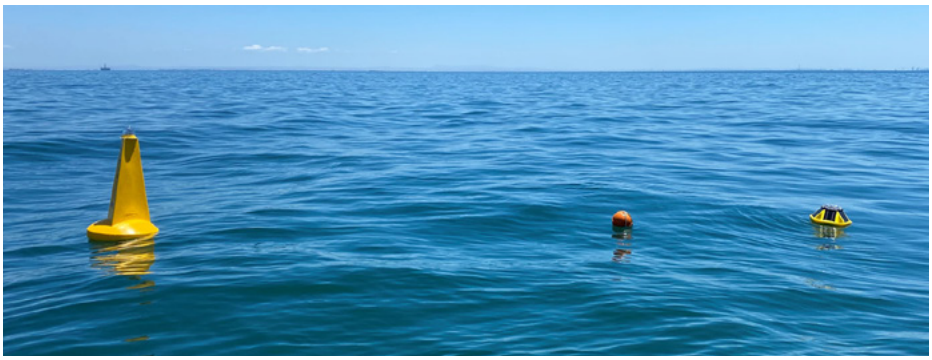
Collaboration is key to establishing a national network of wave buoys

IMOS aims to increase collaboration and connection with a wide range of end-users to enhance our understanding of ocean and coastal processes. No single organisation can achieve this objective; it takes a coordinated community.

IMOS would like to thank our partners who are deploying the wave buoys and delivering data around the country including:

- The University of Western Australia
- Deakin University
- Victoria Government, Department of Energy, Environment and Climate Action
- Eastern Maar Aboriginal Corporation
- South Australian Research and Development Institute (SARDI)
- Flinders University
- Australian Institute of Marine Science
- Queensland Government, Department of the Environment, Tourism, Science and Innovation
- Sydney Institute of Marine Science
- New South Wales Government, Department of Climate Change, Energy, the Environment and Water

IMOS also acknowledges numerous regional collaborators who are co-investing wave data to the new national network. ■



Daniel Ierodiaconou, Deakin University

Building Near Real-Time capability into Australia's National Reference Stations

Written by Julia Scott

Work is underway to add Near Real Time (NRT) telemetry to selected IMOS National Reference Stations significantly strengthening Australia's coastal ocean observing system.

National Reference Stations (NRS) provide fundamental baseline information used to understand how large-scale, long-term climate change and variability is affecting Australian coastal seas. Each station continuously monitors physical ocean conditions, with monthly vessel-based biogeochemical (BCG) sampling at most sites.

Now, the system is being enhanced to deliver near real-time updates, ensuring more timely access to information about developing events such as marine heatwaves, harmful algal blooms, or low-oxygen conditions.

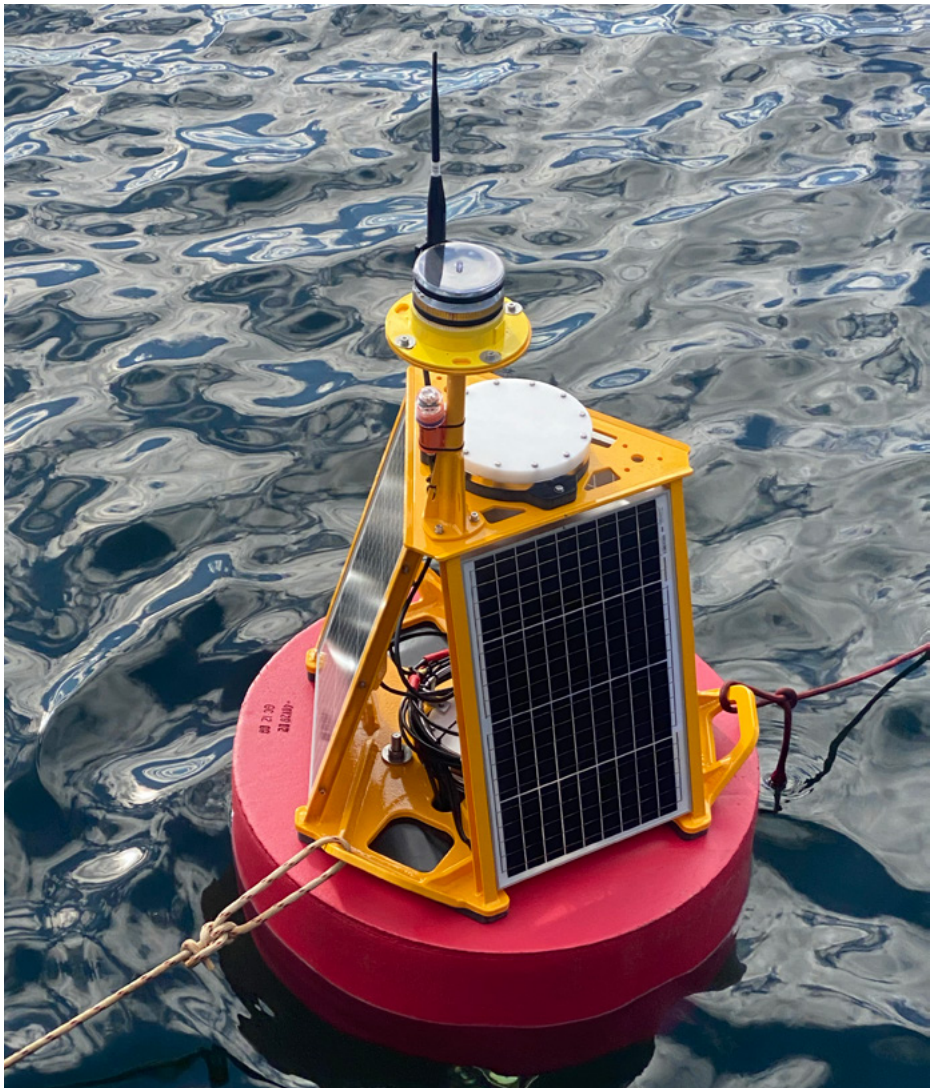
"Near Real Time Telemetry provides a significant increase in capability. Alongside the monthly BGC sampling and delayed-mode data, which currently provide an invaluable long-term time series, the new system will allow timely detection and response to emerging threats," said David Hughes, IMOS National Reference Stations sub-Facility Lead.

Designing a smarter mooring system

This project will design moorings with surface expressions, capable of delivering near real-time data, to enhance existing NRS moorings at Maria Island, Kangaroo Island and Rottnest. To maximise data collection and delivery, two moorings will be produced for each location to enable efficient 'hot-swap' rotations.

The designs and components have been developed in consultation with the IMOS National Moorings Facility community to ensure standardisation across stations. The first system, recently completed for Maria Island, will serve as a test case to confirm functionality and refine the design before final builds are completed for Kangaroo Island and Rottnest.

The moorings are being designed and built in Australia by our partner, CSIRO.



David Hughes, CSIRO

Mechanical components are primarily constructed in-house, while electronics build on earlier CSIRO NRT systems with upgrades including solar charging, and new acoustic modem technologies.

Why near real-time matters

Currently, delayed-mode data from NRS moorings can be up to six months old by the time a mooring is rotated and data recovered. In contrast, NRT data will provide rapid feedback. This is critical for two reasons:

- Detecting technical issues: If a sensor malfunctions, corrective action can be taken immediately, preventing the loss of months of data from a long-term time series.
- Responding to environmental changes: Early signals of developing marine events can inform timely responses by managers, researchers, and industry.

In addition, NRT data can be used to improve ocean models by feeding them with current conditions or validating outputs, increasing their accuracy and usefulness for forecasting.

With the first Maria Island deployment aiming to be completed in 2025, this project will ensure the NRS network continues to deliver both the long-term insights and the rapid information needed to understand and manage Australia's changing oceans. ■

New season of turtle tracking helping to understand the sub-surface waters of Northern Australia

IMOS is providing valuable oceanographic measurements in this poorly sampled region whilst simultaneously delivering information about turtle behaviour and movements by attaching satellite tags to turtles.

On a recent field trip satellite tags were attached to 20 olive ridley turtles during the nesting season at Imalu Beach on Melville Island, which is in the Tiwi Islands group. The turtle tagging is a collaboration between Tiwi Rangers, Tiwi Land Council, IMOS, the Australian Institute of Marine Science (AIMS) and the Sydney Institute of Marine Science.

Olive ridley turtles (*Lepidochelys olivacea*) are an endangered species that are distributed globally across the tropics. They are also culturally important to Traditional Owners of the Tiwi Islands in the Northern Territory. Their sea Country is recognised as one of the most important remaining nesting areas in Australia and the Pacific region.

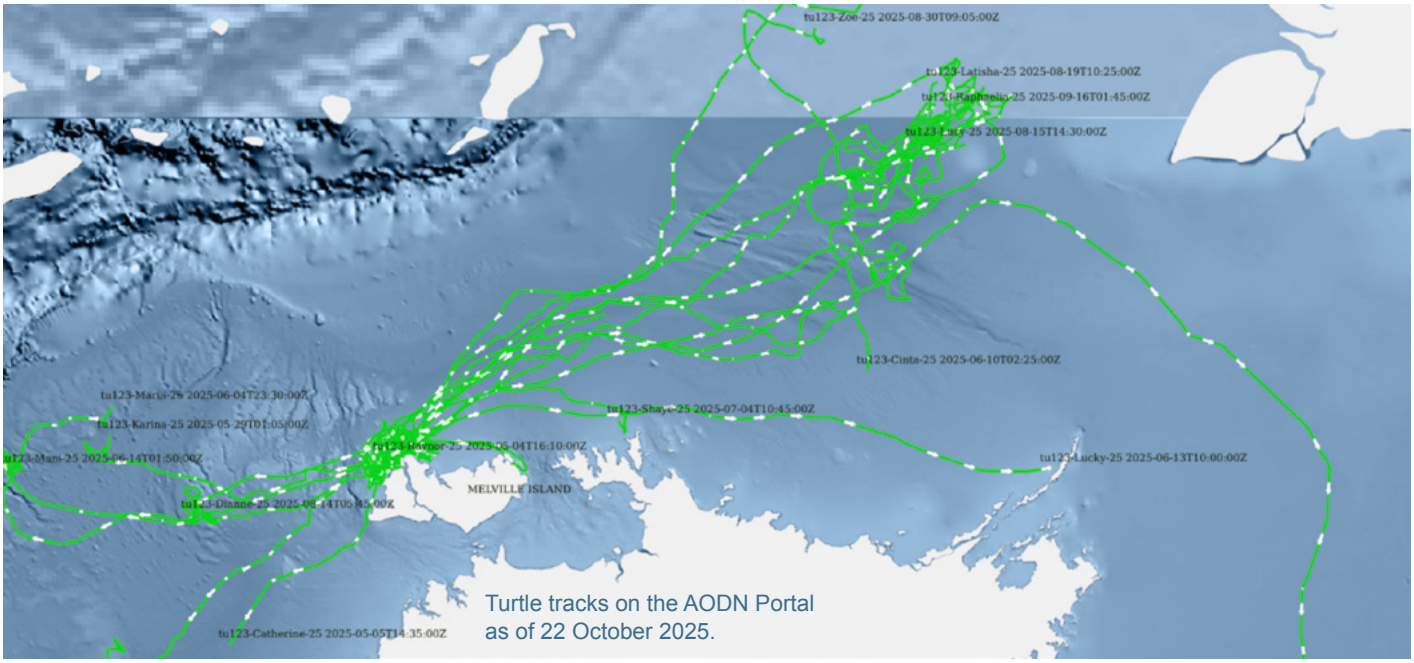
AIMS senior research scientist Dr Michele Thums said, "Before the IMOS project there was very little known about the movement behaviour of olive ridley turtles in Australia. With these tracks we can map the area they use during the inter-nesting season, their migration pathways and uncover the areas they use for foraging which were previously unknown."

Once satellite tagged, the turtles move off the beach and head into the ocean, providing data about their movements and dive behaviour in near real time. The turtle tracks can be viewed on the IMOS Australian Ocean Data Network Portal.

The names that can be seen on the map were given to the turtles by the Tiwi Rangers, who named them after their daughters and other female family members. For example, Rits the turtle, named after the Ranger Coordinator, headed off on her migration (to foraging grounds) around 2 weeks after tagging and is now down in the Gulf of Carpentaria. Another big mover, Letaya has headed north through the Arafura Sea to her foraging ground along the coast of Papua New Guinea.

"These olive ridley turtles dive to the sea floor and then surface to breathe providing valuable profiles of the water column from the bottom to the surface. This enables us to collect critical information that will greatly improve our understanding of large scale oceanographic processes in this poorly sampled region, and even help improve our ability to measure the strength and trajectories of important events like tropical cyclones.

This information along with improved biological data is a wonderful enhancement to our collaboration with Traditional Owners and their wealth of understanding of the ecology of these beautiful animals," said Emeritus Professor Rob Harcourt, Facility Leader for the IMOS Animal Tracking Facility.



Turtle tracks on the AODN Portal as of 22 October 2025.

These newly tagged turtles will add to the information IMOS has gathered in the past in a previous collaborative satellite tagging project in 2022 and 2023. "Beyond the science, this project also highlights the value of two-way learning with Traditional Owners of sea Country and continues to build the capacity of researchers in respectful collaboration", said Tonya Grant, IMOS Indigenous Partnerships Coordinator.

"Since we started working on the satellite tracking with IMOS we have learnt about how far the olive ridley turtles travel and their foraging behaviour. The tracking is giving me more information to pass on to my people and the Land Council," James Desantis, Tiwi Ranger Supervisor, Tiwi Rangers.

Ultimately, the essential behavioural observations IMOS is collecting will result in improved animal behaviour and habitat use models that will allow us to quantify which areas are important, and with Traditional Owners and management agencies refine the designation and protection of areas critical for the turtles nesting and feeding. This is exactly the kind of information needed to support the development of better conservation and improved management policy for this iconic, culturally important and endangered species that we currently know so little about. ■


Michele Thums, AIMS

Tagging olive ridley turtles on Melville Island.


Rob Harcourt, Macquarie University

Turtle tagging team from Tiwi Rangers, AIMS and IMOS.

NEWS FROM THE NODES

New IMOS Node Leader for Queensland

Written by Julia Scott

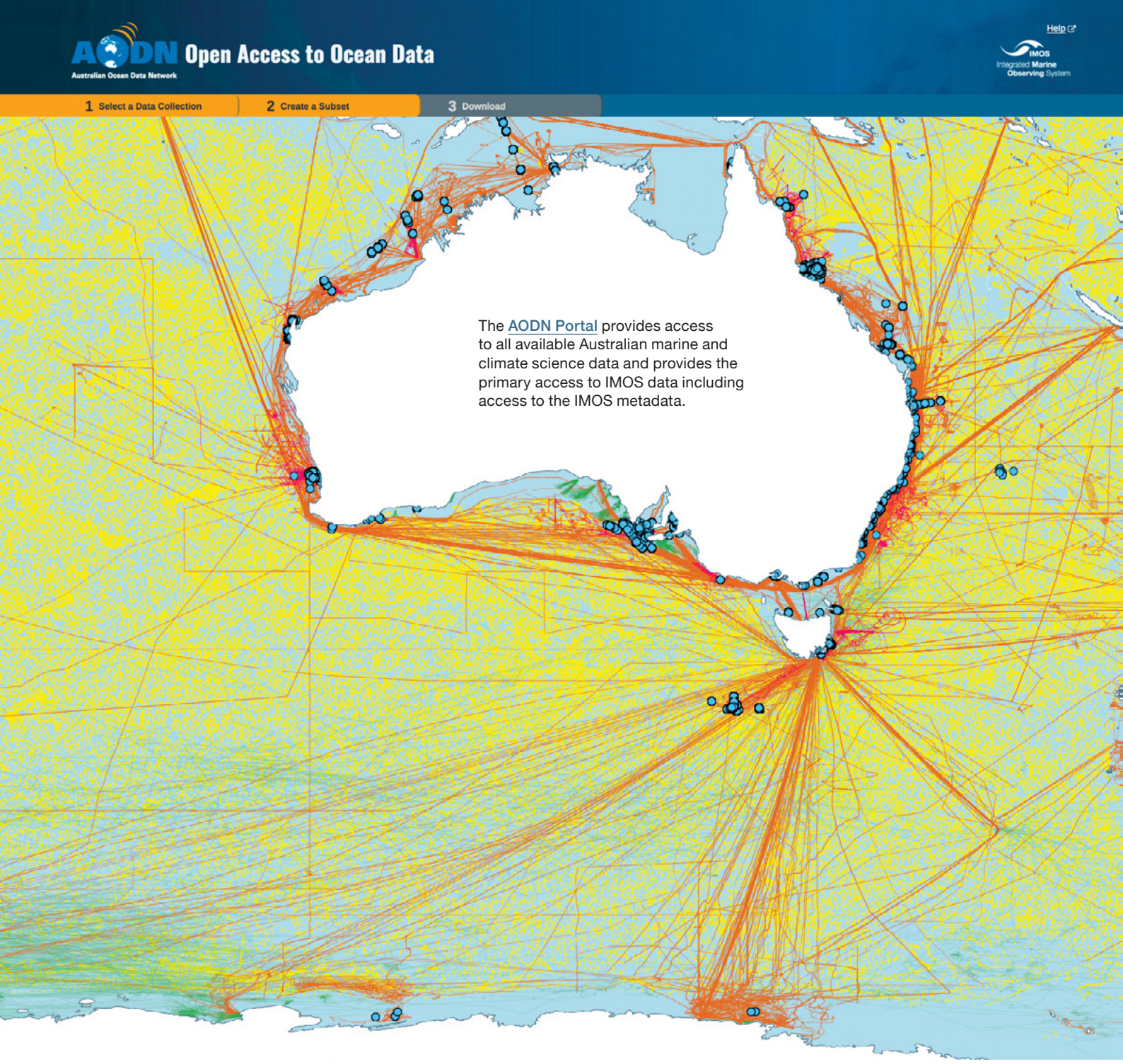
We welcome Dr Paulo Calil from the Australian Institute of Marine Science (AIMS) into the leadership team of the Queensland Node.

Paulo is a physical oceanographer who joined AIMS in April 2025 as an observational physical oceanographer in the Oceanography and Shelf Processes group. Paulo obtained a PhD in Oceanography from the University of Hawaii at Manoa in 2009, before serving as a Postdoctoral Investigator at the Woods Hole Oceanographic Institution.

Over the years, Paulo has held multiple research roles across New Zealand, Brazil and Germany. Most recently, he spent six years at the Helmholtz-Zentrum Hereon in Germany, where his research focused on observing and modelling submesoscale features (small-scale ocean processes, typically spanning 1–10 km, that strongly influence mixing and nutrient transport), and the connections between physics and biology from these features in coastal and shelf regions.

At AIMS, Paulo is particularly interested in ensuring that IMOS data is widely used and reaches a broad range of stakeholders to highlight its societal benefits. In particular, he is interested in using the suite of IMOS measurements to evaluate the impact of extreme events in the coastal regions of northwestern Australia and the Great Barrier Reef. ■

Cameron Laird AIMS



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For more information about IMOS please visit the website www.imos.org.au