



Marine  
National Facility



# Marine National Facility

## Year in Review 2021-22

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

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## Acknowledgements

The Marine National Facility (MNF) is funded by the Australian Government, and is owned 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.



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

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Image: Matt Marrison, CSIRO

# 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, it is owned and 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 35 years of freely available marine data.

The literal flagship of the MNF, *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: Matt Marrison, CSIRO



# From the Chairperson

It's been a busy year for the MNF. In addition to research voyages, the 2021–22 schedule included a concerted effort to install, commission and trial new research capabilities for the benefit of the research community and ultimately the nation. Capability added to RV *Investigator* included the Heavy Ocean Towing System (HOTS), Giant Piston Corer (GPC) and enhanced seismic infrastructure.

2021–22 has also been a productive time for the MNF Steering Committee (MNFSC) and the two assessment committees: the Research Advisory Committee (RAC) and National Benefit Advisory Committee (NBAC). All three committees welcomed new members, with RAC also welcoming a new Chair, Professor Peter Steinberg. I would like to take this opportunity to thank the outgoing Chair, Dr Neville Smith, whose passion for governance and marine research was appreciated by committee members, the MNF, and the marine research community.

In closing, I would like to recognise the work and dedication of the MNF staff. Their resilience and flexibility throughout a challenging 2021–22 was admirable as they worked to manage the operations of a research vessel through the global pandemic. Our collective achievements are a reflection of 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





Image: Robert French, Museums Victoria

## From the Director

This past year has demonstrated that collaboration is at the heart of everything we do at CSIRO. In a challenging operating environment, we remain committed to working 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, 2021–22 saw RV *Investigator* undertake a long maintenance period from July to November 2021. This provided the opportunity to appraise our safety systems, as well as consolidate a significant body of work to maintain and enhance capabilities of both the vessel and our people. In particular, we were pleased to deliver new initiatives that have enhanced the safety, health and wellbeing of voyage participants.

Our achievements during 2021–22 are due to the commitment of many people and collaborators. I want to thank all who have contributed during this time, including our domestic and international research partners, staff and crew from ASP Ship Management and, of course, all of our CSIRO team. I would like to thank the marine research community for their ongoing support of our facility.

### **Toni Moate**

Director, Marine National Facility



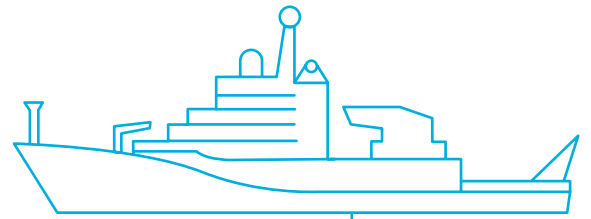
# 2021-22 snapshot

11,998

nautical miles travelled

195

operational days



**Number of CTD casts**

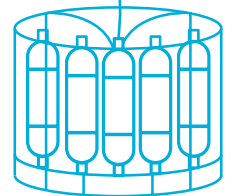
25

**Cumulative CTD distance**

47,965 m

**Deepest CTD cast**

4,819 m



310,518 km<sup>2</sup>

area mapped

7.35

terrabbytes of data collected

13

**participating organisations**

139

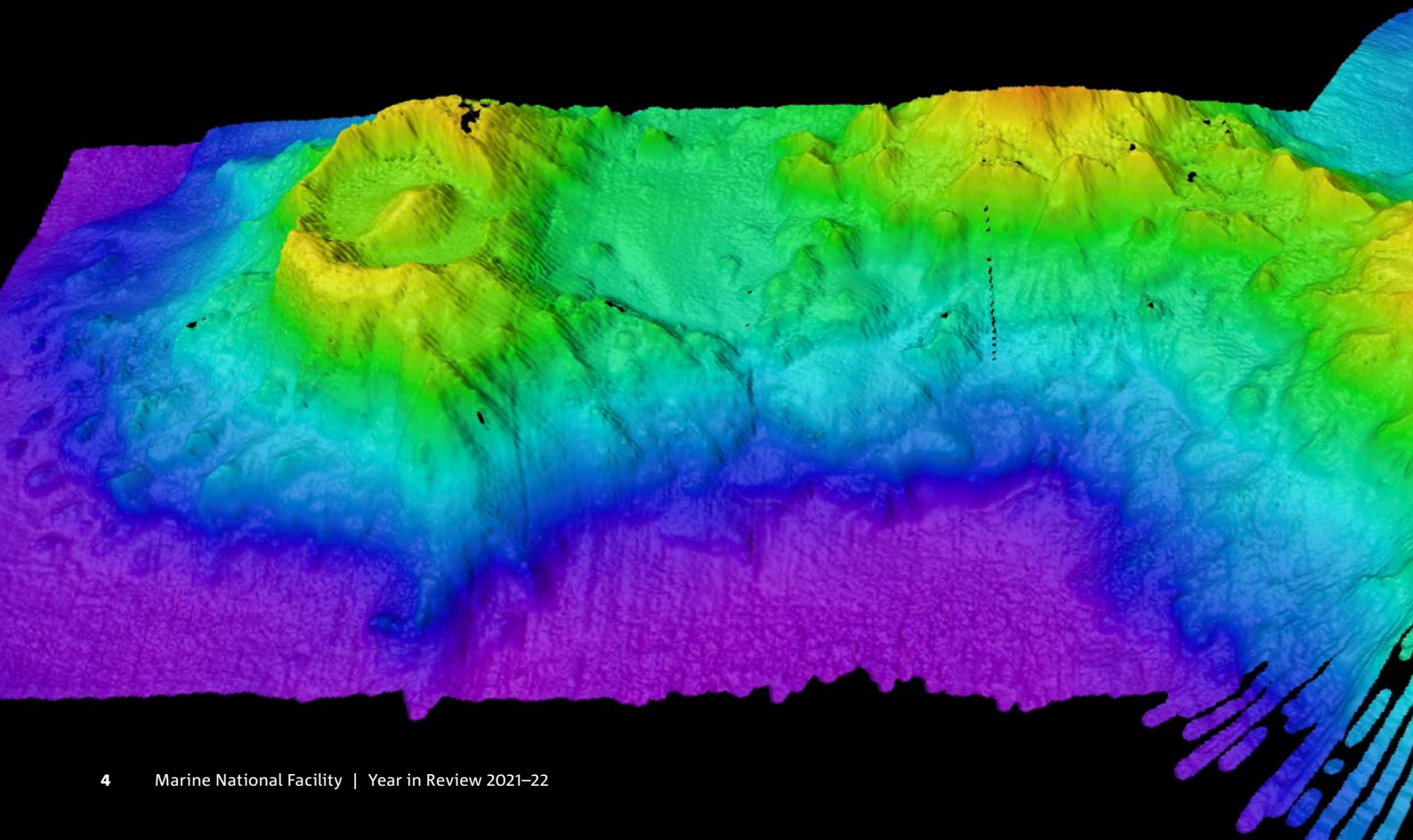
**participating researchers**

28

**research publications\***

\*peer-reviewed journal publications recorded in MNF database as at 30 June 2022

Image: CSIRO



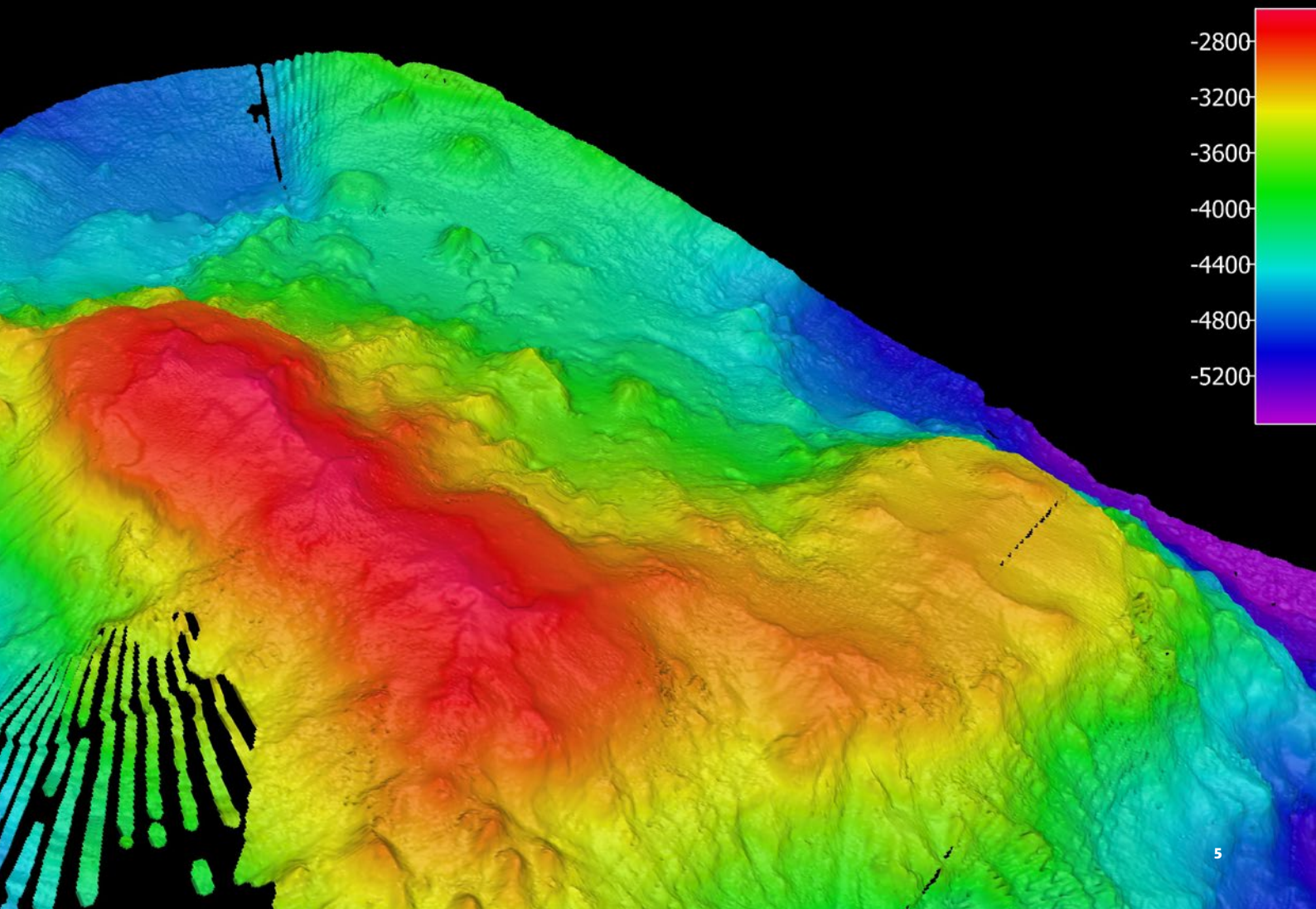


# Research delivered and supported

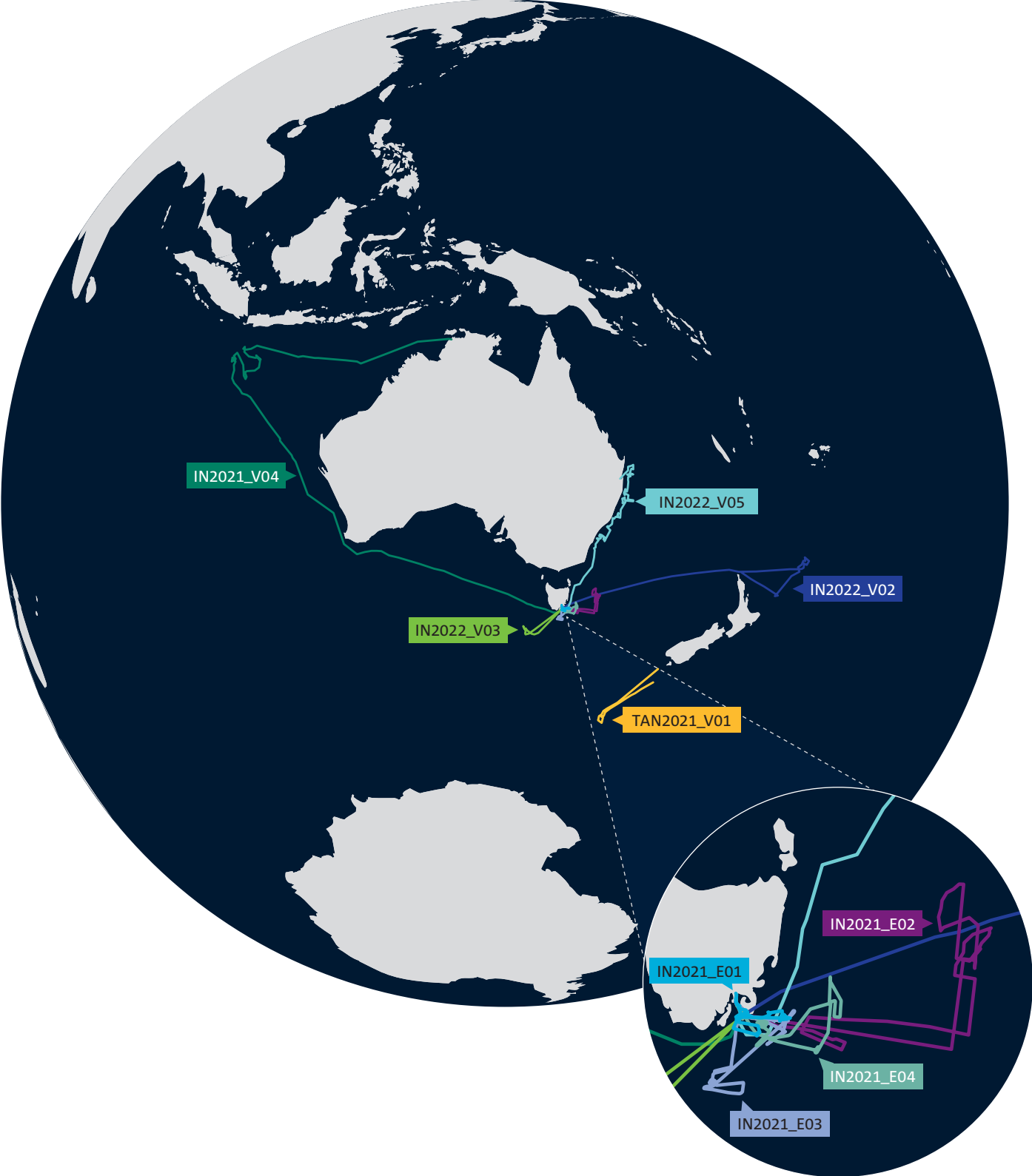
The 2021–22 financial year was challenging for operations of the MNF but also marked by many achievements.

Importantly, it saw the digitisation of the voyage application and planning process via the successful launch of the new Marine Application and Planning System (MAPS). This online platform streamlines end-to-end voyage application, assessment and allocation process for applicants, assessors and staff. This provides significant efficiency, consistency and transparency benefits and helps ensure that we are delivering the highest quality marine and atmospheric research for national benefit.

The Heavy Ocean Towing System (HOTS) was successfully installed and commissioned on RV *Investigator* during the period. This system, which was co-funded by the Science and Industry Endowment Fund, allows fully instrumented deployments of heavy-towed equipment on fibre optic cable down to 6500 m. Additional enhancements deployed to the ship included the new the giant piston corer (GPC) and core pipe handler (CPH) system. These, along with improvements to our fixed seismic infrastructure, provide significant enhancements to vessel research capability.



# Map of 2021-22 voyages



# Voyages delivered



July 2021

## **IN2021\_V04 Biodiversity assessment of Australia's Indian Ocean Territories [Darwin – Hobart]**

Led by Museums Victoria, this 30-day research voyage undertook a world-first biodiversity survey in waters around Christmas Island in Australia's remote Indian Ocean Territories. The voyage included 9 institutions, including 4 Australian museums, and was conducted in partnership with Parks Australia to provide data to support them in the management of new marine parks established around Christmas Island and the Cocos (Keeling) Islands.

Originally scheduled for 45-days, this voyage was suspended partway through to undertake additional certification of some vessel systems following a review of legislative obligations. The review reflected CSIRO's commitment to maintain the highest safety standards in all its operations. The remaining research operations were subsequently rescheduled to a second voyage for delivery in September to November 2022.



November 2021

## **TAN2021\_V01 Probing the Australian-Pacific Plate Boundary: Macquarie Ridge in 3-D [Wellington – Wellington]**

CSIRO chartered RV *Tangaroa*, operated by New Zealand's National Institute of Water and Atmospheric (NIWA) to deliver a 26-day voyage to Macquarie Island to recover 27 ocean bottom seismometers (OBS) deployed by RV *Investigator* during voyage IN2020\_V06. Due to COVID restrictions for entry to New Zealand, the voyage was led remotely by the Australian National University, in partnership with the University of Tasmania, California Institute of Technology (USA) and University of Cambridge (UK).

Data collected from this research will enhance our understanding of earthquakes in the region. This knowledge will be used to improve the accuracy of modelling for tsunami potential, delivering benefit to at-risk communities along the Pacific and Indian Ocean coastlines.



Image: Martin Jutzeler, UTAS

## November 2021

### **IN2021\_E01, IN2021\_E02, IN2021\_E03; IN2021\_E04 Equipment Calibration and Sea Trials [Hobart – Hobart]**

RV *Investigator* returned to at-sea operations in November 2021 with a program of four calibration and science equipment trial voyages. These voyages followed the successful completion of a long maintenance period to undertake required vessel maintenance activities and capability upgrades.

During the equipment calibration and sea trials program, a wide range of equipment testing and commissioning took place, including commissioning of the new giant piston corer and HOTS systems, as well as advanced deep tow camera system. Various technical personnel and crew training were also undertaken, which is important for maintaining the the expertise and world-class capability of a multidisciplinary research vessel.

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## January 2022

### **IN2022\_V01 Studying Antarctic Bottom Water production**

Led by Geoscience Australia, this was a 56-day voyage to East Antarctica to investigate past changes in Antarctic bottom water production revealed by seafloor sediment records. However, this voyage was cancelled by CSIRO following several participants testing positive for COVID during pre-departure screening.

The voyage was subsequently rescheduled to January 2023.

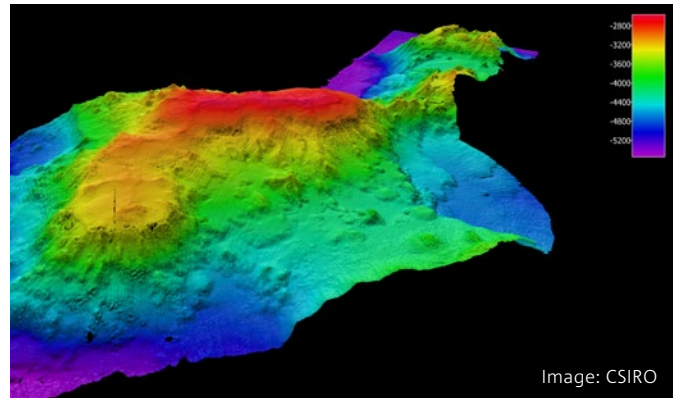


Image: CSIRO

## March 2022

### **IN2022\_V02 Sedimentation at its extreme: how powerful are submarine caldera forming eruptions (Kermadec arc/Rangitāhua) [Hobart – Hobart]**

Led by the University of Tasmania, this was a 32-day voyage to waters northeast of New Zealand to investigate submarine volcanoes to better understand the power of their eruptions. The research focused on three massive caldera volcanoes located along the Kermadec Arc/Rangitāhua, an active volcano island arc that starts northeast of New Zealand and runs north to Tonga along the boundary of two tectonic plates.

The research will support modelling for the first-ever hazard mapping scheme for tsunami and sediment flows for submarine volcanoes globally and provide new ore vectoring strategies for exploration in the Australian continent. The voyage saw the first research application of the newly commissioned giant piston corer and vessel seismic system.

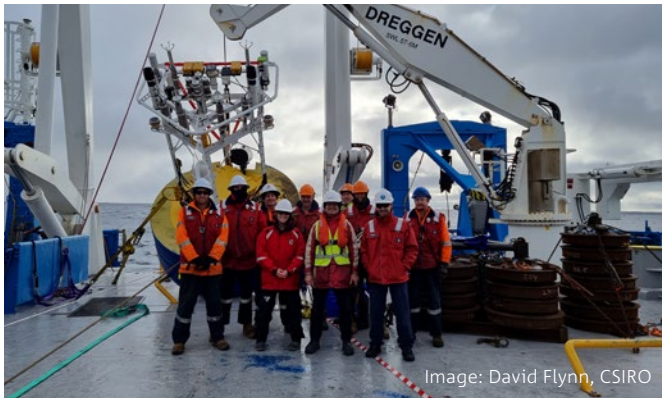


Image: David Flynn, CSIRO



Image: Hannah Power, University of Newcastle

## May 2022

### **IN2022\_V03 Integrated Marine Observing System Southern Ocean Time Series for climate, carbon and ocean health [Hobart – Hobart]**

Led by the Integrated Marine Observing System (IMOS), this 12-day voyage travelled to the Southern Ocean southwest of Tasmania to maintain the Southern Ocean Times Series (SOTS) deep water mooring array. These moorings provide long time-series observations in a critical part of the Southern Ocean where ocean interactions are most intense and least studied.

This voyage is part of an ongoing partnership between CSIRO and IMOS in the maintenance of this mooring array, which collects data vital for informing ocean and climate modelling.

## May–June 2022

### **IN2022\_V05 The tsunamigenic submarine landslides and deep-marine canyons of Australia’s Tasman Sea margin: causes and consequences [Hobart – Brisbane]**

Led by the University of Sydney, this was a 37-day voyage to investigate the deep-marine canyons of Australia’s Tasman Sea margin and the causes and consequences of tsunamigenic submarine landslides.

This research will improve our ability to evaluate the small but significant risk faced by eastern Australia’s seaboard cities and towns from locally sourced, submarine-landslide-generated tsunami. Earlier contributions and mapping for this research was completed by the MNF’s previous research vessel, RV *Southern Surveyor*, in 2013 (SS2013\_V01).

## Protecting our community from COVID

The COVID-19 landscape continued to change and present new challenges for vessel operations and scheduling in 2021–22. The MNF continued to manage its operations under a robust COVID-19 management framework, including a requirement for voyage participants to quarantine and be fully vaccinated prior to boarding RV *Investigator*. Maintaining our commitment to the ongoing protection of the health and safety of voyage participants, crew and the community, the MNF demonstrated an agile approach in adjusting COVID-19 management protocols to ensure operations could be managed safely and effectively during periods of rapid change.

## CASE STUDY

# The vital role *RV Investigator* plays in weather modelling and forecasting

As a nation, we're challenged by the need to increase our understanding of a changing climate, as well as the increasingly volatile weather systems impacting communities across Australia. *RV Investigator* helps support scientists in this work, hosting equipment, sensors and instruments to help study the atmosphere above our oceans.

Image: Robert French, Museums Victoria



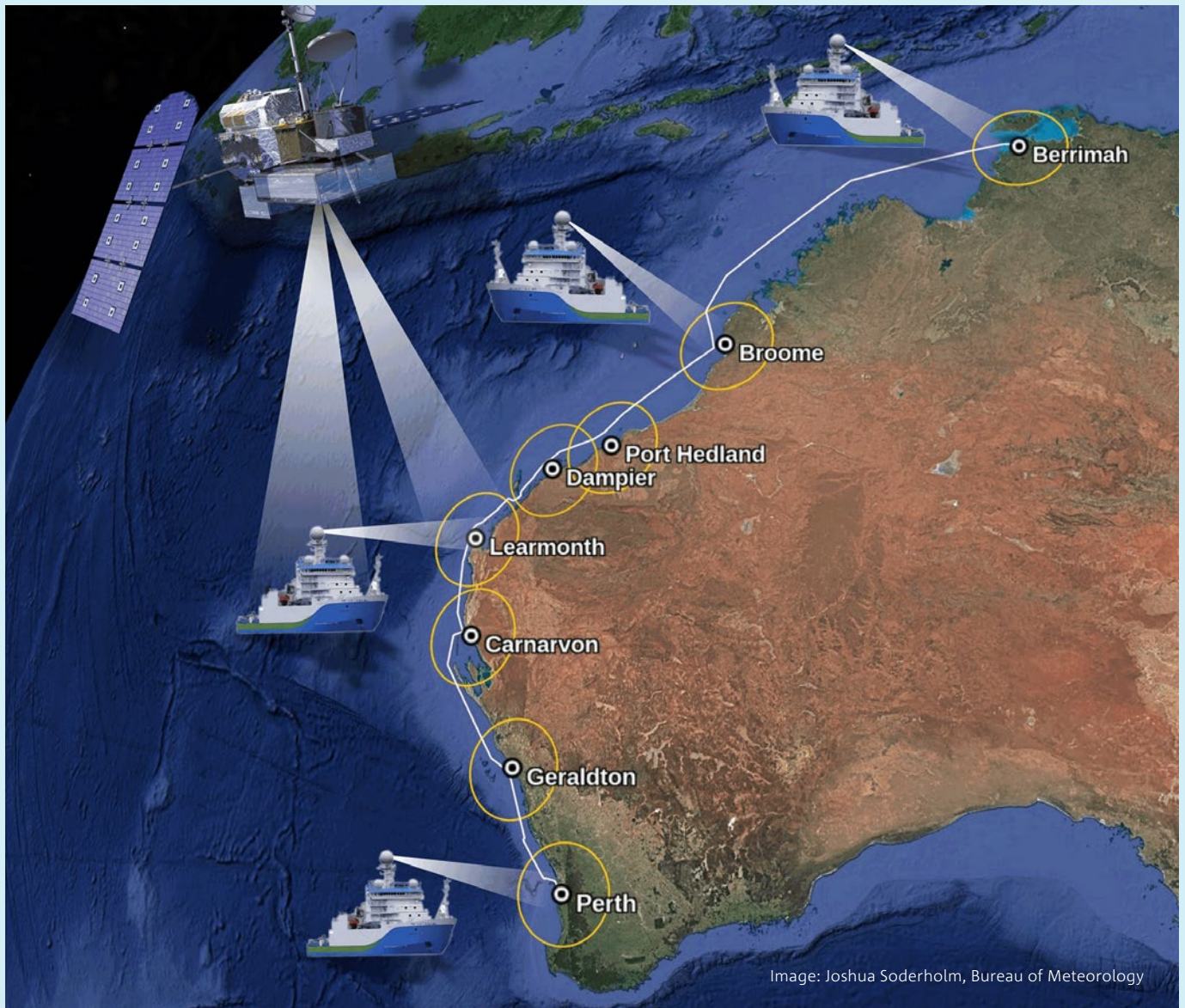


Image: Joshua Soderholm, Bureau of Meteorology

The vessel has impressive atmospheric research capabilities including an advanced dual polarisation Doppler weather radar, air chemistry laboratory, aerosol laboratory, and space for two dedicated container laboratories on the foredeck. The vessel continually samples the air while underway and has instruments which measure sunlight, aerosols, cloud condensation, and other components of the atmosphere. Research published in February 2022 demonstrates the important capability that the vessel delivers for weather and climate forecasting.

During 2019, the Bureau of Meteorology led a 10-day voyage along Australia’s west coast between Darwin and Perth. Scientists used weather radar observations collected from RV *Investigator* to evaluate the Australian weather radar network calibration monitoring technique that uses spaceborne radar observations from the NASA Global Precipitation Mission (GPM). Their results validated the concept of using the GPM spaceborne radar observations to calibrate the national weather radar network, which requires highly precise measurements to be effective. This network plays a

major role in providing situational awareness and nowcasting in severe weather situations, including heavy rain, flash floods, hailstorms, and wind gusts.

The weather and climate research delivered by RV *Investigator* is globally significant and provides data to address the grand challenges being faced by Australia, our region and globally. Without RV *Investigator* and its multidisciplinary capability, many areas of research would remain unstudied.

Citation: Protat, A., Louf, V., Soderholm, J., Brook, J., and Ponsonby, W.: Three-way calibration checks using ground-based, ship-based, and spaceborne radars, *Atmos. Meas. Tech.*, 15, 915–926, <https://doi.org/10.5194/amt-15-915-2022>, 2022.

# Collaboration for national benefit

Collaboration is integral to the success of the MNF. In 2021–22, our research partners included:

- Australian National University
- Bush Blitz
- California Institute of Technology (USA)
- Bureau of Meteorology
- Integrated Marine Observing System
- Museums Victoria
- National Institute of Water and Atmospheric Research (New Zealand)
- Parks Australia
- University of Cambridge (UK)
- University of Newcastle
- University of Sydney
- University of Tasmania
- University of Utah (USA)





Image: Robert French, Museums Victoria

# Connecting with Australians

It is a priority of the MNF to deepen community understanding of marine and atmospheric science. This aligns with raising awareness of the value and contribution of MNF delivered research towards solving our greatest challenges.

Although there were challenges, the past year saw the MNF innovate and work collaboratively with research partners to deliver relevant, accessible and engaging communications. These shared the remarkable stories of our ship, scientists and science. The MNF also seized opportunities to deliver virtual experiences and outreach for the benefit for Australian students and the wider community.

3.1 million

traditional media audience reach

1.5 million

social media impressions

72,800

MNF website page views

380

school students witnessed virtual ship tours

140

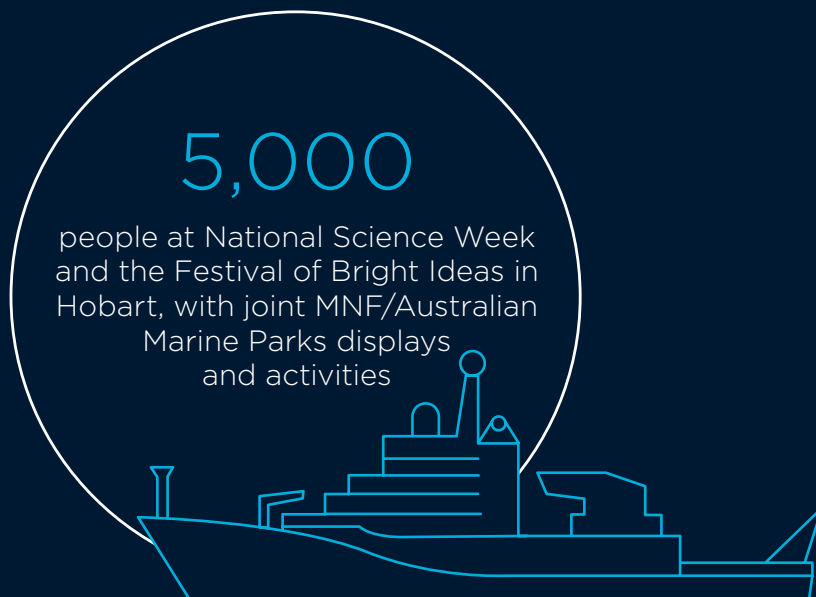
students attended a MNF workshop for the National Youth Science Forum

35

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

1

Indigenous marine science cadet



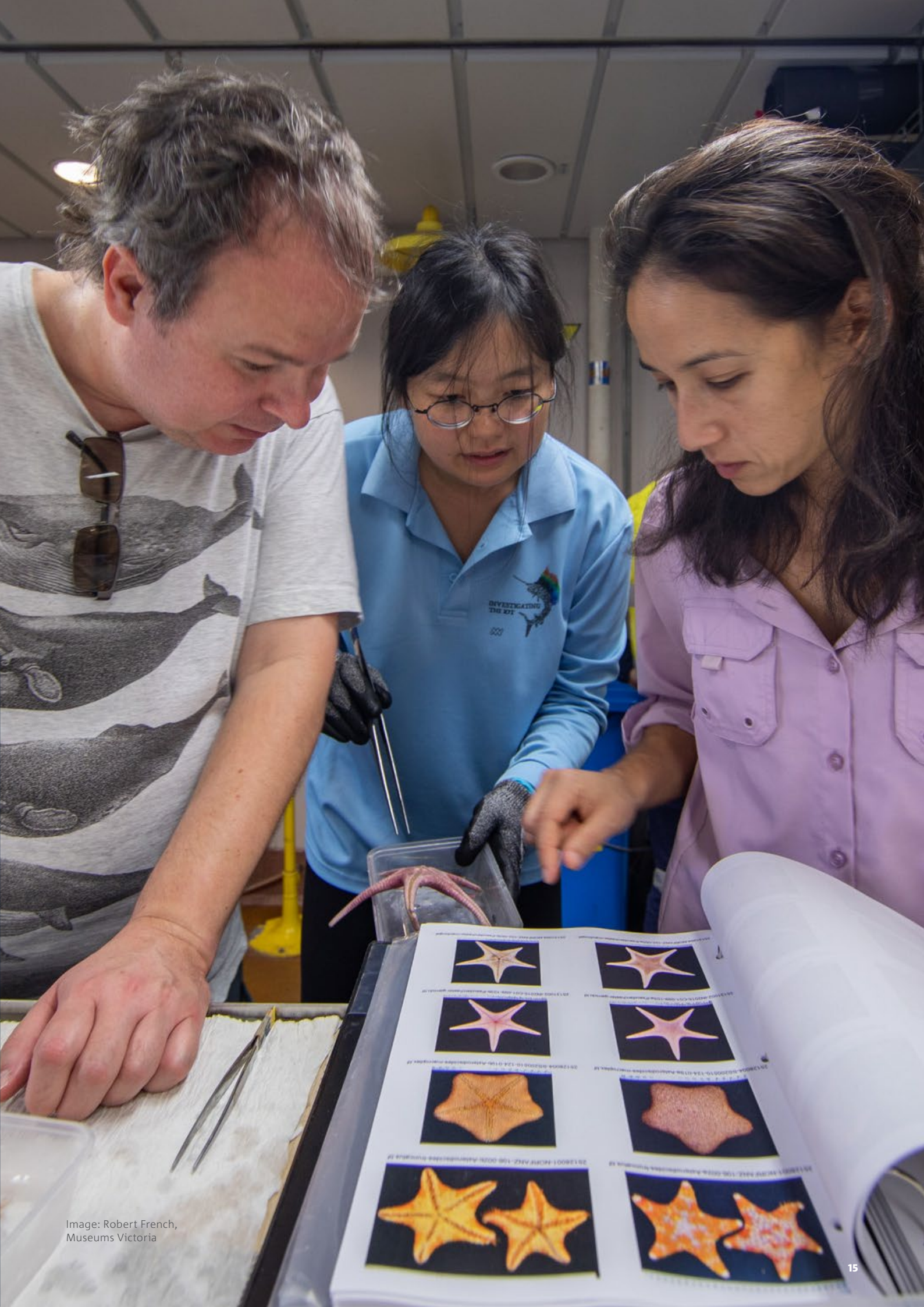


Image: Robert French, Museums Victoria

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