



Integrated **Marine**
Observing System



2023–2024 HIGHLIGHTS

Enabling research that delivers benefits across
Australian society, its environment, and its economy.

Director's Overview

As our oceans continue to change at unprecedented rates, the data collected by Australia's Integrated Marine Observing System (IMOS) is increasingly important in helping understand the state and trends in our environment. In 2023–24 IMOS continued to deliver high-quality data to support the science and decision-making needed to understand and address ocean change within and beyond Australia.



Based on our ongoing success, a range of changes are occurring within IMOS as we continue to grow and evolve. Several new Facilities were added to the program in 2023–24 based on increased funding for step-change investments in Environment and Climate research infrastructure. In addition, IMOS led a collaborative initiative to design a stakeholder-driven coastal research infrastructure for Australia. If funded, this program will create a step-change in our understanding of climate-driven coastal change. We have also continued our journey to increase Indigenous engagement and partnership in IMOS.

IMOS continues to be seen as a world-leader with the Australian Ocean Data Network (AODN) landing major achievements and recognition this year, including being accredited as a National Oceanographic Data

Centre by the Intergovernmental Oceanographic Commission. The AODN also completed the build of the first of its kind Data Management System for the Great Barrier Reef.

IMOS observations have continued to contribute to critical national and international initiatives such as the State of Global Climate Report, the Surface Ocean CO₂ Atlas (SOCAT) and more. IMOS has demonstrated the power and value of collaboration and coordination through the outputs of the expanded Queensland Acoustic Tracking infrastructure and analyses of microbiome communities which leverage both an IMOS partnership with Bioplatforms Australia, but also integrate multiple data sets to create outcomes. These initiatives show the power of sharing and contributing observations to create more cohesive outcomes.

As a program IMOS continues to dive deeper into our oceans. Our ocean glider fleet has covered hundreds of kilometres of ocean, tagged seals in Antarctica are helping improve bathymetric maps of the region, and new deep Argo floats are increasing our ability to monitor deep ocean conditions. These are just some of the many advances IMOS has delivered, facilitated, or supported in 2023–24.

As we near the 20-year anniversary of IMOS, it is increasingly clear that this program serves a wide range of users and needs. This is only possible through the dedicated commitment of IMOS partners, collaborators, and community members. Thank you for your continued contributions, effort and energy, we couldn't do it without you.

Michelle Heupel
IMOS Executive Director

Around the Campfire

Designer: Tarquin Singleton, Yirrganydji

This 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.

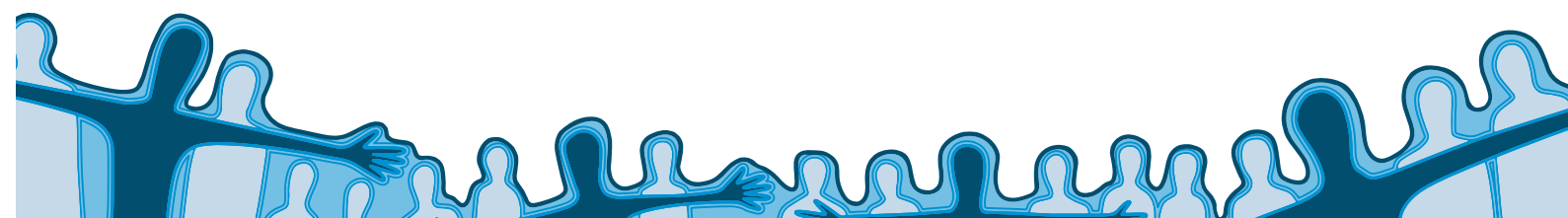
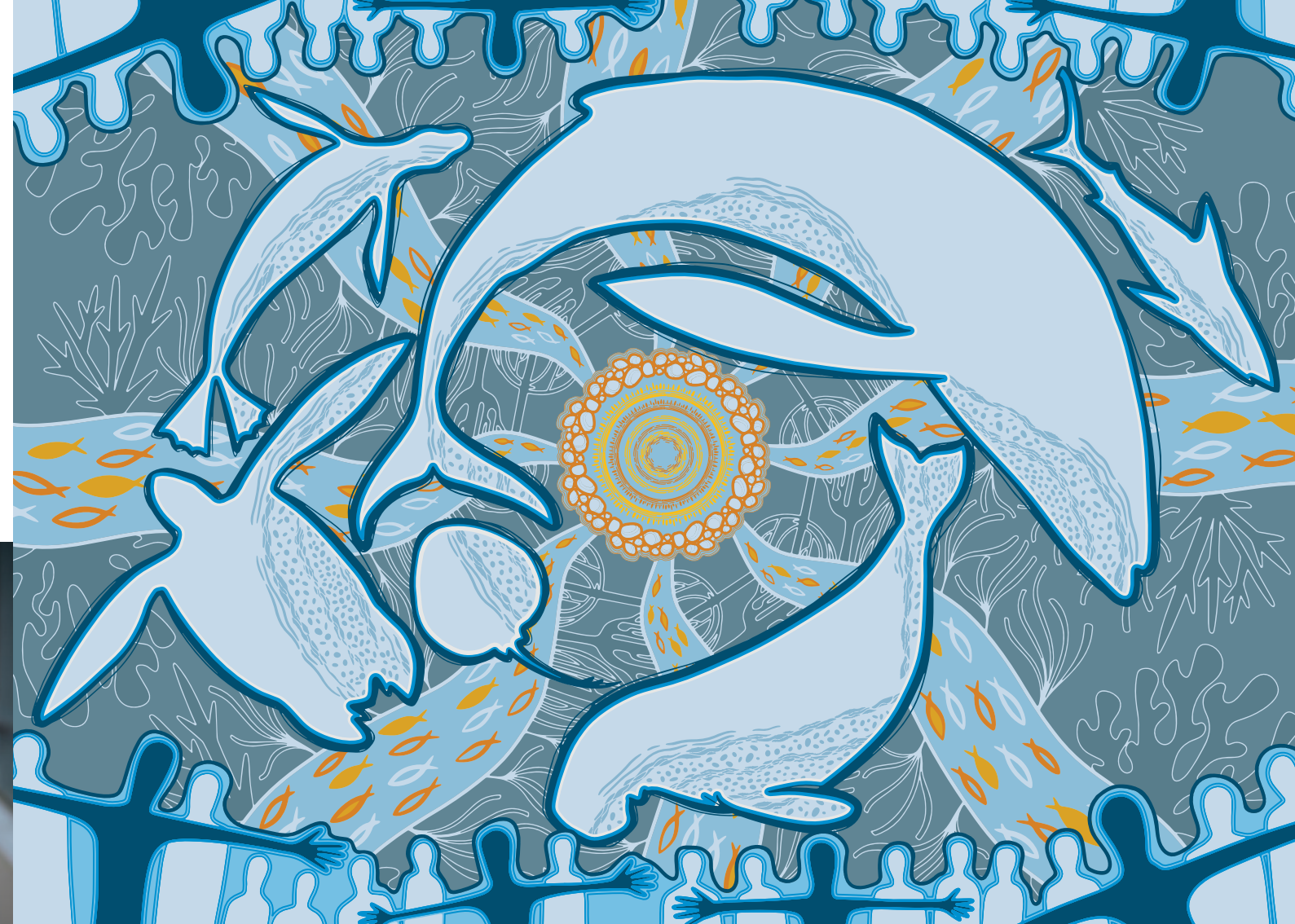
The dark figures symbolise the holders of wisdom – our leaders and educators. They pass their knowledge to the lighter figures, representing the next generation, through storytelling, dance, art, and demonstration.

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 IMOS, 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.



IMOS HIGHLIGHTS 2023–2024

Ocean Gliders travel over 216,726 km

The IMOS Ocean Glider fleet has completed 384 glider missions to monitor Australia's coastal waters, measuring shelf and boundary currents and providing real-time monitoring of marine heatwaves as they develop. The IMOS ocean gliders have now covered over 216,726 km – equivalent to five trips around the equator!

Marine heatwaves are significantly impacting microorganisms

Recent research has demonstrated that marine heatwaves are altering the microorganism communities that form the base of the marine food chain, disrupting coastal ecosystems. The research used data from the Australian Microbiome Initiative, a long-term effort to observe marine microbiota that IMOS operates in partnership with Bioplatforms Australia.

Diving further with Deep Argo Floats

IMOS is expanding our Argo fleet to include floats that can reliably measure temperature and salinity to depths of 6 km; 4 km deeper than regular Argo floats. Deep Argo floats will deliver crucial measurements for tracking changes in ocean heat content, salinity, sea level rise, and deep ocean circulation to assess the consequences for climate change and sea-level rise.

State of Global Climate report confirms that 2023 was the hottest year on record

Records were broken for greenhouse gas levels, surface temperatures, ocean heat and acidification, sea level rise, Antarctic Sea ice cover and glacier retreat. IMOS provides essential ocean observations to help understand the state, trends and future conditions of the oceans. The World Meteorological Organization State of the Global Climate report cites publications that use data from a number of IMOS Facilities, including Argo Floats, Expendable Bathythermographs, Biogeochemical and Sea Surface Temperature Sensors on Ships of Opportunity, Moorings, Acidification moorings, and Satellite Remote Sensing products.

Seal dive data improves Antarctic bathymetry

Analysis of seal dive data (including seals tagged by IMOS) has improved the bathymetry of 22-60% of the sampled area on the East Antarctic continental shelf. Given bathymetry influences warm Circumpolar Deep Water movement onto the shelf, it is an important driver of ice shelf melt and influences the flow of ice shelves into the ocean. Data from seal dives is improving our understanding of the oceanographic processes and ice-sheet dynamics that define Antarctica's role in the global climate.

Amplified seasonal CO₂ cycle in the Southern Ocean

Using data from the IMOS Southern Ocean Time Series moorings over the last decade, scientists have directly measured an increase in the magnitude of the ocean's seasonal cycle of carbon dioxide for the first time. The sustained observations IMOS collects are crucial for untangling the processes behind changes in CO₂ seasonality and evolution of the Southern Ocean carbon sink.

Data Management System for Great Barrier Reef decision makers

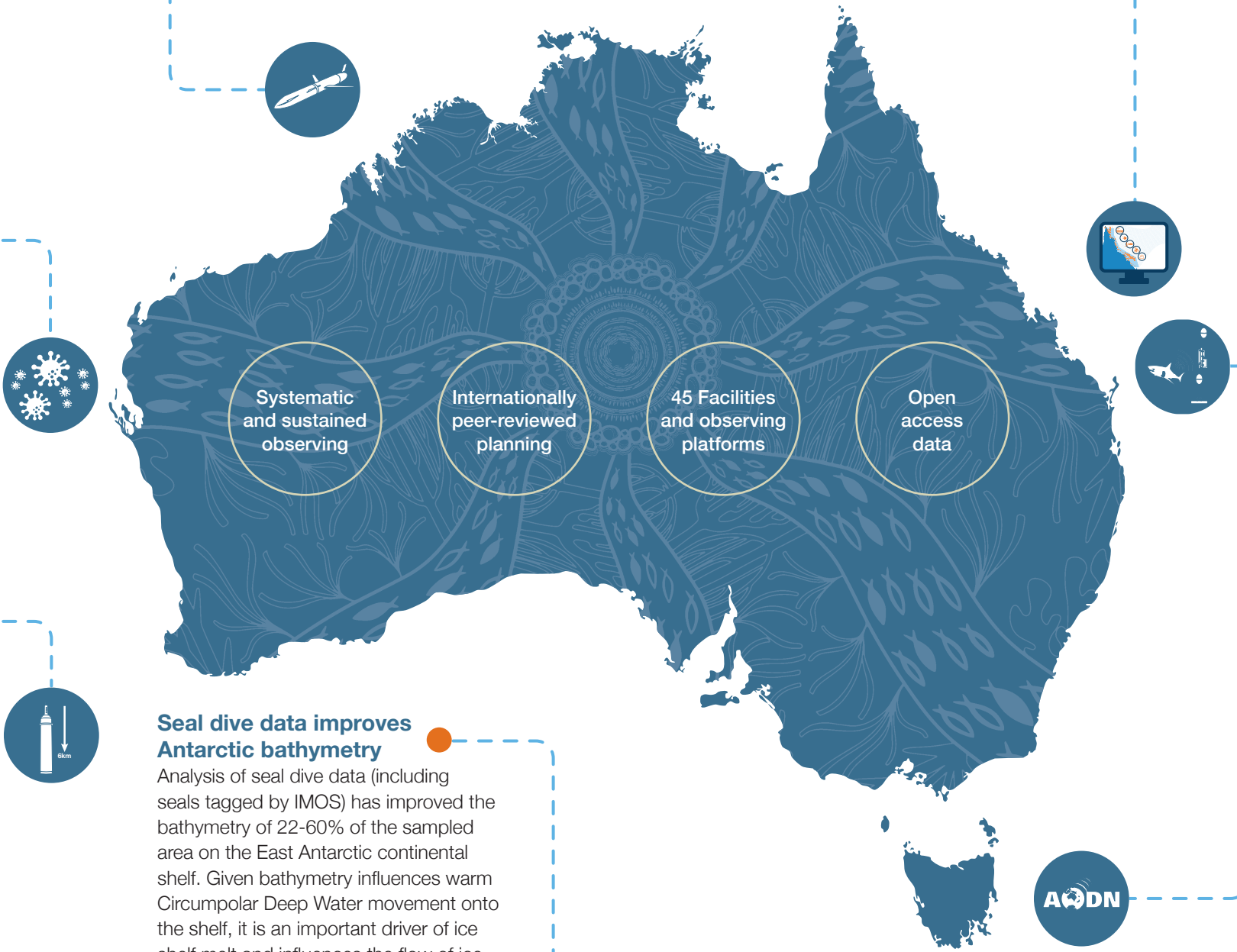
IMOS has delivered a Data Management System (DMS) for the Reef 2050 Integrated Monitoring and Reporting Program (RIMReP). The DMS has documented 329 different datasets and processed 177 high priority data assets, to create a single source for critical data to allow analysts and decision-makers to streamline analytical workflows and improve decision-making timelines.

Enhanced Queensland animal tracking coverage drives collaborative momentum

A recent study details how expanded IMOS acoustic tracking coverage in Queensland catalysed collaboration of a diverse group of stakeholders to collect data on large-scale movements of marine species in the northeast extent of the national array. The array is building a community while uncovering a range of previously unknown movements that will assist in addressing ecological, fisheries, and conservation questions for multiple species.

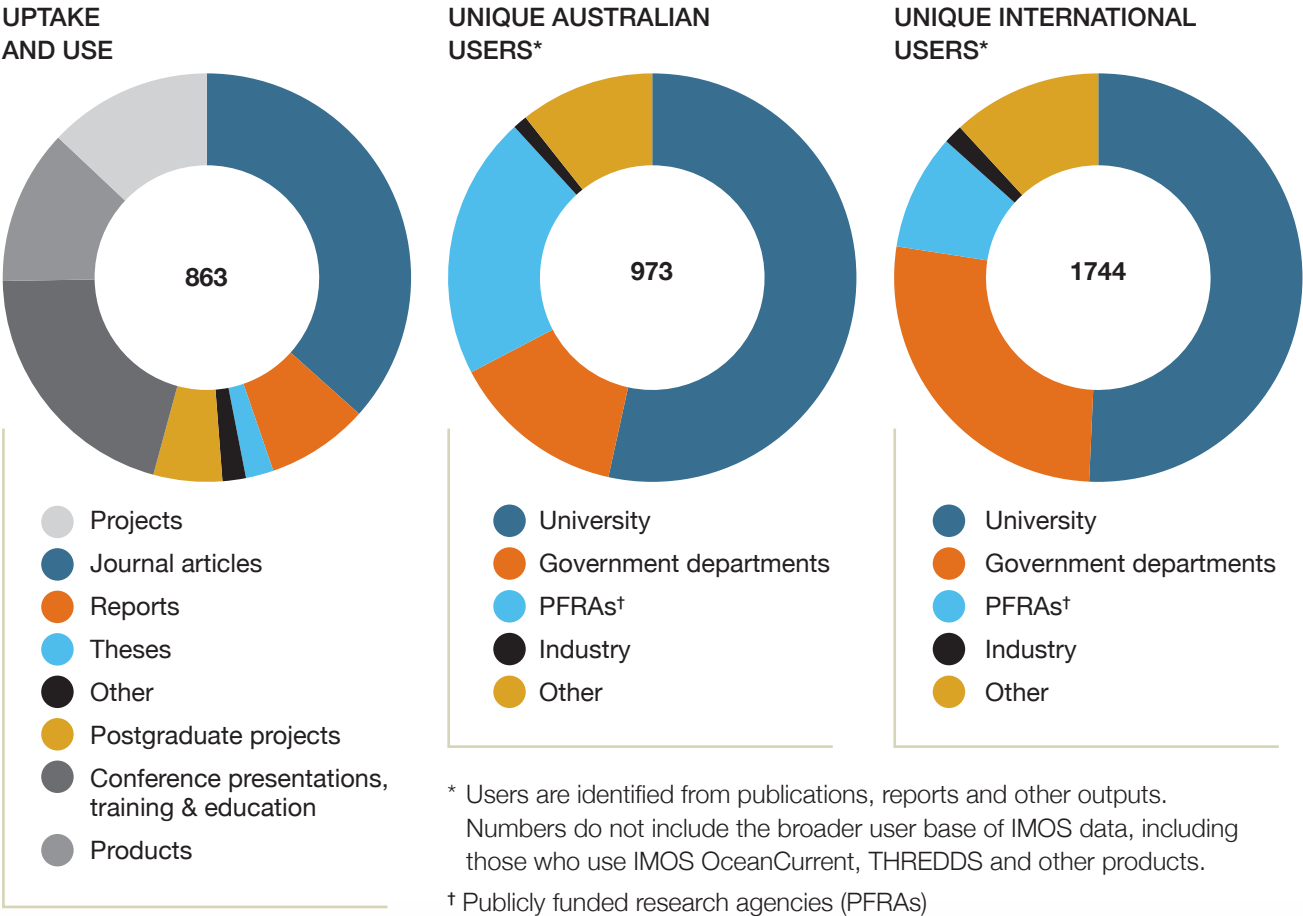
AODN accredited as a National Oceanographic Data Centre

The UNESCO International Oceanographic Data and Information Exchange (IODE) programme of the Intergovernmental Oceanographic Commission (IOC) maintains a global network of National Oceanographic Data Centres (NODC) responsible for the collection, quality control, archive, and online publication of millions of ocean and marine observations. The IMOS AODN received accreditation as an NODC, recognising the team for providing access and stewardship for a national resource of oceanographic data.



Use and Users of IMOS Data

The core uptake and use of IMOS data is measured in terms of numbers of journal articles, reports, theses, research projects, postgraduate student projects, products, and conference presentations, training, and education. Use and user data are provided below for the 2023–24 financial year. All uses are fully listed in the IMOS Impact Database.



Financial Summary

A summary of the IMOS finance for the 2023–24 financial year:

FINANCIAL OVERVIEW	2023–2024	2022–2023
Capital	6,351,817	2,692,768
Personnel	13,554,644	14,067,975
Other	6,904,855	6,767,469
Expenditure relating to NCRIS Funds	26,811,316	23,528,212
Cash Co-investments	1,918,838	3,111,820
In-Kind Co-investments	31,353,626	30,229,749
Total – Resources utilised	60,083,779	56,869,781
Full-time equivalent staff numbers	FTE 2023-24	FTE 2022-23
NCRIS Funded	90.91	102.53
Co-investment funded	22.41	32.86
Total FTE Staff	113.32	135.39

CoastRI – Research Infrastructure Connecting Land and Sea

Over 50% of Australians live within 7 km of the coast, demonstrating our strong reliance on coastal areas for our lifestyle, culture, and livelihoods.

Climate change is altering our coastline at unprecedented rates, with sea level rise, coastal erosion, inundation and weather changes compounding the habitat loss and ecosystem damage already experienced due to human activities.

Information is urgently needed to inform coastal planning and decision-making over a range of scales. Yet, investments

and research to ensure coastal sustainability and health remain fragmented and/or inadequate.

During the past year IMOS led consultation with research users, federal, state, and local governments, industry operators, and First Nations representatives to identify gaps and needs to define the potential role for National Research Infrastructure to inform approaches and solve

problems related to coastal change. Based on this information IMOS is leading a consortium of 13 NCRIS capabilities to design a coastal research infrastructure (CoastRI).

The objective of CoastRI is to gather comprehensive and integrated scientific data from diverse sources, enabling us to better understand, predict, and address the opportunities and imminent risks facing Australia’s coast for all peoples. The NCRIS CoastRI is designed to address coastal information needs and create a step change advance for how Australia understands and manages our coastal zone.

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. www.imos.org.au

PRINCIPAL PARTICIPANTS



SIMS is a partnership involving four universities.

ASSOCIATE PARTICIPANTS



IMOS thanks the many other organisations who partner with us, providing co-investment, funding and operational support, including investment from the Tasmanian, Western Australian and Queensland State Governments.

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.

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

PARTNERS

CO-INVESTORS AND OPERATIONAL PARTNERS • Australian Antarctic Program Partnership • Austral Fisheries • Australian Longline • Australian Museum • Australian Wildcatch Fishing • BHP Billiton • Defence Science and Technology Group • Department of Agriculture and Fisheries, Qld • Department of Climate Change, Energy, the Environment and Water, Reef Trust • Department of Defence • Department of Environment, Science and Innovation, Qld • Department of Fisheries, WA • Department of Jobs, Tourism, Science and Innovation, WA • Department of Climate Change, Energy, the Environment and Water, NSW • Department of Primary Industries and Regional Development, NSW • Department of Primary Industries and Regional Development, WA • Department of Regional NSW • Department of State Growth, Tas • Department of Transport, WA • Environmental Protection Authority, SA • Environmental Protection Authority, Victoria • Flinders University • Geoscience Australia • Great Barrier Reef Foundation • Greybits Engineering • Griffith University • James Cook University • Macquarie University • Manly Hydraulics Laboratory • Marine National Facility • Minderoo Foundation • Monash University • Murdoch University • Oceanographic Field Services Pty Ltd • OMC International • Parks Australia • Parks Victoria • Pilbara Ports Authority • Queensland Museum • Reef Life Survey • Research Attraction and Acceleration Program, NSW • Royal Australian Navy • RPS MetOcean Pty Ltd • South Australia Water • Sydney Water Corporation • TT Line • University of New South Wales • University of Queensland • University of the Sunshine Coast • University of Sydney • University of Technology Sydney • Voyager Seafoods • Woodside Petroleum Pty Ltd • **INTERNATIONAL COLLABORATORS** • Centre National de la Recherche Scientifique, France • European Space Agency • First Institute of Oceanography, China • French Polar Institute • Hokkaido University, Japan • Institut Polaire Français Paul-Emile Victor, France • LOCEAN, France • MetService, New Zealand • National Aeronautics and Space Administration, USA • National Centre for Space Studies (CNES), France • National Institute of Water and Atmospheric Research, New Zealand • National Oceanic and Atmospheric Administration, USA • National Science Foundation, USA • Natural Environment Research Council, UK • Ocean Data Network • Ocean Tracking Network • Scripps Institution of Oceanography, USA • Sealord, New Zealand • Shanghai Ocean University, China • Sofar Ocean Technologies • Southern Ocean Observing System • St Andrews University • Stockholm University, Sweden • TOSCA Dumont d'Urville expedition, France • Woods Hole Oceanographic Institution, USA

RESEARCH PARTNERSHIPS AND COLLABORATORS • Australia's Academic and Research Network (AARNET) • Australian Fisheries Management Authority • Australian Research Data Commons (ARDC) • ARC Centre of Excellence for Climate Extremes • ARC Centre of Excellence for Climate System Science • ARC Centre of Excellence for Coral Reef Studies • Atlas of Living Australia • Biopixel Oceans Foundation • Bioplatforms Australia • Blue Economy Cooperative Research Centre • Bluelink Ocean Forecasting • Charles Darwin University • CSIRO Centre for Southern Ocean Hemisphere Oceans Research • Department of Climate Change, Energy, the Environment and Water • eReefs • Fisheries Research and Development Corporation • Fishwell Consulting • Global Ocean Observing System • Great Barrier Reef Marine Park Authority • National Environmental Science Programme Marine and Coastal Hub • Ningaloo Research Program • Queensland Department of Agriculture and Fisheries (QDAF) Fish Aggregation Devices Program • QDAF Shark Control Program • Reef and Rainforest Research Centre • Reef 2050 Integrated Monitoring and Reporting Program (RIMReP) • Tasmanian Partnership for Advanced Computing (TPAC) • Terrestrial Ecosystem Research Network • Western Australian Marine Science Institution (WAMSI) • Various ARC-funded Projects