IMOS Integrated Marine Observing System

marinematters

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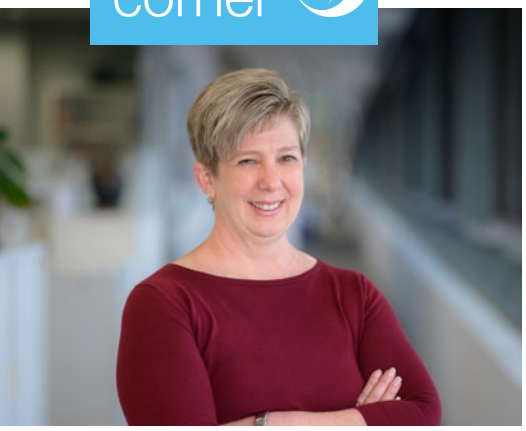
IMOS farewells Dr Helen Beggs

First step-change funded ocean glider deployment

A decade of sustained observing at the IMOS Lucinda Jetty Coastal Observatory

Tarquin Singleton, Yirrganydji

director's corner



IMOS acknowledge the Traditional Custodians and Elders of the land and sea on which we work and observe 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 2024 edition of *Marine Matters*

In this edition of *Marine Matters* we are thrilled to share some new updates and celebrate the ongoing successes of IMOS. The first item of note is that IMOS commissioned an art piece to showcase our role in the community. It is our pleasure to share this beautiful piece by Yirrganydji designer Tarquin Singleton titled "Around the campfire." You will see elements of this art feature in IMOS communications products and slides soon.

In 2024 we had a few milestones occur in the program with the Lucinda Jetty observatory reaching it's 10 year anniversary. IMOS strengthened links with the ACCESS-NRI NCRIS capability through co-hosting the Australian Coastal and Oceans Modelling and Observations (ACOMO) workshop in conjunction with the Consortium for Ocean Sea Ice Modelling in Australia (COSIMA) in Canberra. As modelling is further integrated as a platform in NCRIS we hope to continue to strengthen these connections in the community. On the other end of the spectrum, 2025 will see longtime IMOS supporter Helen Beggs retire from the Bureau of Meteorology. Her input into IMOS will be missed.

The first activities under the 2023 step-change funding have also started to take shape and are featured in this issue. These include expansion of the Argo Facility to include deep Argo floats and expansion of IMOS ocean glider deployments to ensure we have national-scale coverage. The first of the new glider deployments has already been completed.

While IMOS works hard to set standards in data delivery, we also play a big role in helping ensure best practices are followed. IMOS is considered a leader in the global ocean observing community and was prominent at the recent Ocean Best Practice System (OBPS) workshop. Rebecca Zitoun, who was involved with OBPS prior to coming to IMOS is now co-chair of the group.

This edition also includes a range of other updates and highlights. In particular, we would like to draw your attention to the student spotlight featuring Chloe Roberts work on elasmobranchs in South Australia.

As the end of the year approaches and we look forward to another big year in 2025, I hope you enjoy this edition of Marine Matters.

Dr Michelle Heupel
IMOS Executive Director

IMOS Sea Country artwork

IMOS honours Traditional Owners as Australia's first marine scientists and carers of country. We pay tribute to their traditional ecological knowledge, wisdom, and Indigenous perspectives, passed down through generations and applied successfully to sustainable environmental management for thousands of years.

IMOS has been enhancing our connections and partnerships with First Nations, and recently worked with designer Tarquin Singleton, Yirrganydji, to create a piece of Sea Country artwork. The beautiful artwork exemplifies the role of IMOS in fostering collaboration between indigenous wisdom and modern science to provide an inclusive understanding of our marine environments.

'Around the campfire'

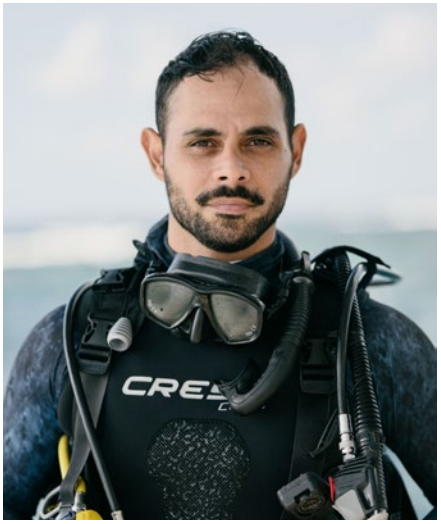
The design underscores the importance of preserving traditional knowledge, understanding marine ecosystems, and fostering collaboration between indigenous wisdom and modern science (data).

It's a powerful reminder of the interconnectedness of all life and the importance of protecting our natural environments for future generations.

The dark figures symbolise the holders of wisdom—our leaders and educators. They pass their knowledge to the lighter figures, representing the next generation, through storytelling, dance, art, and demonstration.

At the heart of the design is the central element, symbolising community and the sharing of knowledge around 'campfires of wisdom.' These campfires reflect both ancient storytelling traditions and modern data collection methods.

Through the efforts of the Integrated Marine Observing System, these approaches come together to provide an inclusive understanding of our marine environments.



Marine animals featured in the design are not only ocean icons but also subjects of marine biology and keystone species crucial to their ecosystems. They hold cultural significance for coastal First Nations people. The patterns within these animals depict water and currents, symbolising their natural journeys.

The fish in the waterways demonstrate the interconnectedness of all things. As they swim with the currents, they traverse vital ecosystems, highlighting the impact that damage to one part of an ecosystem can have on the whole. This is the knowledge held by traditional wisdom, with waterways serving as classrooms where lessons are taught through action.

The designer

Tarquin Singleton, Yirrganydji, is an illustrator and designer, who has worked on Country as a Yirrgandji ranger and in cultural engagement for many years. His design work is a combination of traditional Aboriginal art and modern and western art. Tarquin draws his inspiration for his designs from Bulmba (Country), Kulbul (Sea Country) and Bulurru (Lore, Creator, Culture).

"Yirrganydji country is located from Cairns to Port Douglas making us rainforest and saltwater people. Growing up in two world heritages the Great Barrier Reef and the Wet Tropics Rainforest is something to be proud of and has heavily influenced my work. My designs are heavily influenced by my heritage and combine the elements from traditional Indigenous art with modern art."

Tarquin works with Ingeous Studios, an Indigenous design and creative agency who specialise in crafting contemporary First Nations designs that carry profound meaning. ■

Ocean Modelling and Observations Workshop highlights

Photo: Harshula Jayasuriya, ACCESS-NRI

110 ocean observers and modellers from all over Australia met in July in Canberra for a three-day workshop showcasing the latest research and development in coastal and ocean modelling.

Participants submerged themselves in every aspect of ocean research, including topics as diverse as bluebottles' behaviour, pollution, forecasting, machine learning, fisheries, remote sensing, ocean dynamics, Antarctic sea-ice loss and many more.

This joint workshop of the Consortium for Ocean-Sea Ice Modelling in Australia (COSIMA) & Australian Coastal and Oceans Modelling & Observations (ACOMO), brought together Australia's experts from diverse disciplines and research organisations to share ocean knowledge and collaborate.

The Ocean Modelling and Observations Workshop was organised by two national infrastructures that support research in ocean observations and modelling in Australia: IMOS and Australia's Climate Simulator (ACCESS-NRI), both enabled by the Australian Government's National Collaborative Research infrastructure Strategy (NCRIS).

The workshop started with a beautiful Welcome to Country by Ngambri-Ngunnawal custodian of the Canberra region Paul House, highlighting the importance of respect and community.

This was followed by an introduction to the workshop by the IMOS and ACCESS-NRI Directors, who highlighted the importance of bringing together ocean modellers and observers, along with their supporting infrastructures for advancing ocean science and improving our ability to predict and manage this Earth system.

IMOS Executive Director, Dr Michelle Heupel, highlighted "respect for this country and this planet is what brings us all together to talk about the oceans as a collective. This joint workshop serves as a crucial platform for researchers in marine science, ocean modelling, and observations to address the massive challenges we are facing".

"We are linking two different research communities that look at the same problems from different perspectives. Feedback from models and observations improve both and we really need to integrate them. This joint workshop could be the platform where the crucial connections and collaborations between the two communities start to happen", said ACCESS-NRI Director, Professor Andy Hogg.

The three exciting days of poster sessions, talks, breakout discussions and of course one to one conversation at meal breaks featured 31 engaging talks, 63 insightful posters, 24 lighting talks and 3 invited keynote speakers.

The first keynote speaker, CSIRO's Dr Jennifer Skerratt, kicked off the meeting talking about a decadal assessment of the eReefs Platform compared with field observations in the Great Barrier Reef.

Day 2 started with keynote speaker Dr Jan Zika, from the University of New South Wales, exploring the fascinating question: is numerical mixing in ocean models a solved problem?

On the final day, keynote speaker Dr Catherine Vreugdenhil from the University of Melbourne, gave a fantastic talk entitled "The effects of ocean dynamics on the melting of ice shelves: a fine scale numerical simulation approach".

Professor Matthew England from UNSW, who attended the meeting, said "Australian needs world-class ocean predictions alongside a better understanding of how our oceans are changing, from the open ocean to the nearshore. Bringing together the bluewater and coastal ocean communities in this way, to explore our common objectives and research platforms, was an outstanding initiative".

See Full program and Abstract booklet here. ■

IMOS farewells Dr Helen Beggs

Dr Helen Beggs, a Senior Research Scientist in the Science & Innovation Group at the Bureau of Meteorology, has led two IMOS sub-Facilities since the beginning of IMOS in 2006 – Satellite Remote Sensing Sea Surface Temperature (SST) Products and Ship of Opportunity Sea Surface Temperature Sensors for Australian Vessels, and is retiring from the Bureau of Meteorology early in 2025.

Dr Beggs recalls that before IMOS, ship SST observations in the Australian region were sparse and unreliable, with commercial vessels using uncalibrated sensors and reporting only every six hours, and research vessels not reporting SST to the Global Telecommunications System (GTS).

"This meant that ship SST observations in our region were under-represented in climate data records and numerical weather prediction models and were not used for validation of satellite-derived SST. Locally received SST observations from NOAA Polar Orbiting Environmental Satellites (NPOES) were not ground-truthed and not readily available to researchers," Dr Beggs said.

Over the past 18 years IMOS, in partnership with our operator Bureau of Meteorology, has instrumented more than 20 ships of opportunity with validated, reliable SST sensors. This has significantly improved the quantity and accuracy of SST observations from ships of opportunity and satellites in the Australian and Southern Ocean regions to research and operational systems.

Dr Beggs considers the most exciting technical improvement for SST in the first 18 years of IMOS has been the state-of-the-art reprocessing of 31 years of NPOES and eight years of Himawari-8 2 km satellite SST data, with individual quality flags and bias values for each value. For example, the IMOS NPOES data allowed CSIRO to produce a 25-year daily SST climatology for the Australian region (SST Atlas of Australian Regional Seas – SSTAARS), that revealed hitherto unseen coastal features.

"Having sustained funding and support of ocean in-situ observations is so important to producing a reliable climate data record of Australia's marine environment. Particularly valuable have been the relatively long time series of IMOS data from Argo floats, coastal moorings, Southern Ocean Flux Station and Infrared SST Autonomous Radiometer (ISAR) on RV *Investigator*," Dr Beggs said.

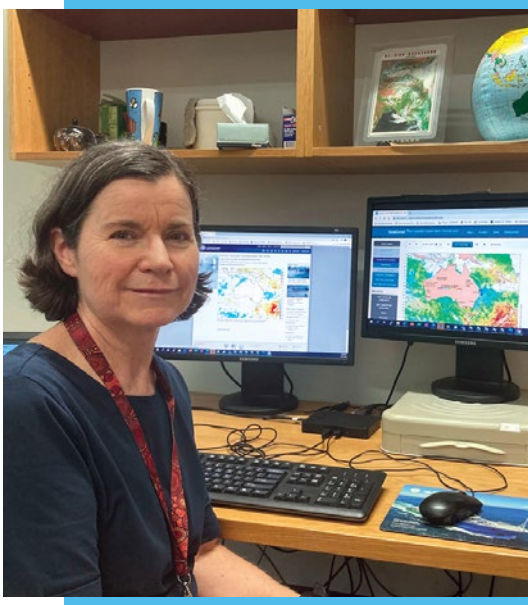
"IMOS has demonstrated to other countries that it is possible to freely share quality-assured ocean observations from different agencies in one data portal in common formats. It has also enabled more Australian ocean observations to be contributed to the GTS and global ocean databases."

For example, IMOS has facilitated the Bureau of Meteorology's satellite SST products to be produced in the international Group for High Resolution SST (GHRSST) format.

"This has meant that international as well as Australian scientists have been able to validate and compare the IMOS SST products with those produced by other agencies, which is very important for sustained monitoring and improvement," said Dr Beggs.

"For me personally, the most important science research highlight using IMOS data has been the contribution that the satellite SST products made to the GHRSST Tropical Warm Pool Diurnal Variation (TWP+) Project that I led. This data set allowed my former PhD student, Haifeng Zhang, in collaboration with Australian and international scientists, to compare various SST diurnal variation models over the Maritime Continent."

In looking forward to the next frontier for ocean remote sensing, Dr Beggs says "I would have to say that in the short-term the Surface Water and Ocean Topography (SWOT) satellite revolutionizes oceanography by detecting sub-mesoscale ocean features as small as 15 km, but with a 21-day revisit. The next frontier would be to launch a constellation of SWOT-like altimeters that could provide a daily snapshot of the earth's sub-mesoscale surface ocean currents."



Dr Beggs is currently on long service leave and is enjoying spending time improving her cycling and recorder playing. She is also exploring opportunities for contributing to science advisory roles after her retirement next March.

Dr Beggs has passed the leadership of the two IMOS sub-Facilities to Pallavi Govekar (Satellite Remote Sensing SST Products) and Haifeng Zhang (SST Sensors for Australian Vessels).

"I would also like to thank the many others who have contributed to producing the IMOS SST products over the past 18 years, including Eric Schulz, Leon Majewski, Joel Cabrie, Julian Rodriguez, Janice Sisson, George Kruger, Ruslan Verein, Aihong Zhong, Lixin Qi and Justin Freeman from the Bureau, Edward King, Nicole Morgan, Mark Snell, Hiski Kippo from CSIRO, Bozena Wojtasiewicz, Jared Johnston and Jessica Benthuysen from AIMS, and Martin Buggeln from Lothlorien Electronics."

IMOS would like to thank Helen for her significant contribution to the program, her input into the system will be missed. ■

IMOS to co-lead the Ocean Best Practices System

IMOS contributes significantly to the Ocean Best Practices System (OBPS) repository, sharing operational best practices that are widely used by the global ocean observing community. IMOS is considered a leader in the global ocean observing community and was prominent at the recent OBPS workshop. Dr Fabrice Jaine, the IMOS Principal Science Officer, delivered the final plenary for the southern hemisphere time zone, highlighting key lessons learned and the recommendations developed during the workshop.

IMOS is pleased to announce that Dr Rebecca Zitoun, a member of the IMOS team, has taken on the role of Co-Chair for the Ocean Best Practices System (OBPS) alongside Cristian Munoz Mas from the Institute of Marine Research in Norway. Both Rebecca and Cristian stepped up from their roles as Co-Chair Elects, beginning their two-year term in November 2024.

The IMOS Community within the OBPS repository plays an important role in centralising and promoting IMOS approaches to marine observing.

Through this role, Rebecca will help further the collaboration between IMOS and OBPS, supporting global efforts to improve the quality, interoperability, and sustainability of ocean science and operations.

We congratulate Rebecca on her new role and look forward to IMOS's continued engagement with the OBPS initiative. ■

Update from the Understanding of Marine Imagery sub-Facility

Written by Jacquomo Monk and Ariell Friedman

The IMOS Understanding of Marine Imagery sub-Facility, through the SQUIDLE+ platform, has established itself as the most comprehensive and mature end-to-end platform globally with nearly 10 million fully openly accessible images and almost 4 million quality annotations (of which approximately 80% of the finalised, QA/QC'd annotations are openly accessible). Understanding of Marine Imagery has imagery covering both Poles and everything in between from 26 distinct data sources.

The IMOS Understanding of Marine Imagery sub-Facility has had a productive quarter, showcasing how SQUIDLE+ has responded to user needs by working with machine-learning experts to incorporate new machine-learning models into the world's largest open marine imagery repository.

The collection of available models and bots is growing, and several are currently available through the SQBOT machine-learning dashboard. Users can now reliably detect range-extending species (urchins) and rare species (handfish), as well as classify the cover of various benthic categories including canopy-forming macroalgae, sponges, hard corals, seagrass and *Ecklonia radiata* using pre-trained machine learning (ML) models running on cloud compute infrastructure.

The flexible structure of SQUIDLE+ facilitates cross-disciplinary collaborations between marine scientists and machine learning researchers, enabling new models to be developed with more soon to be released.

Showcasing some of these developments, Jacquomo Monk, Understanding of Marine Imagery sub-Facility's Project Manager delivered a keynote presentation at the Australian Marine Sciences Association Conference in Hobart, and an invited presentation at Parks Australia's Science Forum, where he highlighted how Understanding of Marine Imagery sub-Facility's FAIR and open data are creating streamlined, management-ready data pipelines.

Jacquomo Monk presenting at the Australian Marine Sciences Association Conference.

He showcased how these pipelines connect with platforms like Seamap Australia to enhance public outreach of imagery datasets. His presentation also emphasised how Understanding of Marine Imagery sub-Facility has enabled the formation of collaborations between machine-learning researchers and ecologists, using real-world datasets to build and operationalise multiple new models that improve annotation processes and elevate the quality of imagery data.

At the Marine Imaging Workshop 2024, hosted by the Monterey Bay Aquarium Research Institute, Ariell Friedman, Understanding of Marine Imagery sub-Facility's chief software architect, delivered an talk and ran two hands-on workshops. The presentation covered how SQUIDLE+, now the largest repository of openly accessible georeferenced marine images globally, is poised to revolutionise the marine imagery landscape regarding how survey data is delivered, managed, annotated and reused.

The talk showcased the advanced collaboration workflows, synthesis and translation outputs, QA/QC tools and machine-learning integrations. The hands-on sessions allowed users to explore the existing public datasets and also create and analyse their own experimental datasets for analysis. In the short time during each interactive session, users were able to obtain fully annotated, QA/QC'd datasets with the assistance of automated labelling algorithms.

Both presentations sparked considerable interest, with the Understanding of Marine Imagery sub-Facility team receiving numerous inquiries about potential collaborations and applications of the facility, including how the platform could work with industry and traditional owners to meet their emerging needs. ■

Diving further into the ocean with Deep Argo Floats

IMOS is expanding our Argo Floats Facility to include Deep Argo Floats to better understand the deep ocean to inform climate and weather.

The IMOS Argo Australia Facility, which is operated by CSIRO, is a major contributor to the global array of 3,908 floats, maintaining 10% of the international Argo program.

Argo Floats measure temperature, conductivity (for conversion to salinity), and pressure in the upper 2 km of the ocean. By providing continuous observations of the global ocean, Argo floats have revolutionised our understanding of the oceans and their role in climate.

However, regular Argo floats only sample about half the ocean volume. Sparse ship-based measurements show that change is also underway in the deep ocean. Recognising the urgent need for more complete sampling of the deeper part of the ocean, the International Argo community has developed Deep Argo Floats that can reliably measure temperature and salinity to depths of 6 km.

The sustained, continuous measurements provided by Deep Argo Floats will allow changes in the deep ocean to be assessed and understood for the first time. Deep Argo will provide crucial measurements for tracking changes in ocean heat content, salinity, sea level rise, and deep circulation. The deep ocean slows the rate of climate change by taking up heat and carbon, therefore changes in the deep ocean may affect the pace of climate change.

The new Deep Argo Floats sub-Facility will enhance Argo Australia by adding deep floats able to profile the full water depth, and contribute to the global array target of 1,200 Deep Argo Floats. Just as Argo has revolutionised oceanography in the upper ocean, Deep Argo will drive a similar revolution in the deep ocean.

“We used to think the deep ocean was very stable and unlikely to change very rapidly. But sparse observations from ships show that this is not the case, with the deep ocean south of Australia changing more rapidly than anywhere else,” said the leader of the new sub-facility and CSIRO scientist, Dr Steve Rintoul.

“By providing sustained, broad-scale measurements of the deep ocean, Deep Argo will help us to understand how and why the deep ocean is changing, and to assess the consequences for climate and sea-level rise.”

IMOS will contribute 15 Deep Argo Floats to the global array, and our partner the Australian Antarctic Program Partnership (AAPP) are also providing a substantial contribution with a further 10 Deep Argo Floats.

The locations of float deployments will be determined in consultation with scientists by considering scientific justification, availability of supporting measurements, co-investment, and feasibility. ■

Photo: AAPP, CSIRO

First step-change funded ocean glider deployment along the east coast of Tasmania

The IMOS Ocean Glider Facility has been expanded through the 2023 step-change NCRIS funding, with additional glider deployments ensuring IMOS has national-scale coverage.

The ocean glider was launched in August this year for a 26-day deployment along the east coast of Tasmania (Figure 1). This mission proved challenging for the glider pilots at the IMOS Ocean Glider Facility (operated by The University of Western Australia) due to the strong northward flowing currents it encountered along the shelf almost constantly during the deployment. These currents were due to a succession of cold fronts to the south of Tasmania.

The ocean glider revealed instances of dense shelf water transport as seen in the temperature plot (Figure 2) and in the cross-shelf parameter plots for selected transects mission (Figures 3,4 and 5).

Dense shelf water transport occurs when evaporation in summer and subsequent cooling in winter produce higher density waters closer to the coast that sink to the bottom and flow offshore across the continental shelf. The slow-moving process provides an effective mechanism for the transport of water, heat, salt, phytoplankton, nutrients and pollutants from shallow coastal regions into the deeper ocean.

During this ocean glider deployment, the warmer waters of the East Australian Current were sampled off the continental shelf and the presence dense shelf water was evident in many of the cross-shelf transects and often associated with high backscatter (Figures 2-5). Backscatter is a measure of the amount of suspended material in the water column.

Previous ocean glider deployments along the east coast of Tasmania were undertaken as part of the Event-Based sub-Facility which aimed to observe ocean conditions during marine heatwaves in summer.

"This step-change glider is the first winter deployment that has documented the presence of dense water transport for the first-time off Tasmania. Now IMOS ocean gliders have sampled dense water transport around the whole continent of Australia," said Professor Charitha Pattiaratchi, Leader of the IMOS Ocean Glider Facility and Professor of Coastal Oceanography and The University of Western Australia.

The IMOS step-change allows for two glider missions per year at four locations around Australia where there is a scarcity of data. These include, in addition to East Tasmania, Eastern Great Australian Bight, Western Great Australian Bight and Gulf of Carpentaria. ■

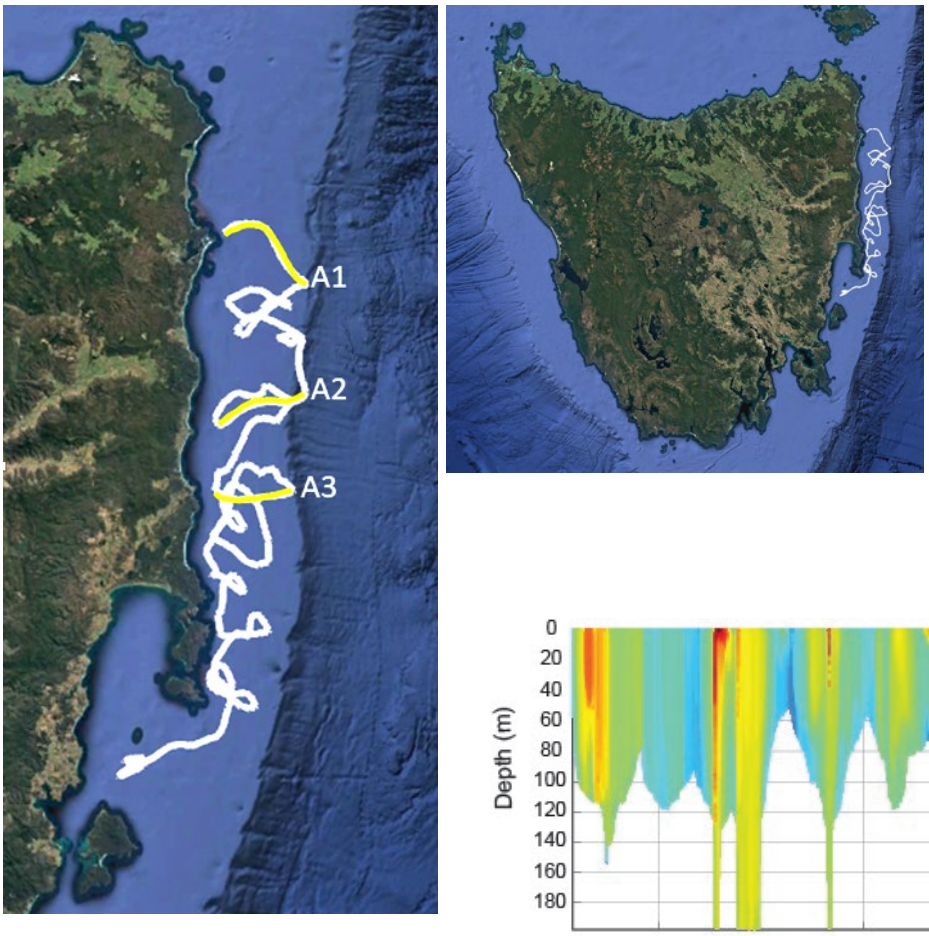


Figure 1: Track of Slocum glider (unit248) along the east coast of Tasmania (29 August to 23 September 2024). The transects in yellow are shown on Figure 2 to 5).

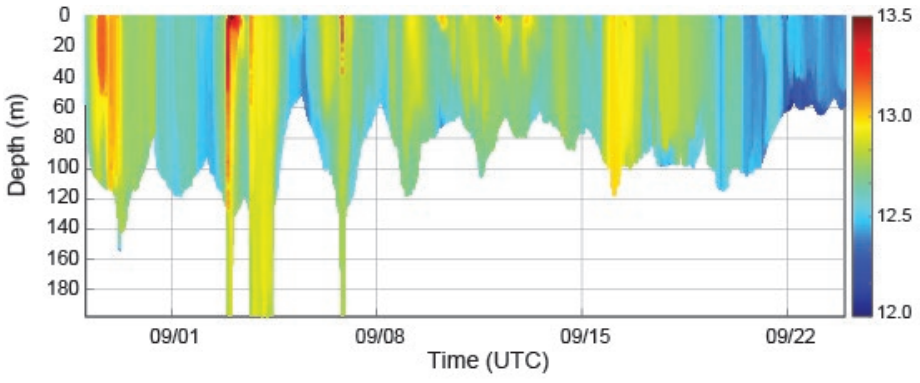


Figure 2: Temperature distribution for the whole mission.

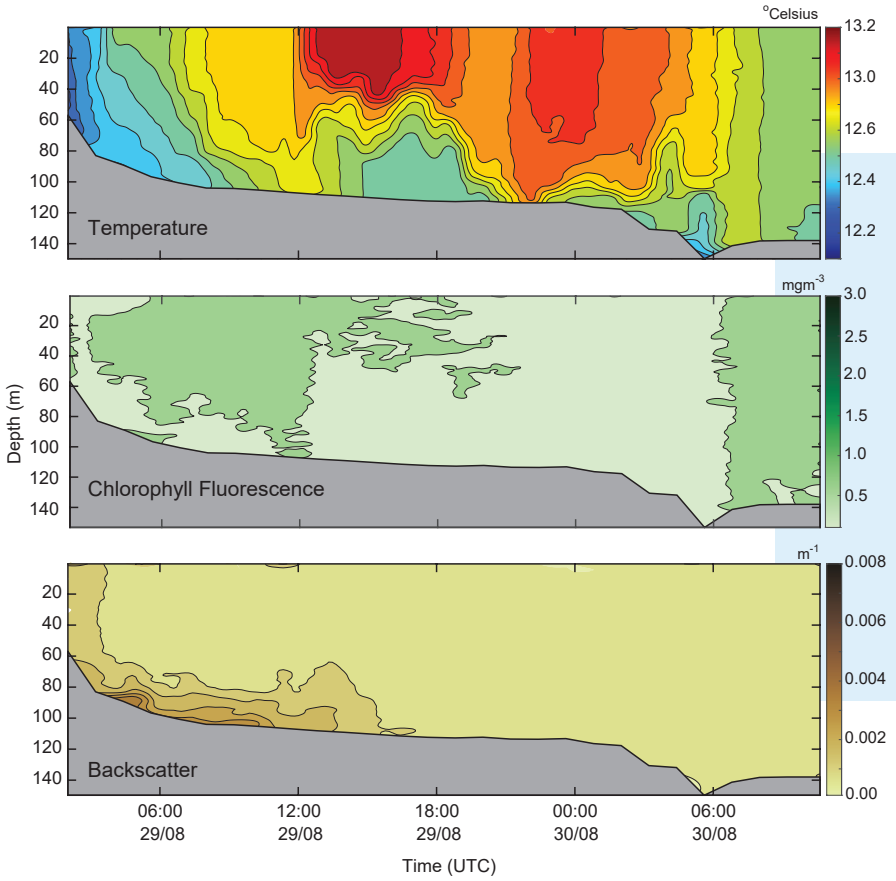


Figure 3: Cross-shelf plot from Transect A1 of temperature, chlorophyll and backscatter (turbidity). The temperature plot shows the dense water transport (colder water). The backscatter shows that higher turbidity is associated with the colder water. However, there is low chlorophyll associated with the colder water.

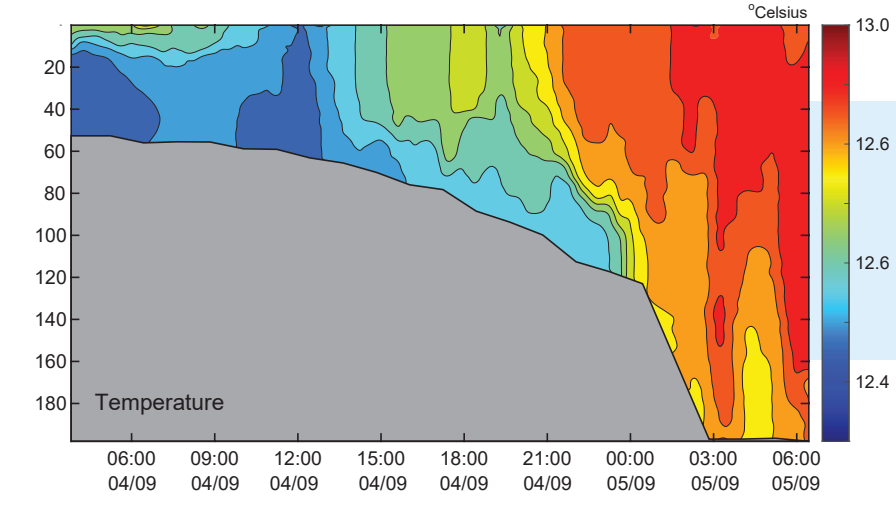


Figure 4: Cross-shelf plot from Transect A2 of temperature. Note that the colder water extends across the shelf to depths > 100m.

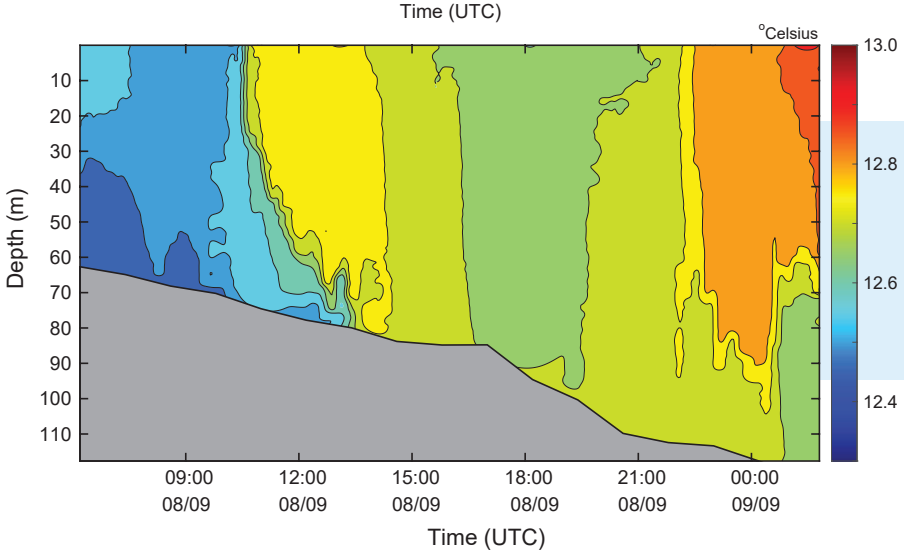


Figure 5: Cross-shelf plot from Transect A3 of temperature,

A decade of sustained observing at the IMOS Lucinda Jetty Coastal Observatory: significance and impact

Written by Thomas Schroeder

This year marks the 10th anniversary of sustained marine and atmospheric observing at the IMOS Lucinda Jetty Coastal Observatory. The observatory is located on the end of the 5.8 km long Lucinda Jetty in coastal waters of the Great Barrier Reef World Heritage Area close to the Herbert River Estuary and the Hinchinbrook Channel in Queensland.

The Lucinda observatory site was re-established in 2013 after complete destruction from Tropical Cyclone Yasi (2011) and operational data delivery to the IMOS Australian Ocean Data Network (AODN) commenced in 2014. Since then the Lucinda observatory has provided high quality observations that support the validation and parametrization of satellite Ocean Colour Radiometry and help advance the understanding and link between the radiometry (reflectance) and the in-water as well as atmospheric optical properties (absorption, scattering) to support biogeochemical processes and modelling studies.

The Lucinda observatory is recognized by the international space community as a unique contribution to global collaboration in quantitative Earth Observation, and that it is leveraged nationally to position Australia to benefit through deeper integration into foreign satellite data supplies. As such, the site was a key bargaining aspect in convincing the European Commission to enter into the Australia Regional Copernicus Data Hub agreement that now ensures long-term supply of Sentinel satellite data for Australia.

The Lucinda observatory is one of only a few sites globally that combines the acquisition of both atmospheric and in-water optical measurements. The site is currently the only fixed-platform in Australia that does sustained observations of this nature and one of only four southern-hemisphere sites within NASA's global network of multi-spectral sun-photometers (AERONET-OC).

Observations from the Lucinda observatory support a wide range of national and international projects and activities that have been published by the research community in almost 50 journal papers since 2013. At a national level the radiometric observations are critical for projects such as eReefs and AquaWatch to validate the quality of atmospheric correction, a satellite image processing step to obtain the marine surface reflectance for subsequent water quality estimation and assimilation into biogeochemical models.

Also in the context of the Great Barrier Reef, the Lucinda observatory's continuous in-water optical measurements have for the first time allowed evaluation of hourly water quality retrievals from the geostationary Himawari-8 satellite to quantify diurnal variability.

During the fortnightly site maintenance trips, Lucinda observatory operations also support the collection of observations for other agencies and projects such as the Marine Monitoring Program of Great Barrier Reef Marine Park Authority (now Reef Authority) collecting pesticide data, and the IMOS Acoustic Telemetry sub-facility in deploying acoustic receivers to detect movement of animals between state waters.

The platform also supported the IMOS Radiometry Task Team that engaged the wider Australian research community through dedicated laboratory and field inter-comparison experiments to advance the quality and consistency of radiometric observations. The Australian Sentinel-3 Validation Team relies on Lucinda observations to inform the satellite

Photos: Thomas Schroeder

Hyper-spectral radiometer on pneumatic mast.

Hyper-spectral radiometer on sun-tracker close-up.

Radiometry Task Team inter-comparison setup.

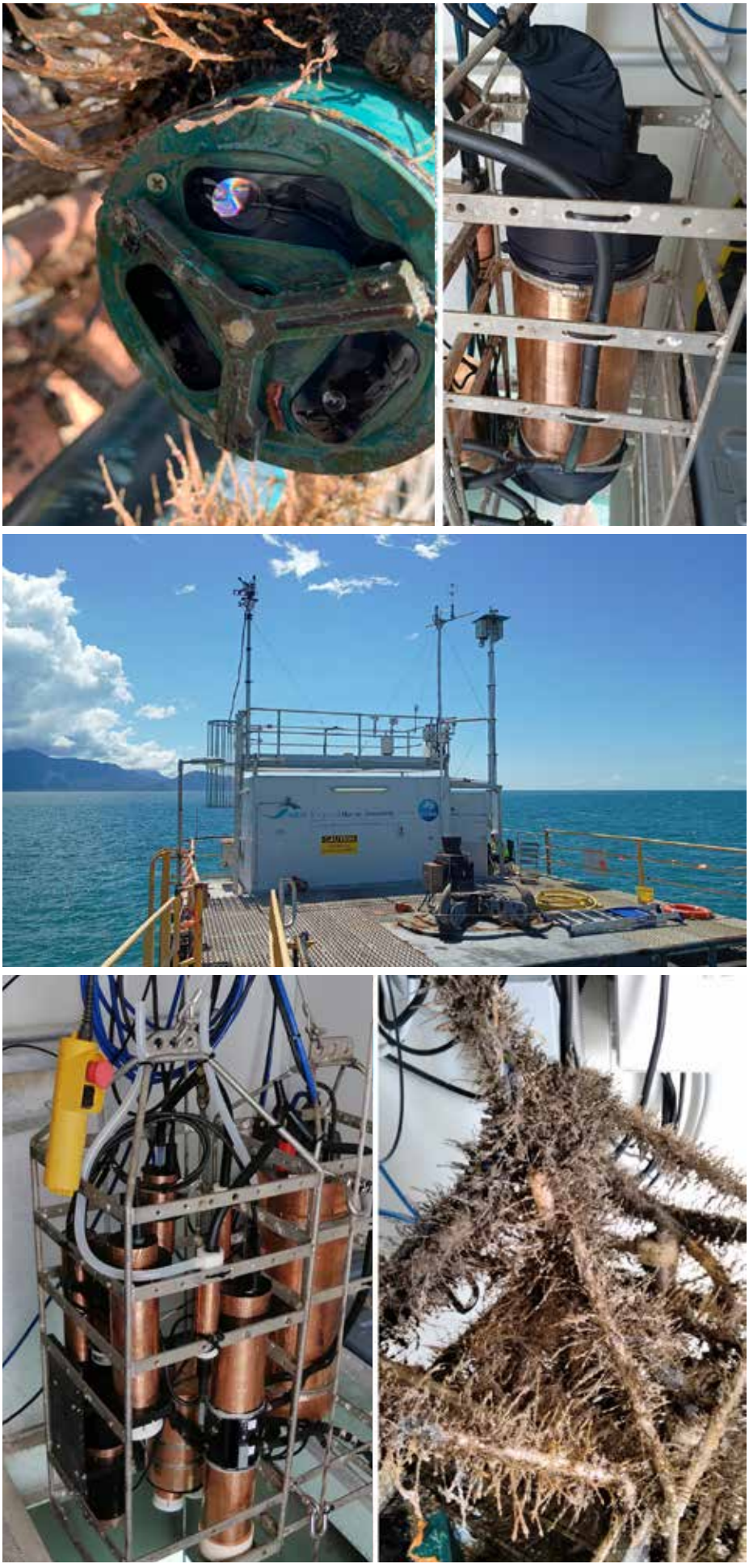
Multi-spectral SeaPRISM AERONET radiometer.

operators European Space Agency (ESA) and European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) on the quality of their marine satellite products in our waters.

Integration of the Lucinda observatory data into global databases such as NASA's SeaWiFS Bio-optical Archive and Storage System (SeaBASS) assist Space Agencies to reduce the northern hemisphere data bias and to improve the accuracy of global ocean colour algorithms/products in the Australian region. Algorithm inter-comparison experiments such as those conducted under the International Ocean Colour Coordinating Group have used Lucinda observatory data to evaluate radiometric correction methods globally.

More recently this data has been used to validate the accuracy of new hyper-spectral satellites such as German EnMAP (DLR) and Italian PRISMA (ASI) missions. Lucinda atmospheric observations have also helped with quantifying and tracking of stratospheric sulfate aerosols and their radiative impact from the Hunga Tonga–Hunga Ha'apai volcanic eruption in 2022 and to validate satellite retrievals of atmospheric aerosols such as the distribution of dust and biomass burning aerosols emitted by Australian wildfires.

In 2025 Lucinda will become part of the global HYPERNETS hyper-spectral radiometer network supported by the European Space Agency who will fund a set of two radiometers for operation under IMOS. ■



Top: Optical face of EcoTriplet with wiper; In-water data logger copper taped to reduce bio-fouling.

Middle: Site enclosure.

Bottom: In-water instruments on deployment winch; Severe bio-fouling on in-water instrument cage.

Photos: Thomas Schroeder

Chloe Nichola Roberts

University: Southern Shark Ecology Group, Flinders University

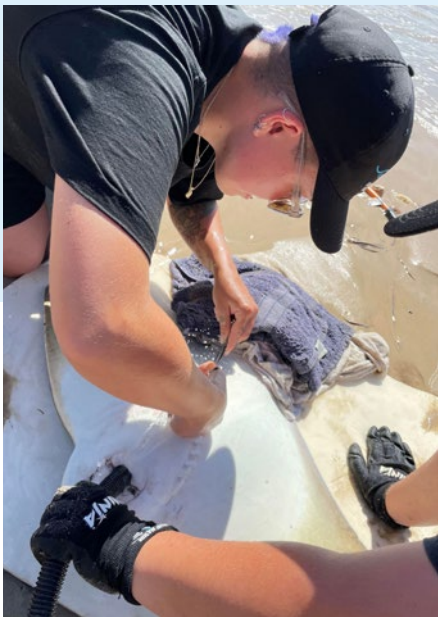
Variations in spatial niche of benthic elasmobranchs across coastal habitats and anthropogenic pressure in Gulf St Vincent, South Australia

Port Jackson sharks (*Heterodontus portusjacksoni*) and southern eagle rays (*Myliobatis tenuicaudatus*) are two temperate benthic species endemic to the south-eastern Indian Ocean around southern Australia and New Zealand. They provide key ecosystem services through nutrient cycling, connecting habitats, and prey regulation, but the movement and residency of these two species in Gulf St Vincent, South Australia is unknown.

To address this, Chloe deployed 54 acoustic receivers (VR2W; Innovasea) at three sites of varying habitats and anthropogenic pressure along 120 km of the Adelaide coastline, and tagged 65 Port Jackson sharks and 21 southern eagle rays with acoustic transmitters to monitor their movements over two years. Acoustic detections were obtained from the IMOS Australian Animal Acoustic Telemetry Database.

Nearshore reef, estuarine, and shallow seagrass environments were important areas for Port Jackson sharks, possibly due to these areas providing suitable habitats and abundant prey and nutrients for breeding, egg-laying, and juvenile survivorship. Their movement was restricted to the nearshore environment, which contrasts other populations that undertake large-scale seasonal migrations, e.g., the east coast population.

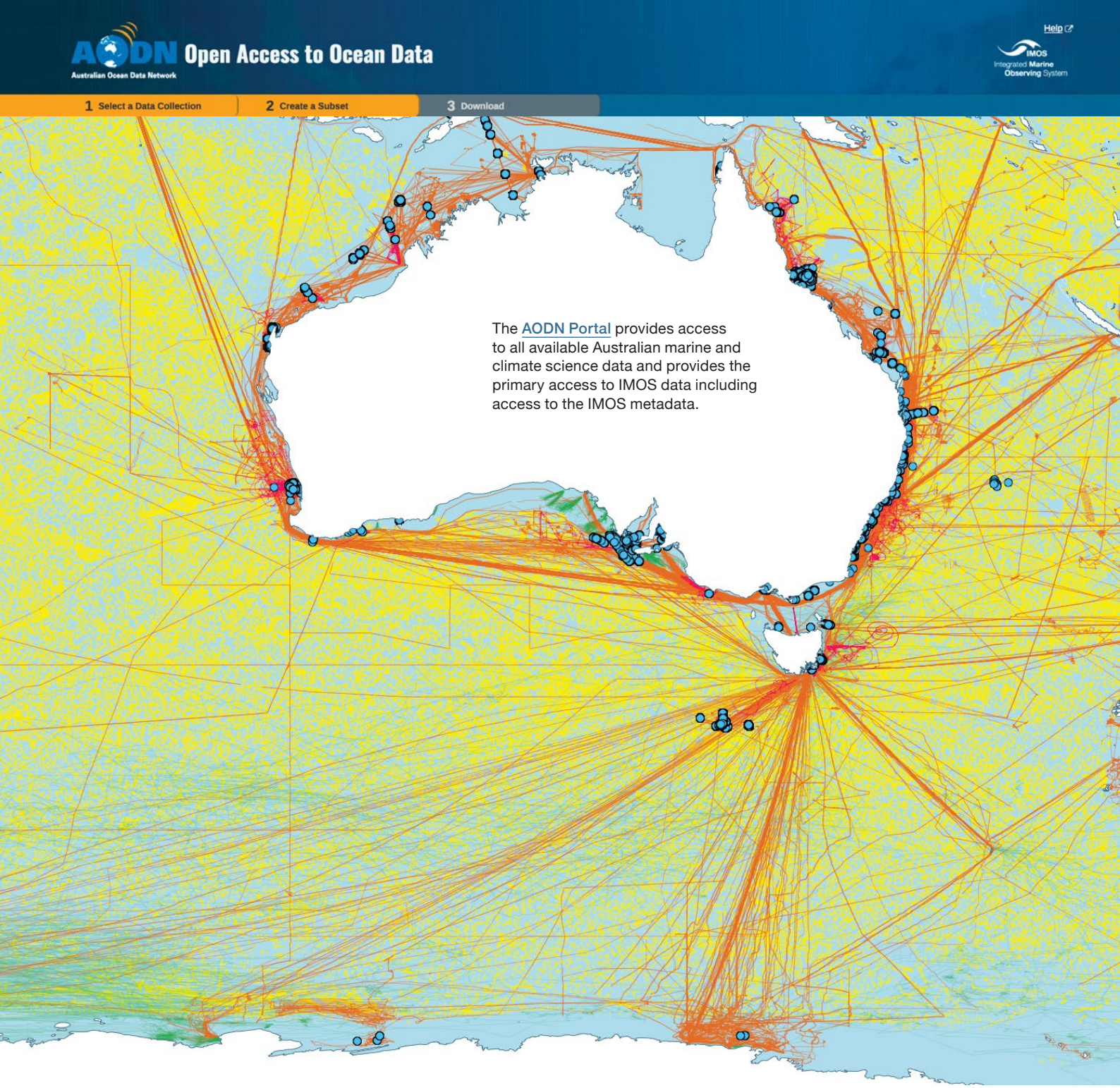
Southern eagle rays showed high residency to the area where they were tagged, mostly occupying shallow areas in less than 3 m depth of two metropolitan beaches, with limited movements to other parts of Gulf St Vincent. Similar to Port Jackson sharks, the preference for shallow, warm, and productive nearshore areas could contribute to reproductive output by aiding embryonic development, which is supported by the larger movements undertaken by some males.



Above: Chloe releasing a Port Jackson shark following the successful implantation of an acoustic transmitter at Long Spit, South Australia.

Right: Chloe inserting an acoustic transmitter into a southern eagle ray at Christies Beach, South Australia.

While further acoustic tracking and genetic studies are required to improve ontogenetic and demographic resolution, the current study highlights the importance of the nearshore ecosystems in Gulf St Vincent and small space use of two benthic elasmobranchs, providing a powerful baseline for future management of these species. ■



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