



MNF Voyage Highlights

Voyage #:	IN2026_V01
Voyage title:	Cook Ice Ecosystems and Sediments (COOKIES)
Mobilisation:	Hobart, Thursday, 1 January 2026 (and pre-Christmas 20/21.12.2025)
Depart:	Hobart, Friday, 2 January 2026
Return:	Hobart, Wednesday, 25 February 2026
Demobilisation:	Hobart, Thursday, 26 February 2026
Voyage Manager:	Claire Grubb
Chief Scientist:	Linda Armbrecht
Affiliation:	Institute for Marine and Antarctic Studies (IMAS), University of Tasmania (UTAS)
Principal Investigators (alphabetical):	<p>Tristan Cordier (NORCE, Norway), Laura De Santis (on-board Deputy; National Institute of Oceanography and Applied Geophysics (OGS), Italy), Amaranta Focardi (University of Technology Sydney, Australia), Nicole Hill (IMAS/UTAS), Jan Jansen (IMAS/UTAS), Amy Leventer (Colgate University, USA), Jan Lieser (Bureau of Meteorology, Australia), Taryn Noble (on-shore Deputy; IMAS/UTAS), Alix Post (Geoscience Australia), Alessandro Silvano (University of Southampton, UK), Jan Strugnell (James Cook University, Australia), Leonie Suter (Australian Antarctic Division)</p>
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Voyage Highlights

A milestone Antarctic voyage delivering science for the future

The 55 days Cook Ice Ecosystems and Sediments (COOKIES) Voyage to East Antarctica delivered major scientific advances, helping to improve our understanding of one of the most remote and unexplored, yet most important regions on Earth - the Cook Glacier marine region.

Aboard the CSIRO research vessel (RV) *Investigator*, a team of international researchers travelled more than 6,500 nautical miles through challenging conditions, including towering icebergs, powerful ocean swells and sub-zero storms to collect a uniquely multidisciplinary dataset.

Unlocking Antarctica's past to understand its future

The team set out to understand how Antarctica and the Southern Ocean have changed over millions of years until present, to better predict the future responses to climate change. They collected long cylinders of seafloor mud, known as sediment cores. Each layer within these cores acts like a page in a history book of the Earth, preserving traces of past ocean conditions, climate, and life.

One of the voyage's standout achievements was recovering a record 20.5-metre-long sediment core - the longest collected on *RV Investigator*. In total, more than 10,000 sediment samples were brought back to Australia for detailed laboratory analysis, allowing the scientists to reconstruct environmental changes.

Mapping the unknown seafloor

Less than one-third of the world's ocean floor has been mapped in detail. The COOKIES researchers used advanced sonar systems to map large areas of previously unexplored seabed and to image layers beneath it. This work not only revealed new features of the ocean floor but also guided where to collect sediment samples. Every new section of seabed mapped adds to global knowledge of how the seafloor influences ocean currents, ecosystems and climate processes.

Discovering and monitoring life in the ocean and on the seafloor

The voyage captured a snapshot of life in the ocean, from the surface to the seafloor. Water samples collected during the entire journey sampled microscopic life such as algae, bacteria and tiny animals, as well as traces of DNA left behind by organisms. Deep-sea cameras and netted sleds were used to explore the seafloor ecosystems, revealing a biodiversity rarely seen by humans. These surveys recorded over 400 organisms, 10,000 images and 9 hours of video footage.

At the same time, instruments lowered through the water column measured temperature, salinity, nutrients and trace metals such as iron and zinc - key factors that control ocean health, productivity and habitability. Small changes in these parameters can have major impacts on marine ecosystems and the global climate.

Why this matters

The results of the COOKIES voyage will help answer critical questions about climate change, ocean health and biodiversity. For Australia, this work strengthens our role as a leader in Antarctic research and contributes to global efforts to understand and protect the Southern Ocean.

Importantly, the knowledge gained extends beyond the scientific community. Understanding how Antarctica is changing helps inform decisions that affect climate policy, planning for sea-level rise, and conserving our oceans—issues that ultimately impact all Australians.

COOKIES supports years of scientific research. It highlights the value of investing in ocean research and demonstrates how exploring even the most remote parts of the planet can deliver knowledge that benefits society.

The Chief Scientist



Dr Linda Ambrecht is an early-mid-career researcher and senior lecturer at the Institute for Marine and Antarctic Studies, University of Tasmania. Her research focuses on the reconstruction of marine ecosystems with an emphasis on the Antarctic environment, where research into resilience and sustainability is critical due to climate change. Linda specialises in paleo-genomics techniques, in particular, the analysis of ancient DNA from the seafloor (*sedaDNA*). These novel approaches allow her to track complex species-level and ecosystem-wide changes over thousands of years, knowledge that can be directly applied to predicting future changes and management of marine ecosystems, fisheries, and keystone species. Linda has extensive sea-going experience, having spent 260 days at sea during previous research expeditions, five of which were remote voyages to the Southern Ocean. COOKIES was the first voyage she led as a Chief Scientist.

Title

Cook Ice Ecosystems and Sediments (COOKIES)

Purpose

Models suggest that a major collapse of the marine-based ice sheet over the East Antarctic Wilkes Subglacial Basin (WSB) could be triggered by 2200. Around 60% of the ice held within the WSB is drained by the Cook and Ninnis Glaciers, which are inferred to be sensitive to ocean warming. Recent modelling suggests that the Cook Ice Shelf is especially vulnerable, with a projected considerable ice mass loss (-14 Gt per year) over the next 200 years. The COOKIES voyage (IN2026_V01) set out on the 2nd of January on the CSIRO research vessel (RV) *Investigator*, to study the Cook/Ninnis/Mertz Glacier marine region (~150°E), as well as the adjacent Dibble Glacier region (~132°E). The voyage had three major objectives:

- a) to characterise marine ecosystem composition of the Cook Glacier marine region throughout the past and into the present, focussing on warm periods throughout the last 1 million years,
- b) assess relationships of benthic biodiversity and population genetic signatures with productivity and ice-sheet history, and
- c) determine the geological and palaeoceanographic conditions that may have influenced the spatial distribution of the Cook region marine life.

To achieve these objectives, a highly multidisciplinary dataset was acquired and integrated. We collected bathymetry (multibeam) and sub-bottom profile data, sediment cores (Multi-, Kasten, Piston Cores) for sedimentological, geochemical, paleontological and genomics investigations, imagery of seafloor biodiversity (deep-towed camera), benthic organisms (epibenthic sled), and physical (CTD, ADCP, Argo floats), chemical (Trace Metal Rosette) and biological oceanography (CTD, underway seawater sampling). Highlights of the voyage include the creation of new seafloor maps spanning 4,206 nautical miles across both slope and shelf in the study region alongside novel imagery of the seafloor biodiversity, the acquisition of the longest piston core on *RV Investigator* to date (20.5 m), the collection of over 400 benthic organisms for population genetic analyses. Our dataset comprises a unique resource of the ice sheet history in the Cook/Ninnis/Mertz and Dibble Glacier regions that will inform future research in this area in the years to come.

Contribution to the nation

The Cook Ice Shelf of the Wilkes Subglacial Basin (WSB) is the most vulnerable region to climate change in East Antarctica. The WSB contains enough ice to increase global mean sea level by 3-4 m. The Cook Glacier alone has the potential to contribute ~1.5 m, so it is crucial to understand how this translates to ocean circulation and regional ecosystem disruption. The region also lies within the Australian Antarctic Territory – yet we currently have limited data to support our sovereignty offshore. As a result of this voyage:

- We have new, fundamental data on bathymetry, oceanography, biodiversity and productivity in the WSB region. These data will inform ice sheet models for understanding sea level impacts on Australia and globally, and improve Antarctic ecosystem management.
- We imaged and sampled seafloor life on the slope off the Cook/Ninnis/Mertz Glaciers, and found that some species inhabited much deeper water depths than previously assumed (>3,000m). We conducted the first biodiversity survey in the Dibble Glacier region, identifying potential glacial refugia sites and allowing investigations into Vulnerable Marine Ecosystems.
- We mapped 4,206 nautical miles south of 60°S and between 153.18°E and 131.48°E, which adds significantly to establish the outer limit of Australia's extended continental slope and shelf.
- We have commenced a research program in the Cook/Ninnis/Mertz and Dibble Glacier regions that will be the baseline for several future international research campaigns currently underway to study this important East Antarctic region.

Next steps

The next steps will include reporting to meet MNF milestones, data and sample analysis, and dissemination of results and findings through presentations at conferences and workshops, stakeholder meetings, and scientific papers. In detail:

MNF Reporting Milestones:

- 05.03.2026 (1 week after voyage): Chief Scientist Report to MNF
- 26.03.2026 (1 month after voyage): Highlights and Summary Report to MNF

Scientific milestones:

- Two weeks after voyage: Communication of voyage achievements to stakeholders and to the public. Specifically, public seminars were held at the Institute for Marine and Antarctic Studies (IMAS), University of Tasmania (<https://www.youtube.com/watch?v=LZOMliSkrE4>) (02 March), at the Climate Action Week, Sydney, hosted by the Istituto Italiano di Cultura (10 March), and at the “Antarctica: The Ice That Shapes Our World” event, Canberra, hosted by the Embassy of Italy in Australia and the Research School of Earth Sciences and Institute for Climate, Energy and Disaster Solutions at The Australian National University (11 March).
- Six months after voyage: Voyage report complete and publicly available via IMAS Data Portal, biosecurity sample release, sampling party, CTD and hydrochemistry data publicly available (via CSIRO data portal), deep-towed camera/downward facing camera image annotation complete, Bathymetry and Sub-bottom profile data processed and available via AusSeabed (<https://www.ausseabed.gov.au/>).
- One year after voyage: Collaborative data and sample analysis by the science team, preliminary results presentation at conferences (e.g., SCAR Open Science Conference Oslo, August, 2026 (2 abstracts on voyage already submitted by PI’s Armbrecht/De Santis et al., and PI Cordier et al.), Australian Antarctic Research Conference, Hobart, August 2026; Session proposed on Wilkes Subglacial Basin (WSB) co-convened by PI’s Armbrecht and Strugnell).
- Two to three years after voyage: Synthesis, publication and presentation of results, information to stakeholders and policy makers, including specific outputs such as: Information Sheet on biology to Antarctic Environments Portal (AEP, <https://environments.aq/>), genomics raw data publicly available, e.g., Sequence read Archive (SRA, <https://www.ncbi.nlm.nih.gov/sra>), bathymetry data delivery to the International Bathymetric Chart of the Southern Ocean team (IBCSO, <https://ibcso.org/>), oceanographic data delivery to the Southern Ocean Observing System (SOOS; <https://www.soos.aq/data>), hydrochemistry and dissolved trace metal data delivery to GEOTRACES (<https://www.geotraces.org/data/>), geochemistry data dissemination via SCAR INSTabilities & Thresholds in ANTArctica Team (INSTANT, (<https://scar.org/science/research-programmes/instant>) and storage at PANGAEA (<https://www.pangaea.de/>), biodiversity synthesis, fact sheet production and annotation publicly available on Squidle+ (<https://squidle.org/>), integration of this voyage’s datasets with those of upcoming programs in the WSB region.