CSIRO

Marine
National Facility

Marine National Facility

Year in Review 2022–23

Operated by CSIRO,
Australia's National Science Agency,
on behalf of the nation

Citation

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Important disclaimer

Acknowledgements

The Marine National Facility (MNF) is funded by the Australian Government's National Collaborative Research Infrastructure Strategy (NCRIS), and operated by CSIRO, Australia's national science agency, on behalf of the nation.

CSIRO acknowledges the Traditional Owners of the land, sea and waters of the area that we live and work across Australia. We acknowledge their continuing connection to their culture and we pay our respects to their Elders past and present.

NCRIS
National Research Infrastructure for Australia
An Australian Government Initiative

This research is enabled by NCRIS.

SCIENCE AND INDUSTRY ENDOWMENT FUND

This research is supported by the Science and Industry Endowment Fund.

Cover: Fatigue test float on the RV *Investigator* (Image: Margot Hind) and Dr Julie Janssens collects water sample from CTD instrument (Image: Benjamin Healley, Museums Victoria)

Contents

Image: Rohan Newton

About the MNF

The Marine National Facility (MNF) is Australia's dedicated blue water research capability, enabling world-class marine and atmospheric research across our vast marine estate. Funded by the Australian Government through the National Collaborative Research Infrastructure Strategy (NCRIS), it is operated by CSIRO, Australia's national science agency, on behalf of the nation. The MNF is overseen by an independent Steering Committee and includes the advanced ocean-class research vessel (RV) *Investigator*, a suite of scientific equipment, technical staff and expertise, and more than 40 years of freely available marine data.

RV *Investigator* caters to the diverse and multidisciplinary research needs of Australian marine researchers and their international collaborators. It provides the capability for a broad range of oceanographic, biological, atmospheric and geophysical research. In addition, the vessel provides a vital catalyst for maritime education, outreach and training.

RV *Investigator* is funded for full year operations and can accommodate a research team of 40 participants, stay at sea for 60 days, and cover 10,000 nautical miles per voyage. The vessel can operate anywhere from the Antarctic ice edge to the tropics. With the delivery in 2020 of the 10-year strategy, MNF 2030, the MNF is fulfilling its mission to facilitate safe, efficient and excellent marine and atmospheric research that is aligned with national priorities and addresses challenges facing Australia's society, economy and environment.

Image: CSIRO

From the Chairperson

It's been another busy year for the MNF, with the team, our RV *Investigator* crew, and our partners delivering 10 voyages that enabled an incredible range of geospatial, atmospheric, oceanographic and biodiversity research that will benefit Australia into the future. Additionally, during the 2022–23 schedule, the team successfully installed, commissioned, and trialled a range of new research capabilities, including a new satellite system which dramatically increased the volume of data we can send from the ship to shore in real time. Not only does this new system provide participants and crew greater access to colleagues while at sea, we're pleased it also supports their wellbeing by improving connection to family and friends when they're offshore.

The year didn't come without its challenges, and I would like to recognise the dedication of our team and partners in supporting voyage participants who experienced health issues during several voyages throughout the year. I'm proud that our evacuation and emergency procedures, when tested, stood up well. These instances showcased our values of putting the health, safety and wellbeing of people first.

The MNF Steering Committee (MNF SC) and its two assessment committees, the Research Advisory Committee (RAC) and the National Benefit Advisory Committee (NBAC), also had a productive 2022–23 period. There were some movements across our committees, with NBAC welcoming a new Chair, Peter Cochrane, for a period of three years from January 2023. We welcomed new NBAC members Dr Lyn Goldsworthy, Emily Jateff, Rhys Arangio and Dr Chels Marshall.

Three new members joined RAC, with Associate Professor Jochen Kaempf and Associate Professor Patti Virtue endorsed to support the review of applications for grants of sea-time in 2025–26. Dr Eric Raes was also endorsed as a provisional member of RAC.

We thanked Drew Clarke AO PSM and acknowledged his contribution while performing the CSIRO Board Observer role on the MNF SC and welcomed Dr Michele Allan AO as his replacement.

In closing, I would like to recognise the commitment of the MNF staff. Their work to manage the operations of a research vessel during a challenging operating environment has been outstanding. Our collective achievements reflect the ongoing commitment they have to the safe and successful delivery of marine and atmospheric capability for all of our stakeholders.

Dr Sue Barrell
Chairperson, MNF Steering Committee

From the Director

The past year has showcased the dedication of our team and our partners to delivering amazing research at sea. Whether it be the discovery of new species on biodiversity voyages, the confirmation of the wreck of the MV *Blythe Star,* or the collation of vital climate and atmospheric data on board RV *Investigator,* we've collectively delivered some incredible results.

Despite these successes, 2022–23 delivered some challenges we are working through to ensure we can continue to deliver world-class research voyages. The operating environment is constantly changing, and we have seen increases in the cost of freight, staff, equipment and fuel. We will work through these challenges and remain committed to collaborating closely with our partners, clients and community in the delivery of safe and successful research voyages to maximise the benefit from our national blue-water research capability.

Reflecting our commitment to safety, 2022–23 provided the opportunity to appraise our safety systems and to work with our team and crew to maintain and enhance capabilities of both the vessel and our people. In particular, we were pleased to deliver new initiatives including the introduction of a health and wellbeing support cabin trial to better manage fatigue and psychosocial safety at-sea; installation of air purifiers throughout all cabins and communal spaces onboard RV *Investigator;* and a regular emergency response scenario drill program that has enhanced the safety, health and wellbeing of voyage participants.

During the past year, we also undertook a major project, the Request for Tender for our Ship Management Services contract. Through this, we appointed a new ship manager, MMA Offshore Limited, who will commence the management of RV *Investigator* in late 2023.

We would like to acknowledge and thank ASP Ship Management for their 10-year partnership with CSIRO in delivering excellent marine research to benefit the nation, which included commissioning and bringing RV *Investigator* into service.

We continued to proudly showcase the value and impact of our work with the Australian community by sharing the amazing stories of our research, some of which are covered in this Year in Review. Additionally, we had the opportunity to collaborate with the Royal Australian Mint and Australia Post to showcase the MNF's vessel, equipment and capability by producing the 'Creatures of the Deep' coin. That was a real highlight!

Finally, I would like to thank our people, crew and collaborators, including our national and international research partners, and of course all of our CSIRO team, for a fantastic year of achievements outlined in this MNF Year in Review. I would like to extend my gratitude to the marine research community for their ongoing support of our facility.

Toni Moate PSM FCPA GAICD
Director, Marine National Facility

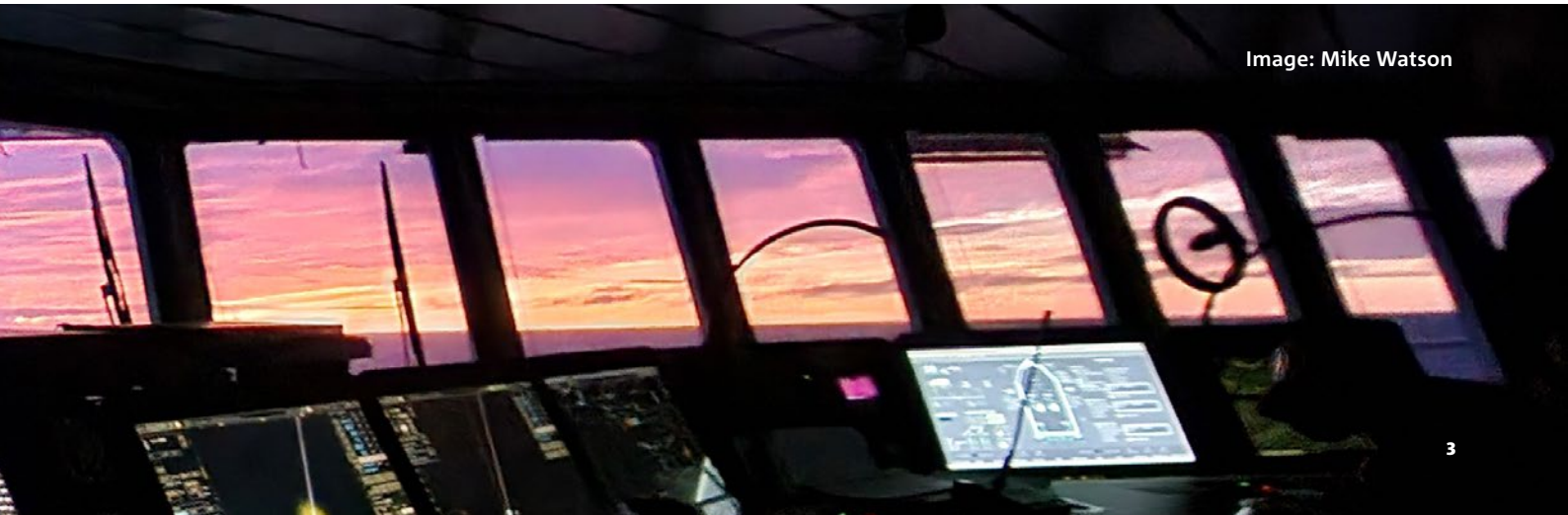


Image: Mike Watson

2022–23 snapshot

34,785.21
nautical miles travelled

298 (98%)
operational days
% target delivered

384,005
km² area mapped

55.99
terrabytes of data collected

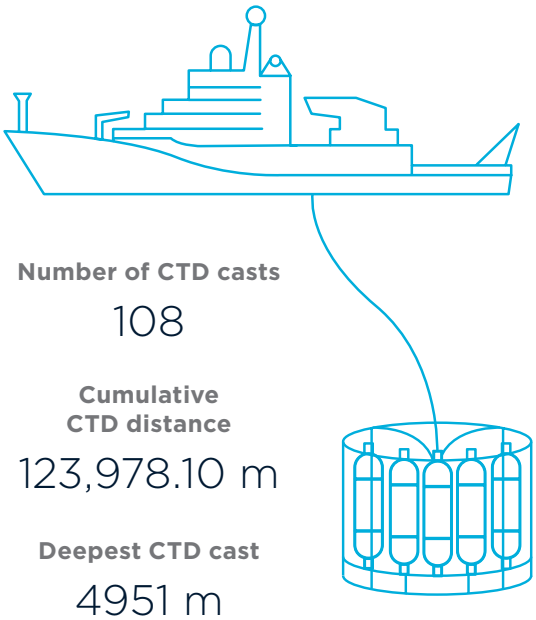
23 participating students

247 participating researchers

72 journal articles
with publication date within the financial year

8 datasets (external sites)

111 datasets hosted by MNF Information and Data Centre



Number of CTD casts
108

Cumulative CTD distance
123,978.10 m

Deepest CTD cast
4951 m
IN2022_V08 at -11.65°, 103.98°
on 7 Oct 2022

Image: Tauri Minogue

Image: Frederique Olivier

Research delivered and supported

The 2022–23 financial year was marked by many achievements. Across our voyages, we brought together Australian and international research collaborations to advance priority research areas identified in our MNF 2030 strategy.

A number of important sea floor mapping projects were undertaken within Australian marine parks. Researchers on board RV *Investigator* not only completed a world-first survey of biodiversity in the newly-established Cocos (Keeling) Islands Marine Park, they put more of our vast marine estate on the map delivering the first detailed seafloor map of this new marine park. Mapping and biodiversity surveys like this, and others completed in 2022–23 like the Gascoyne Marine Park and Carnarvon Canyon Marine Park, highlight the value and benefit of the MNF and this data stream in supporting marine park managers.

In February 2023, the MNF opened the 2025–26 Primary Application Call which invited Australian research institutions and their collaborators to apply for fully funded grants of sea time on RV *Investigator* to conduct excellent research of national benefit. The outcomes of this Application Call will be announced in early 2024.

To enhance RV *Investigator's* research capability, we also implemented a number of new improvements. These included increasing our Deep Towed Camera's imagery depth capability from 2500 metres to 3900 metres; deploying our DeepBRUVS system to enable scientists to explore the composition, distribution and extent of deep water fish and invertebrate species; expanding our atmospheric research remote sensing systems to include a micro-rain radar; and developing a deep sea power and fibre optic instrumentation interface to improve imaging, oceanographic, and bio-optic sensors.

Map of 2022–23 voyages

Voyages delivered

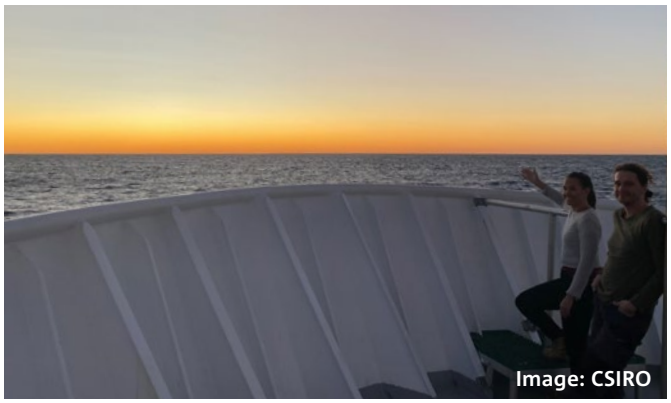


Image: CSIRO

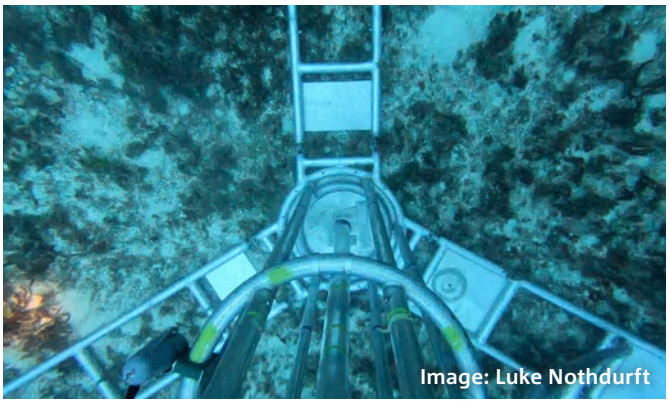


Image: Luke Nothdurft

July 2022

IN2022_V06 Sustained monitoring of the EAC: mass, heat and freshwater transports [Brisbane to Brisbane]

Led by CSIRO, a team of 25 science participants from four institutions embarked on this 16-day research voyage to the East Australian Current (EAC), off Brisbane, to recover a long-term deep-water mooring array used for monitoring of ocean and climate. The monitoring of the EAC is a component of the Integrated Marine Observing System and has contributed to our understanding of the relationship between global ocean and climate variability.

Through CSIRO's Indigenous Time at Sea Scholarship, two Indigenous university students participated in this voyage to gain experience and training in at-sea research operations.

August 2022

IN2022_V07 Halimeda bioherm origins, function and fate in the northern Great Barrier Reef [Brisbane to Cairns]

This research voyage, led by the University of Sydney, saw scientists travel to the Great Barrier Reef to investigate and map the origin, development and distribution of *Halimeda* bioherms – ancient donut-shaped deep-water reefs. *Halimeda* (a genus of green calcareous macroalgae) bioherms on the northern Great Barrier Reef shelf are the most extensive, actively accumulating *Halimeda* deposits in the world, contributing outstanding universal value from a geological and geomorphological perspective. However, little is known about the fundamental processes that control *Halimeda* bioherm distribution and development, so the team on board conducted a detailed study of *Halimeda* bioherms' role as key inter-reef habitats and carbon sinks.

The voyage science team represented 10 institutions, including six Australian universities, Geoscience Australia, the University of Tokyo and the University of Granada (Spain).

Image: Benjamin Healley, Museums Victoria

Image: Frederique Olivier

September 2022

IN2022_V08 Biodiversity assessment of Australia's Indian Ocean Territories (IOT) – Voyage II [Darwin to Fremantle]

Led by Museums Victoria Research Institute, this voyage saw 32 science participants from seven Australian and international institutions travel to the Cocos (Keeling) Islands to complete a marine biodiversity survey of our Indian Ocean Territories (IOT). These islands, along with Christmas Island, form Australia's newest marine parks.

This project, which commenced on voyage IN2021_V04 in 2021, completes a world-first investigation of the marine biodiversity of the massive underwater mountains, known as seamounts, that make up these islands. These seamounts are mostly of late Cretaceous age (65–80 million years ago) and may harbour ancient endemic communities. Marine habitats on seamounts are also easily damaged by human activities and this voyage gathered important data for their conservation and management.

Throughout this voyage, the team from Bush Blitz also delivered an outreach program which connected 27 Australian and Cocos (Keeling) Islands schools and organisations with the research being conducted on board.

November 2022

IN2022_V09 Surveying seabed habitats and biodiversity in the Gascoyne Marine Park [Fremantle to Fremantle]

Researchers from four institutions spent 31 days surveying seabed habitats and biodiversity in the Gascoyne Marine Park, off Western Australia, which stretches from depths of less than 100 m to more than 5000 m.

Led by CSIRO, this voyage provided vital data to assist marine park manager, Parks Australia, in maintaining the natural values of the Gascoyne Marine Park, and Carnarvon Canyon Marine Park which was also surveyed.

The Gascoyne region was identified for protection as an area of national significance with a new marine park proclaimed in 2013. It lies in a region with great but poorly known biological diversity and potential for economic development and we are proud this voyage was able to support the first scientific baseline marine survey of the Gascoyne Marine Park.

January 2023

IN2023_V01 Antarctic Bottom Water production in the past: Records from marine sediments, East Antarctica [Fremantle to Hobart]

Image: Sienna Blanckensee

Led by Geoscience Australia, 35 scientists from nine institutions travelled to the East Antarctic margin with the goal of investigating and understanding past changes in Antarctic Bottom Water production to help predict how a warming climate will impact future ocean circulation.

Due to a participant becoming unwell and requiring advanced medical treatment that was not available on-board RV *Investigator,* the voyage returned to Australia early and therefore researchers could not complete all intended science objectives. However, during their time at sea, researchers were able to collect sediment cores and conduct seafloor mapping that will advance our understanding of Antarctic Bottom Water production now and in the past.

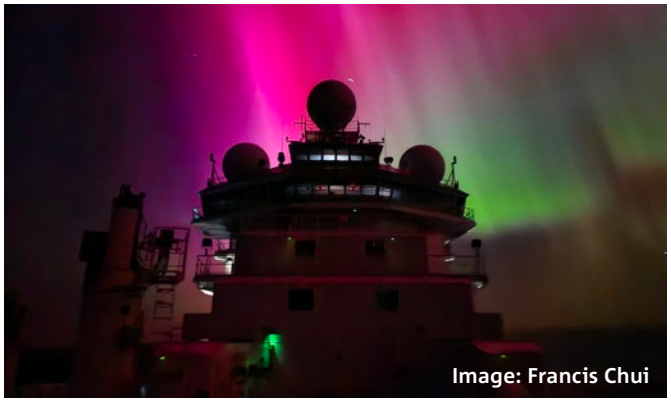


Image: Francis Chui

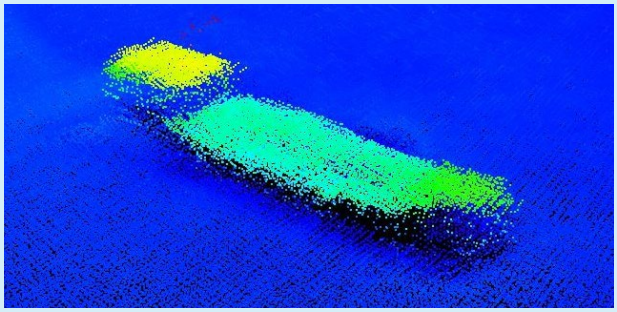
March 2023

IN2023_V02 Gigantic submarine landslide offshore western Tasmania [Hobart to Hobart]

Scientists travelled to the west coast of Tasmania to investigate a gigantic submarine (underwater) landslide on the continental shelf. Led by the University of Tasmania, the team surveyed the surface and sub-surface of failed and unfailed gigantic submarine (underwater) landslide deposits to understand how, when and why this underwater landslide happened.

These data will be used to identify if such an event could occur nearby or in other places on the Australian shelf and establish hazard mitigation maps for Australia. This research will also help in risk assessment and mitigation for shelf-derived tsunami that could impact Australian coastal communities.

Image: Queen Victoria Museum via AUCHD



Locating the MV *Blythe Star*

The 44-metre MV *Blythe Star* was a coastal freighter that disappeared off Tasmania nearly 50 years ago. The vessel was travelling from Hobart to King Island when, on 13 October 1973, it suddenly capsized and sank off the southwest coast of Tasmania. All 10 crew members were able to escape the sinking vessel into an inflatable life raft. Tragically, three crew members died before the survivors were able to find help and be rescued 12 days later on 24 October 1973.

The disappearance of the MV *Blythe Star* sparked the largest maritime search ever conducted in Australia to that time. No trace of the vessel was ever found by the searchers.

In April 2023, a University of Tasmania-led voyage included a piggyback project to investigate an unidentified shipwreck, which had been pinpointed by fishing vessels and previous seafloor surveys in the region. Piggyback projects use resources already allocated to a voyage to collect additional useful or important data for national benefit.

The investigation, which was led by CSIRO, included systematic mapping of the unidentified shipwreck using multibeam echosounders and then a visual inspection using two underwater camera systems. The mapping data and video imagery collected was able to confirm that the shipwreck was the MV *Blythe Star,* ending the 50-year mystery.

CSIRO and our partners were pleased to be able to assist in providing closure and to confirm the final resting place of the MV *Blythe Star* for the last remaining crew member, and families and descendants of the crew.

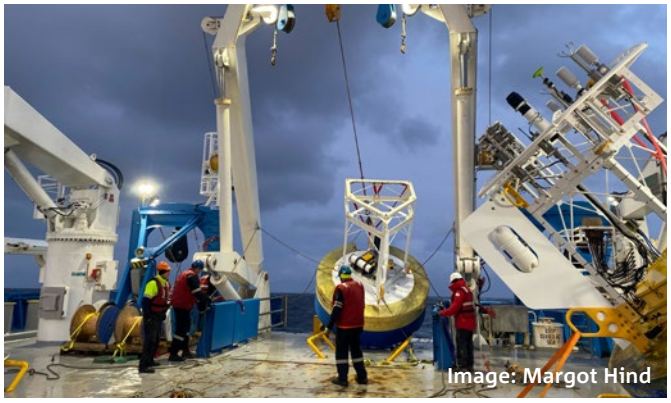


Image: Margot Hind

Image: Julie Janssens

May 2023

IN2023_V03 Maintaining automated moorings for long-term monitoring of the Southern Ocean [Hobart to Hobart]

The Southern Ocean Time Series (SOTS) moorings provide year-long observations in a critical part of the Southern Ocean, where ocean interactions are most intense and least studied. This information is vital for informing ocean and climate modelling. This RV *Investigator* voyage, led by CSIRO and supported by 29 science participants across six institutions, saw the recovery and deployment of SOTS moorings which contribute to global data sets and support an increased understanding of Southern Ocean characteristics, variability and processes.

SOTS is part of the Integrated Marine Observing System, and is a global monitoring program to collect long time-series ocean data to better understand ocean and climate change and variability.

June 2023

IN2023_V04 International Nutrient Inter-comparison Voyage [Hobart to Hobart]

In a world-first, the International Nutrient Inter-comparison Voyage to the Southern Ocean, brought together global ocean chemistry laboratories to study ocean nutrients. The voyage aimed to minimise differences and enhance comparability of nutrients datasets between global laboratories through in-depth investigation of the knowledge, methodologies, techniques, and instrumentation used in each laboratory.

The voyage included 33 science participants from 14 institutions from 12 countries (Australia, Japan, China, South Korea, United States, United Kingdom, Canada, Brazil, Argentina, Spain, Netherlands and France). This included two junior researchers from developing countries funded by the Partnership for Observation of the Global Ocean.

During the voyage the team led an International Nutrient Workshop which included seven live broadcasts from aboard RV *Investigator* with live demonstrations and research presentations from the experts on board. The data collected during this voyage will lead to improvements in ocean nutrient data collected by our international partners.

Image: Rowan Tribelco

June 2023

IN2023_V05 South-East Australian Marine Ecosystem Survey

A team of 33 scientists from three institutions conducted a repeat survey of the biodiversity and habitats of the marine waters of southeast Australia. These waters are a global ocean-warming hotspot. In this region, the ocean surface is warming at a rate four times the global average and many species have extended their distributions southward, with apparent changes in local abundance. Projections show that these changes will continue for the next century.

Fishery and ecosystem assessments were last conducted in this region 25 years ago. This voyage, led by CSIRO, repeated the surveys to document changes and establish a new biological and environmental baseline. The knowledge generated will be essential for better planning and managing current and emerging industries, and will support protection of important habitats and species in the region.

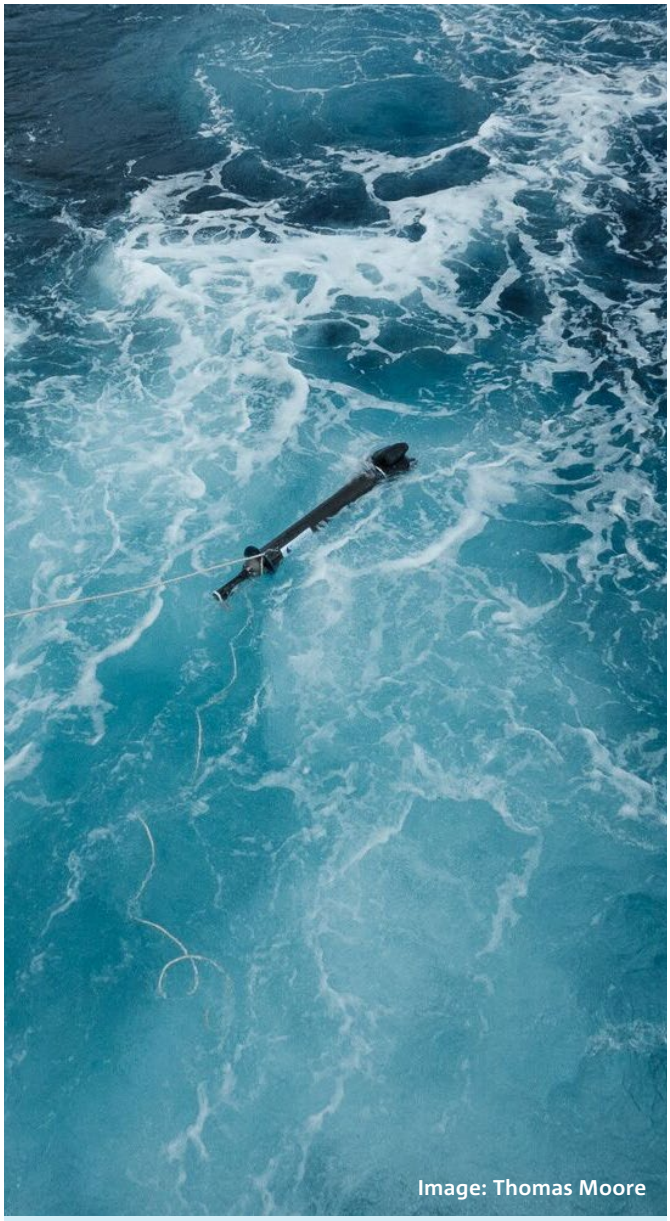


Image: Thomas Moore

Argo float data helping scientists better-understand climate change

Argo floats collect information from the ocean using a fleet of sensors. These robotic instruments drift with the ocean currents and move up and down between the surface and 2000 metres deep. They help researchers understand and assess ocean temperatures, the water cycle and sea level rise. Argo floats were deployed across several research voyages in 2022–23, and the data collected from the instruments will contribute to the International Argo Program.

CASE STUDY

International laboratories collaborate to help improve ocean studies

In a world-first voyage to the Southern Ocean, 14 leading ocean chemistry laboratories from 12 countries worked to collect important ocean data and compare how ocean measurements are made.

The 14-day International Nutrient Intercomparison Voyage (INIV) aboard RV *Investigator* provided the opportunity for global ocean chemistry laboratories to collect data and share knowledge that will help researchers monitor the health and productivity of our oceans.

Image: Benjamin Healley, Museums Victoria

Image: Carla Howarth

'We spent two weeks working side-by-side in an intensive program of ocean sampling to ensure we're all using uniform, best practice approaches in the study of our oceans,' CSIRO Principal Research Engineer and voyage Chief Scientist Andreas Marouchos said.

'The data collected on this voyage fills important gaps in our records, and will allow researchers to better understand how nutrient levels in the Southern Ocean vary at different times of the year.'

The Southern Ocean is responsible for absorbing about 40 per cent of the carbon dioxide produced by human activities and its nutrient rich waters support vital food webs and productivity.

Participants used RV *Investigator's* advanced oceanographic instruments and onboard laboratories to study ocean properties and nutrients. This included collecting seawater samples from different depths in the ocean using a CTD (conductivity, temperature, depth) instrument.

This instrument can be deployed to a depth of 6000 metres and collect up to 36 seawater samples from different depths in the water column. Teams collected and analysed more than 5000 seawater samples during the voyage.

Japan Agency For Marine-Earth Science and Technology researcher, Dr Mariko Hatta, said the voyage would help establish a global network between laboratories.

'It's vital that we understand our rapidly changing ocean conditions,' Dr Hatta said.

'This voyage will not only to improve the quality and the compatibility of the global data base but also provide us with a unique opportunity for educational networking and future collaboration.'

Countries which participated in the voyage were Japan, China, South Korea, United States, United Kingdom, Canada, Brazil, Argentina, Spain, Netherlands, France and Australia.

Collaboration for national benefit

Collaboration is integral to the success of the MNF.
In 2022–23, our research partners included:

- Australian Fisheries Management Authority
- Australian Museum
- Australian National University
- Bangor University (UK)
- Bureau of Meteorology
- CESIMAR-CONICET (Argentina)
- Colorado State University (USA)
- Defence Science and Technology Group
- Department of Environment Underwater Cultural Heritage Branch
- Federal University of Rio Grande Brazil
- Fisheries and Oceans Canada (Canada)
- French Research Institute for Exploration of the Sea
- Geoscience Australia
- ICM-CSIC (Institute of Marine Sciences Spain)
- James Cook University
- Japan Agency for Marine-Earth Science and Technology (Japan)
- Korea Institute of Ocean Science & Technology (KR)
- Mineral Resources Tasmania
- Moss Landing Marine Laboratories (USA)
- Museum of New Zealand – Te Papa (NZ)
- Museums Victoria Research Institute
- Royal Netherlands Institute for Sea Research (Netherlands)
- Parks Australia
- Plymouth Marine Laboratory (UK)
- Queensland University of Technology
- Royal Netherlands Institute for Sea Research
- Scripps Institution of Oceanography (USA)
- South Australian Research and Development Institute
- Southern Cross University
- Tasmanian Museum and Art Gallery
- University of Adelaide
- University of Canberra
- University of Hawaii (USA)
- University of Melbourne
- University of New South Wales
- University of New South Wales – School of Mathematics
- University of Queensland
- University of Sydney
- University of Tasmania
- University of Technology, Sydney
- University of the Sunshine Coast
- University of Utah (USA)
- Utrecht University (Netherlands)
- Victoria University of Wellington (NZ)
- Western Australian Museum (Perth)
- Xiamen University (China)

Image: Chloe Creed

Connecting with Australians

A key commitment of the MNF is to deepen community understanding of marine and atmospheric science.

In the past year, we have worked to raise awareness of the value and contribution of MNF-delivered research towards solving Australia's greatest challenges.

Together with our research partners, we delivered relevant, accessible and engaging communications which shared the remarkable stories of our ship, scientists and science. The MNF also delivered virtual experiences and outreach for the benefit for Australian students and the wider community.

Stef Stimson and Tegan Sime holding the 'Creatures of the deep' coin in front of RV *Investigator* (Image: Jason Fazey)

18.2 million
traditional media audience reach

5.8 million
social media impressions

93,270
MNF website page views

600
school students visited CSIRO displays at 2022 Australian Antarctic Festival

400 school students witnessed virtual ship tours

MNF participated in the National Youth Science Forum

350 students joined a virtual ship tour for the National Youth Science Forum

30 students visit CSIRO Marine Laboratories at Battery Point Working on Water program

2 MNF Indigenous Time at Sea Scholarship participants

Image: Frederique Olivier

As Australia's national science agency, CSIRO is solving the greatest challenges through innovative science and technology.

CSIRO. Creating a better future for everyone.

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