



marinematters

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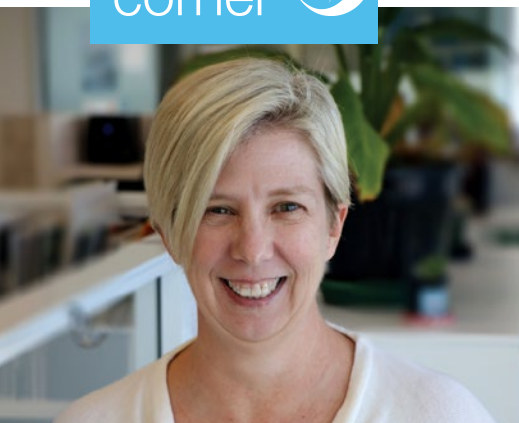
IMOS recognises the effort and dedication of our community during the pandemic



New olive ridley turtle satellite tagging program



IMOS and the State of the Environment Report 2021



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 December 2022 edition of Marine Matters.

This edition of *Marine Matters* includes a special section of recognition. The period during peak COVID-19 restrictions was very difficult for a range of reasons and it is only due to effort and dedication of members of our community and IMOS team that the program continued to deliver during this period. We do not want these extraordinary efforts to go unnoticed. The IMOS community were asked to nominate individuals who had gone above and beyond during COVID-19. Nominated individuals were recognised at the Annual Meeting in September, but are also highlighted here as a sign of our thanks and recognition for all of their contributions.

As we tentatively ease our way out of COVID-19 we are starting to host in person events again. This month we hosted a combined Forum for Operational Oceanography and Australian Coastal and Oceans Modelling and Observations workshop. This workshop was an amazing opportunity to link the operational and modelling community to discuss areas of overlap and intersection.

This edition of *Marine Matters* also provides updates on a range of other IMOS activities including our strong presence in the Oceans Best Practices System workshop, release of the 21/22 IMOS Highlights document and tracking the use of IMOS data in the recently released State of the Environment Report.

Finally, we've provided an update on the highly collaborative sea turtle tracking project in northern Australia. This is a great initiative and one we hope will deliver significant results for a range of end-users.

I hope you enjoy this edition of *Marine Matters*.

Dr Michelle Heupel
IMOS Director



IMOS recognises the effort and dedication of our community during the pandemic

The COVID-19 pandemic created a range of complications for IMOS operations including: lock downs and quarantine; border closures prohibiting travel to deploy or service equipment; social distancing limited the number of staff/crew allowed on vessels; sourcing parts, calibrating and/or repairing equipment became more difficult and time consuming due to shipping and supply chain issues.

COVID-19 disruptions required changes to IMOS operations to allow work to continue.

For example, teams helped each other complete work while unable to travel to be on site. Larger vessels were sourced to allow work to continue, or trips were reconfigured to operate over multiple days with fewer staff on board. Individuals found novel solutions to ensuring IMOS operations continued wherever possible.

Milestone delivery during the COVID-19 period has dropped, but operations continued, and we maintained the majority of our data streams. The performance and success through this period is based on the dedication of all of the members of our community and the commitment of our partners.

At the recent IMOS Annual Meeting in September, IMOS Director Michelle Heupel thanked the broader IMOS community who has committed to ensuring IMOS data continued to be collected and delivered during these unprecedented times and recognised the members of the community who had been nominated for specific dedication during this period.



Frank Coman, CSIRO

Frank Coman's leadership has ensured that the plankton team at CSIRO in Brisbane have met the project deliverables of delivering high-quality and timely plankton data for IMOS. Frank has taken on extra responsibility at CSIRO by becoming a team leader and is excellent at motivating the plankton team. He ensures the various aspects of the IMOS work runs smoothly, including sample collection, sample counting, sample transport, OH&S, permits, and general administrative tasks.

Gary Curtis, CSIRO

Gary Curtis, of the CSIRO moorings team in Hobart, is recognised for an outstanding effort keeping the mooring turnarounds on track over the last few years. Gary organised the logistics and fieldwork for six monthly turnarounds. Apart from organising and ensuring ships and moorings were ready for turnarounds he had to travel out of Tasmania under COVID-19 restrictions on several occasions to complete the field work. He was a major reason the project could deliver good quality data and ensured the travel and safety guidelines for the field work were always met.



Jack Beardsley, University of Tasmania and CSIRO

Jack Beardsley works as the Marine Geodesy Officer in the sub-Facility Satellite altimetry calibration and validation. In preparation for the launch of the Surface Water and Ocean Topography (SWOT) mission later this year, Jack has worked tirelessly in sub-Facility's small team to significantly redevelop and expand the surface GNSS equipped buoy capability. Throughout the COVID-19 period, Jack was able to push forward dealing with various contractors and a myriad of other constraints – the result was a fleet of six field-tested and fit-for-purpose buoys with a further three coming from subsequent co-investment. This is a major milestone for the sub-Facility and we are significantly indebted to Jack for his efforts.



Phil McDowall, Sydney Institute of Marine Science

Phil McDowall who took on the mantle of Fieldwork Manager for the whole of SIMS during COVID and in so doing ensured continuance of all of IMOS animal tracking long-term datastreams and maintained our field operations despite ever-changing border restrictions and lockdowns. He is also key to renewal of the field team through mentoring and training of new staff and volunteers



Paul Tinkler, Deakin University
Paul Malthouse, SARDI

Senior technical officers Paul Tinkler of Deakin University and Paul Malthouse of SARDI worked together to tackle the challenge of setting up infrastructure during COVID-19. When border closures prevented SARDI staff from entering Victoria the technical teams from Deakin and SARDI worked together, going the extra mile to ensure the Bonney mooring was sustained. Paul Tinkler led the field operations at this time and Paul Malthouse coordinated equipment, calibrations, and field support for a “green” crew. In addition, Paul Tinkler led the servicing of the other IMOS infrastructure including the Portland Curtain, the wave buoy off Cape Bridgewater, and led field operations for quarterly carbonate sampling, CTDs, microplastic sampling.

Both Paul Tinkler and Paul Malthouse have exuberated the IMOS spirit, working collaboratively and across borders to contribute to the sustained observing system.

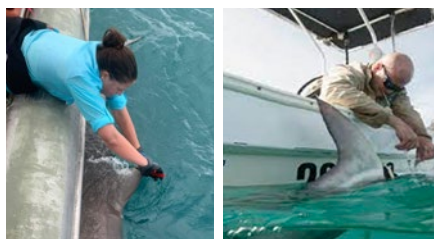
Salman Khan, CSIRO
Gabriela Semolini-Pilo, CSIRO
Roger Scott, CSIRO
David Griffin, CSIRO
Diana Greenslade, Bureau of Meteorology

Led by Salman Khan, the team effort of Gabi Semolini-Pilo, Roger Scott, David Griffin and Diana Greenslade to overcome many hurdles to make the new composite Waves product available as a feature on the IMOS OceanCurrent website. It is one of the first integrated displays of satellite wave measurements, fixed buoys from many operators, and a forecast model for all of Australia and represents a real achievement for the “I” in IMOS.



Lyndon Llewellyn, Australian Institute of Marine Science (AIMS)

Lyndon Llewellyn ensured that the IMOS infrastructure operated by AIMS continued during the pandemic, Lyndon is always available to field questions and provide support for IMOS work.



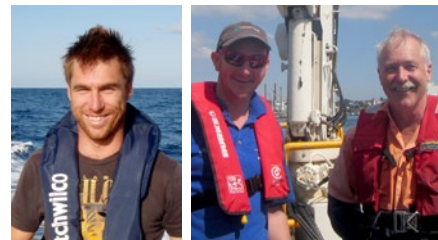
Stacy Bierwagen, AIMS
Adam Barnett, James Cook University

Stacy Bierwagen took on the role of managing the IMOS Queensland Acoustic telemetry array project, which involved learning all the AIMS procedures to follow, conducted field trips, coordinated collaborators and tagged animals to meet our targets for several priority species. Stacy worked with Adam Barnett at James Cook University managing this large project with 20 collaborators, 300+ stations of which 130+ are maintained as part of the project, and 650+ animals tagged.



Fabrice Jaïne, Sydney Institute of Marine Science

Fabrice Jaïne has led multiple initiatives that have produced major innovations and improvements to the input of data into the IMOS Acoustic Telemetry database, improving the use of the data through the development of the Remora R package.



Tim Austin (left), University of NSW (UNSW)
Stuart Milburn (middle), UNSW
Clive Holden (right), Oceanographic Field Services

Tim Austin, Stuart Milburn and Clive Holden worked tirelessly to maintain the continuity in the NSW-IMOS moorings data during the COVID-19 period. They immediately adapted the programme (including adjusted sampling intervals on instruments) to maintain data continuity. Tim, Stuart and Clive negotiated the pandemic travel limitations in NSW, securing approvals to travel to the regional locations of Coffs and Narooma for mooring servicing every three months. This includes ever increasing paper work, COVID-19 response plans, and of course taking plenty of RATs.

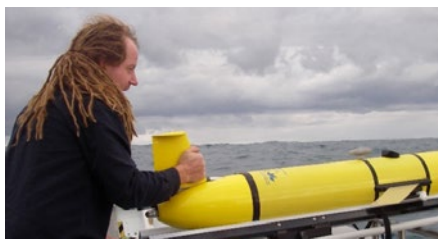
Nick Caputi, WA Department of Primary Industry and Regional Development

Nick Caputi has been an active member of the WA reference group and a strong supporter of sustained oceanography observations. Nick has also worked in collaborations in using IMOS mooring and national reference station data to detect marine heatwaves and cold spells and their impacts on fisheries.



Ian Darby, CSIRO

Ian Darby is retiring after more than 12 years of service in CSIRO under the IMOS Western Australia Mooring sub-Facility. Ian was the founding lead of the WA technician team and navigated the challenge of operating a diverse range of mooring equipment over the years.



Dennis Stanley, University of Western Australia

The IMOS Ocean Glider Facility Operations manager, Dennis Stanley, travels the length and breadth of the country to deploy gliders around Australia. This became a huge challenge with the appearance of COVID-19 in March 2020. However, no one has navigated the virus and the various border closures and openings across the country like Dennis. Considering the zipped-up border of WA where IMOS Ocean Gliders are based and the subsequent restrictions on WA-based staff, the Facility relied on Dennis to keep east coast operations going. During this difficult period, Dennis deployed 10 gliders Australia wide, often with circuitous routes to the deployment locations due to lockdowns. Deployment sites included the Great Barrier Reef QLD, Heron Island QLD, Pirates Bay Tas, Portland Vic, Onslow WA, and Weipa QLD. Amongst all of this, Dennis also returned to Perth whenever possible to service gliders in the lab.

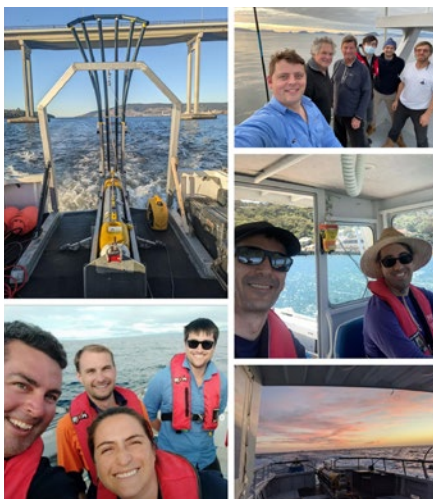
Craig Hanstein, CSIRO

Craig Hanstein worked very hard to ensure that the Ships of Opportunity XBT lines were maintained, with extra effort taken to remain in contact with our regular ships. Even though ship riders couldn't be onboard during the COVID-19 period, it was very important to keep the ships involved. Craig took extra time to keep those relationships going, and now ship riders can be sent again, the regular program with these ships can be continued.



Toni Cooper and Lizzi Oh, University of Tasmania

Toni Cooper and Lizzi Oh work in the National Reef Monitoring Network (NRMN) team. Toni and Lizzi, working with the AODN team, undertook an entire redevelopment of the database, keeping masses of incoming reef biodiversity data quality checked, uploaded and available. They also worked with the Understanding of Marine Imagery sub-Facility to continue to build the available data on benthic communities on reefs through a prolific global collaborative network. Toni and Lizzi ensured the data were available for the national reefs case study in the 2021 State of the Environment Report, even though the database was under development at the time.



Autonomous Underwater Vehicles (AUV) team, University of Sydney

The team includes: Lachlan Toohey, Jackson Shields, David Henderson, Christian Lees, George Wakeham, and Christian Reeks.

The IMOS AUV team have worked hard under trying circumstances to keep our operational program going during the pandemic. Operations have been limited over the past couple of years due to border closures, and it has been a challenge to get back into the field.

Queensland and Northern Mooring Team, AIMS

The team includes: Simon Spagnol, Felicity McAllister, John Luetchford, Chris Bartlett, Shaun Byrnes, Ash McMahon, Virginie Van Dongen Vogels, Tom Armstrong, Simon Harries, Josh Biggs, Craig Steinberg, Madeleine Cahill. With support from the AIMS vessel management team: Ben Fusco, Gary Brinkman, Patrick Bunday.

This team has kept the IMOS moorings network across Northern Australia operating throughout the pandemic. For the first 2 years of the pandemic, with individual states and territories adopting different border closure strategies which often changed at short notice, maintaining a vessel-based field program that spanned three states presented a major challenge for AIMS and the field teams involved. First and foremost, it required a focus on keeping our staff and vessel crews safe from COVID-19. This necessitated strict controls on vessel access, vessel operations and manning levels. In the case of AIMS vessels we reverted to single occupancy of science cabins, reducing the size of our field going teams. This then required a review and update of operating procedures for all aspects of vessel activities, everything from eating and relaxing in the mess, working in the labs, deck operations and mobilising and demobilising, to ensure that we could safely operate with the skeleton team onboard. At the same time, AIMS moved to only operate out of 2 main ports – Townsville and Darwin – where we could most effectively manage vessel access and logistics. For the IMOS moorings network, this meant extended duration trips with reduced manning. In particular, for the mooring array in the Northwest – this meant trips of three-week duration, departing Darwin to Ningaloo and back to Darwin, without making landfall. For some of the team members, this approach also meant repeat periods of 2-week isolation when returning to their home state at the end of field work. ■

Obituary: Robert Kay, CSIRO

Written by Mark Underwood



We would like to mark the passing of a CSIRO staff member who was known to many in the IMOS community.

It is with great sadness that we advise that Robert Kay passed away unexpectedly and peacefully at home on the 6th April 2022.

Robert Kay was the Manager of the CSIRO Oceanographic Calibration Facility in Hobart, a position he had held since 2009. Robert was a strong leader in enhancing the capability of the Calibration Facility with increased workflow and growing the range of oceanographic instruments being calibrated. The work of his team touched many groups in IMOS that use high precision instruments to monitor the marine environment.

As well as professional and technical skills, Robert possessed an open and friendly nature that brought added value to many relationships. Outside work Robert had a passion for dogs and Land Rovers and was devoted to his daughters. ■

The IMOS Annual Highlights Document 2021–22 is available now

The document showcases the impact IMOS research infrastructure and data provides across the country.



The IMOS Annual Highlight Document 2021–22 outlines some of our significant achievements during the past year, including showcasing IMOS' strengths at an invited presentation at UN Headquarters in New York.

The 16th year of operation for IMOS revealed the resilience and commitment of the marine science community as we continued to operate despite ongoing COVID-19 disruptions. The achievements outlined in this document are a testament to the strength, support and dedication of our partners and the marine science community.

The 2021–22 document provides an overview of the benefit IMOS delivers on both national and global scales which is demonstrated by the extensive use of IMOS data streams in key documents and reports. The Intergovernmental Panel on Climate Change (IPCC) Working Group II Climate Change 2022: Impacts, Adaptation and Vulnerability report released in February 2022 included numerous publications using IMOS data. Similarly, IMOS data had a strong presence in the 2021 State of the Environment Report released in July 2022.

Integration of IMOS data into both of these outputs creates a pathway to impact as the reports guide policy and other actions.

In addition to the two high-level reports released this year, IMOS continued to deliver a range of high-quality outputs and ensure our data are available and accessible to a range of stakeholders and end-users. As we look to 2022–2023 we hope to expand our user base as well as the benefit IMOS can provide within and beyond Australia.

Please find the 2021–22 Annual Highlights document for Australia's Integrated Marine Observing System (IMOS) [here](#). This web page has links to the pdf of the document, as well as more detailed information. ■

New olive ridley turtle satellite tagging program reveals migration pathways and key habitats to inform their conservation

The tags were deployed in a recent expedition to the Tiwi Islands as part of a collaboration between the Department of Defence, Integrated Marine Observing System, Sydney Institute of Marine Science, the Australian Institute of Marine Science, and the Tiwi Islands Marine Rangers.

Olive ridley turtles (*Lepidochelys olivacea*) are an endangered species that occur in mostly coastal waters, especially in soft-bottomed habitats.

The species has a worldwide distribution across the tropics. In Australia, olive ridley turtles occur along the coast from southern Queensland and the Great Barrier Reef, northwards to Torres Strait, the Coral Sea, Gulf of Carpentaria, Arafura Sea, and Joseph Bonaparte Gulf in Western Australia. The Tiwi Islands in the Northern Territory (NT) are recognised as one of the most important remaining nesting areas in Australia and the Pacific region.

All marine turtle species are experiencing serious threats to their survival. The main threats to the olive ridley turtles are climate change (e.g. sea-level rise flooding nests), marine debris entanglement and predation of eggs and hatchlings by pigs and dogs. Other threats include domestic fisheries bycatch and chemical and terrestrial discharge (Northern Territory population).

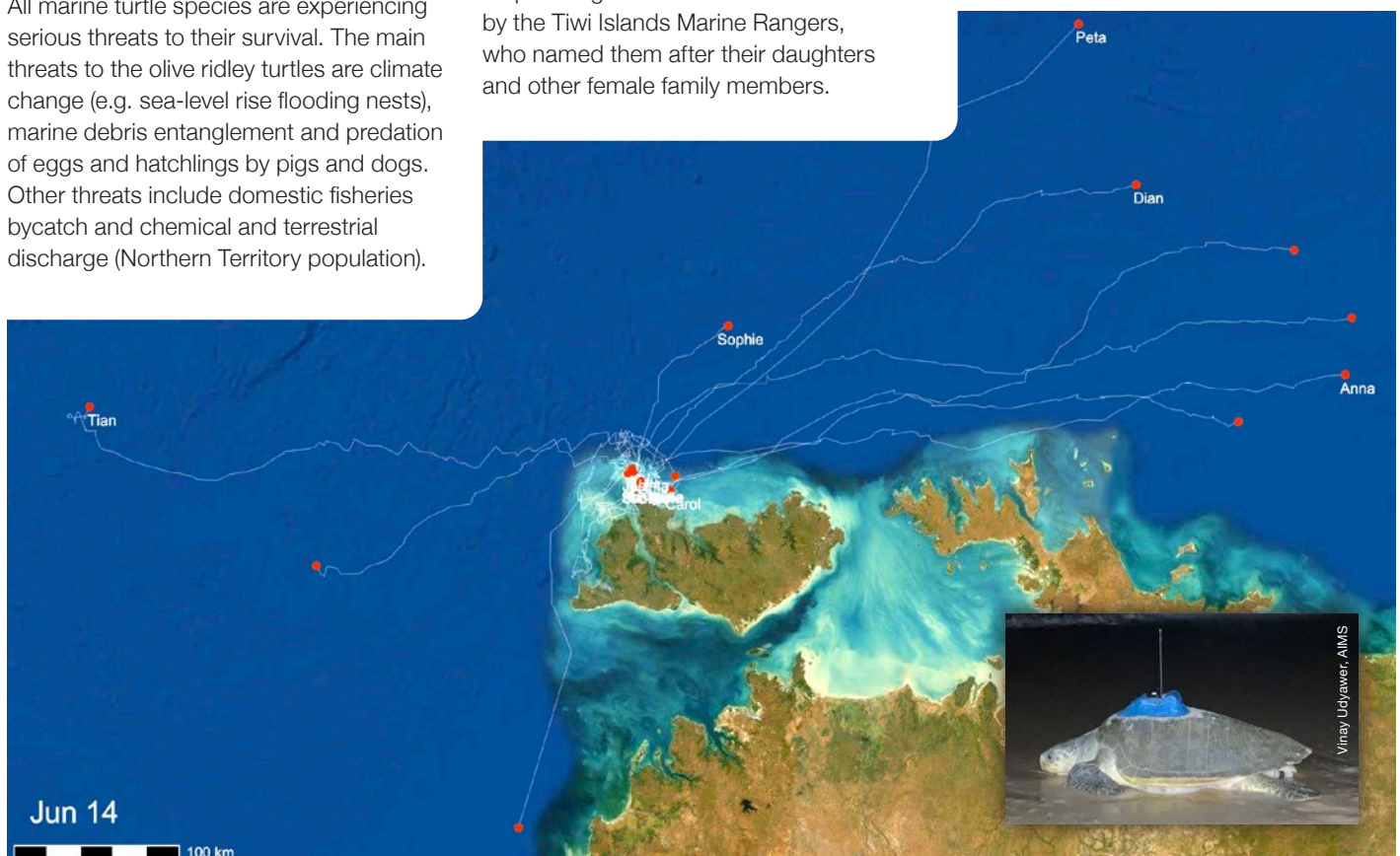
During May this year, the Tiwi Islands Marine Rangers, the first Aboriginal marine rangers in the NT, invited researchers to tag olive ridley turtles. The Rangers and researchers tagged 20 olive ridley turtles over several nights, equipping them with satellite-linked GPS biologgers.

Olive ridleys are one of the most understudied species in Australia. Attaching GPS biologgers to the turtles will provide much needed information on turtle migratory movements, habitat uses and their foraging behaviour, which in turn will assist in understanding how the turtles use the seas to the north of Australia and how the animals interact with their environment including interactions with fisheries.

Once tagged the turtles move off the beach and head into the ocean, providing data about their movements and dive behaviour in real time. The map below demonstrates the differences already apparent in their behaviour. The names that can be seen on the map were given to some of the turtles by the Tiwi Islands Marine Rangers, who named them after their daughters and other female family members.

Increasing our knowledge of the turtle's behaviour at-sea will allow us to develop high quality integrated habitat-behaviour models. These models will demonstrate which parts of the Timor and Arafura Seas are important for olive ridley turtles, and when linked to remotely sensed environmental data and known bathymetry we will be much better placed to combine environmental states with behaviour and at-sea animal performance.

Ultimately, the essential behavioural observations this project 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, endangered species that we currently know so little about. ■



IMOS and the State of the Environment Report 2021

IMOS was a major contributor to the State of the Environment (SoE) report 2021 released by Minister for the Environment and Water Tanya Plibersek earlier this year.

The report is a comprehensive assessment of the state of Australia's environment produced every five years by the Australian Government. It is an independent and evidence-based review that is mandated by the *Environment Protection and Biodiversity Conservation Act 1999*.

The State of the Environment 2021 combines scientific, traditional and local knowledge. Indigenous and non-Indigenous people have worked together to create this first holistic assessment of the state of Australia's environment. The report aims to help shape policy and action, influence behaviours, and assess our actions as stewards of the Australian environment.

The report covers the terrestrial environment including freshwater systems, coastal and marine environments, air quality, Antarctica, urban environments, heritage and biodiversity. In 2021 the report also included issue-based chapters on Climate and Extreme Events.

IMOS AND THE REPORT

The State of the Environment report 2021 includes 99 publications using data from IMOS infrastructure which were cited 170 times. The citations were predominantly in the Marine and Antarctica chapters, but also in the Coasts, Overview, Climate and Extreme Events chapters.



Authors of the report assess various aspects of the environment and rate their status, the impact of pressures, the effectiveness of management, and the impact on our wellbeing. In the Marine chapter 21 of the 66 assessments directly used IMOS data. Those using IMOS data included the state and trends of marine habitats, communities, marine species, and ecosystem processes, and pressures on the marine environment from climate change and associated extremes.

The individual assessments and case studies have been archived on the Integrated Marine Observing System Australian Ocean Data Network.

The use of IMOS data in the State of the Environment 2021 demonstrates the value of the sustained ocean observations IMOS provides, improving our understanding of conditions, species and habitats to support management and protection of our precious marine estate. ■

IMOS highlighted at the Ocean Best Practices System (OBPS) Workshop VI



Andrew Martini, CSIRO

The OBPS Workshop engaged the ocean research and applications community in the creation and use of best practices. It draws on the experience of OBPS user groups and stakeholders, with the workshop providing a place to share experiences and an opportunity to provide feedback on how the system should evolve to better fulfill the community vision, mission, and needs.

The IMOS Principal Science Officer Paul van Ruth continued to promote IMOS best practice protocols through his role

as chair of the program committee for the OBPS Workshop. The Ocean Best Practices (OBP) repository is maintained by the International Oceanographic Data and Information Exchange (IODE) of the UNESCO-IOC as an IOC (IODE, GOOS) coordinated activity.

IMOS' efforts in establishing and endorsing national and global best practices was highlighted through a keynote in the initial plenary session and through the participation of members of the IMOS community throughout the

workshop, including the IMOS Science Officer Natalia Ribeiro, and members of the mooring and microbiome facilities. The Principal Science Officer has also been elected to the steering group of the Oceans Best Practices System (OBPS).

The workshop will produce a set of documents on community-specific and general recommendations for community service, OBPS development, and for expanded community engagement. For more information: <https://www.oceanbestpractices.org/> ■

Combined Forum for Operational Oceanography (FOO) and Australian Coastal and Oceans Modelling and Observations (ACOMO) Workshop 2022



Richard Saunders, IMOS

Over 90 scientists and managers from across industry, government and academia gathered for the combined Forum for Operational Oceanography (FOO) and Australian Coastal and Oceans Modelling and Observations (ACOMO) Workshop on 21–23 November.

The theme for the combined workshop was 'Improving Integration to Optimise Operational Outcomes'. With the goal of this meeting to stimulate debate about ways that ocean observations, and outputs from the models into which they flow, can be used to support maritime safety and security, maximise the productivity of marine industries while minimising environmental impacts, and assist in the management of biodiversity and coastal environments.

The workshop featured invited speakers, submitted abstract presentations, and finished with a panel discussion on the topic "How can we integrate existing models to develop a skilful National Scale Prediction System?"

Keynote speakers included:

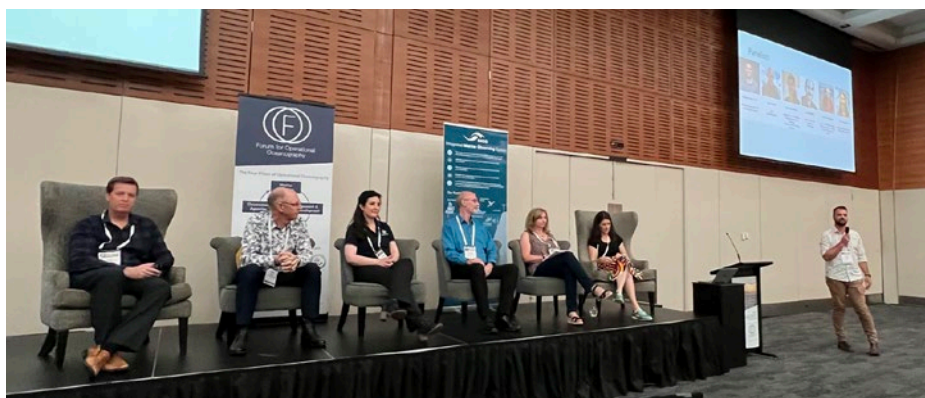
- Professor Andy Hogg, Director of ACCESS-NRI,
- David Carter, CEO of Austral Fisheries, and
- Commander Belinda Finlay, Assistant Director – Oceanography, Australian Geospatial-Intelligence Organisation.

"The 2022 combined Forum for Operational Oceanography and Australian Coastal Oceans Modelling and Observations workshop is a fundamental event in the IMOS calendar. This workshop creates opportunities to identify

observing and modelling gaps, explore new opportunities to apply modelling to assist marine operations and creates a platform for exchange and connection of research and industry communities," said IMOS Director Michelle Heupel.

The combined Forum for Operational Oceanography and the Australian Coastal and Oceans Modelling and Observations 2022 Workshop was organised by IMOS with support from the Bureau of Meteorology and CSIRO.

More information about the program can be found here: https://conferences.com.au/2022foo_acomo/program/ ■



Richard Saunders, IMOS



Christopher Trail

Institute for Marine and Antarctic Studies, University of Tasmania

PROJECT TITLE:

Lithogenic particle flux to the subantarctic Southern Ocean: A multi-tracer estimate using sediment trap samples.

Mineral dust is a key source of essential micronutrients, particularly iron, for phytoplankton in the Southern Ocean. However, observations of dust deposition over the iron limited Southern Ocean are sparse, hindering assessments of its influence on marine biogeochemistry. One way to estimate dust deposition to the ocean is from below the surface by measuring the dust (soil, or lithogenic material) content in sinking marine particles. The IMOS Southern Ocean Time Series (SOTS) Observatory has provided long-term measurements in the subantarctic Southern Ocean for two decades, including a sediment trap time series collecting sinking marine particles.

Using the 1000 m depth SOTS sediment trap, we investigated how the flux of lithogenic particles between 2010 and 2019 can be used to estimate dust deposition. This lithogenic particle flux was calculated from the iron, aluminium, titanium and thorium concentration in the sinking particles collected in the sediment trap samples. By using multiple elemental tracers in our estimation, we have higher confidence that the particles we investigated were

indeed dust. Moreover, this method indicated possible origins of this dust by comparing elemental ratios in regional dust sources and aerosols to those of particles collected by sediment traps.

Using a combination of these elemental ratios and airborne particle back trajectory analysis, we found that the lithogenic particles collected by SOTS sediment traps at 1000 m depth were likely to be from dust sources of southern Australia. An elevated concentration of lead in sediment trap samples from fossil fuel emissions was found, further indicating that particles deposited to the Southern Ocean at SOTS are atmospherically transported from mainland Australia.

The IMOS SOTS Observatory will provide key data for future work in Christopher's PhD project: *'Coupling iron and carbon biogeochemical cycles in the Southern Ocean south of Australia'*. Both the sediment trap time series and the combined Southern Ocean Flux Study (SOFS) - PULSE biogeochemistry mooring at SOTS will be used to investigate the influence that micronutrients like iron have on biological productivity, and subsequently carbon sequestration. ■

1 Select a Data Collection

2 Create a Subset

3 Download

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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NCRIS
National Research
Infrastructure for Australia
An Australian Government Initiative

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