

SCAR Open Science Conference 2026, Conference Abstracts

Below are a compilation of the conference abstracts for presentations made by the Antarctic Sea-Ice Switch (ASIS) research programme team, at the SCAR open science conference (Norway, August 2026).

1. Last Interglacial Climate and Ice-Shelf Stability in the Ross Sea: Insights from the RICE Ice Core

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Abstract:

The Roosevelt Island Climate Evolution (RICE) project recovered a 763.4 m ice core to bedrock from Roosevelt Island, a grounded ice rise at the northern margin of the Ross Ice Shelf. Although the ice surface accumulates locally, the surrounding Ross Ice Shelf flows around the island, creating a unique setting for recording regional climate signals. Comparisons between modern RICE stable-isotope measurements and meteorological observations show that the core captures temperature variability representative of the Ross Sea region, the Ross Ice Shelf, and western West Antarctica. The record is also highly sensitive to changes in regional sea-ice extent and to major low- and mid-latitude climate modes, including ENSO, the PDO, and the SAM.

The RICE17 chronology constrains the depth–age relationship for the upper 754 m of the core through synchronization of CH₄ and $\delta^{18}\text{O}_{\text{atm}}$ with the WAIS Divide ice core, extending the record back to 83 ka. New ⁸¹Kr ages from the deepest ice confirm that the core reaches at least 150 ka, preserving ice from MIS 5e and older. We present the full suite of stable-isotope, geochemical, and gas records from RICE and discuss the implications of the presence of last-interglacial and older ice on Roosevelt Island for past Ross Ice Shelf stability and for future ice-shelf and ice-rise dynamics in a warming climate.

2. Early Antarctic Cold Reversal Conditions Recorded in the Roosevelt Island (RICE) Ice Core

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Abstract:

The Roosevelt Island Climate Evolution (RICE) project recovered a 763.4 m ice core to bedrock from Roosevelt Island, located at the northern margin of the Ross Ice Shelf. Although the ice is grounded 210 m below sea level, it accumulates locally while the surrounding Ross Ice Shelf flows around the island, providing a stable archive of regional climate. Comparison of modern RICE water-isotope data with instrumental records shows that the site captures temperature variability across the Ross Sea, the Ross Ice Shelf, and western West Antarctica, and is particularly sensitive to changes in regional sea-ice extent and to low- and mid-latitude climate modes including ENSO, the Pacific Decadal Oscillation, and the Southern Annular Mode.

We present gas, isotope, geochemical, and physical-property measurements spanning the past 65 ka, supported by an age model synchronized to the WAIS Divide ice core using CH₄ and $\delta^{18}\text{O}_{\text{atm}}$.

High-resolution CH₄ and δ¹⁵N records enable precise assessment of interhemispheric phasing during abrupt climate events. The RICE record indicates that the Ross Sea region entered Antarctic Cold Reversal-like conditions approximately 125 years before the onset of the Bølling transition in the Northern Hemisphere and roughly 300 years before the Antarctic Cold Reversal onset recorded at WAIS Divide. We interpret this early signal as evidence for a regional atmospheric shift that reduced snow accumulation and initiated isotopic cooling ahead of broader Antarctic changes. We explore the implications for ocean circulation, sea-ice dynamics, and ice-sheet behavior in the Ross Sea sector.

3. The Antarctic Treaty System and the BBNJ Agreement: on a collision course?

Author: Professor Joanna C Mossop¹

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Abstract:

A new Agreement on the Conservation and Sustainable Use of Marine Biodiversity of Areas Beyond National Jurisdiction (BBNJ Agreement, also known as the high seas treaty) entered into force in January 2026. The Agreement sets out processes for establishing high seas area based management tools (ABMTs) including marine protected areas (MPAs), conducting environmental impact assessments (EIAs), capacity building and the transfer of marine biodiversity. The Agreement is careful to ensure that neither the ABMT nor EIA provisions undermine the competences of existing instruments, frameworks and bodies, of which the Antarctic Treaty System (ATS) is one. However, more problematic for the ATS are the provisions establishing notification requirements for those accessing marine genetic resources (MGRs) beyond national jurisdiction, and the expectation that some benefits will flow from the use of those resources or digital sequence information to the international community.

Two complex questions arise for the intersection between the ATS and the BBNJ Agreement. First, are the waters of the Southern Ocean ‘areas beyond national jurisdiction’? Second, can the ATS argue that the MGR provisions of the Agreement do not apply to MGRs collected in the Southern Ocean? Understandably, some ATS member States have argued that the BBNJ Agreement doesn’t apply to the Southern Ocean and that the ATS is the sole authority to regulate MGRs. However, this position needs further analysis - legally there are some difficulties with this approach. In addition, there is a real geopolitical risk if States not Party to the ATS raise questions in the United Nations about the sharing of benefits from MGRs sourced from the Southern Ocean. This paper will explore these issues and identify options that could be considered to minimise the legal and political risks.

4. Revealing the link between East Antarctic climate and Southern Ocean productivity over glacial-interglacial cycles

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Abstract:

Antarctic continental climate and the Southern Ocean are tightly coupled over glacial-interglacial cycles through both global climate forcing, such as greenhouse gas concentrations and orbital parameters, and regional atmospheric and ocean circulation patterns. Here we examine the teleconnections between Antarctica and the Southern Ocean with a transient model simulation over the Marine Isotope Stage 8/7 (MIS 8/7; approx. 256-244 ka) glacial-interglacial transition using the UVic ESCM v2.9 Kiel Marine Biogeochemistry Model v3 (KMBM3; Kvale et al., 2021). We show high correlation between the surface air temperature of the interior of East Antarctica and sea surface temperature (SST), dissolved inorganic carbon (DIC), and coccolithophore net primary productivity (NPP) in the Pacific sector of the Southern Ocean. This contrasts with a lack of correlation with diatom NPP. These links are supported with a high-resolution marine sediment biogeochemical

proxy record from IODP Expedition 383 Site U1539, located in the Pacific sector just north of the modern Sub-Antarctic Front (SAF; ~56 °S). Over the MIS 8/7 interval, we observe a close correlation between the RGB color scan (an indicator of carbonate versus siliceous productivity at Site U1539) and the δD record from EPICA Dome C. We use our model simulation to explore potential common drivers, including westerly wind strength, upwelling and nutrient supply, migration of the SAF, and meridional overturning circulation. Simulations of other time periods and different combinations of orbital parameters (obliquity, eccentricity, and precession) reveal the sensitivity of phytoplankton primary productivity in the Southern Ocean to high latitude radiative forcing, resulting in non-linear impacts on the Southern Ocean biological pump and carbon uptake.

5. Identifying West Antarctic Ice Sheet retreat using sediment provenance records

Authors: Jim Marschalek¹, Edward Gasson², Stefan Jendersie^{3,4}, Liz Keller^{3,5}, Patric Simões Pereira⁶, Claus-Dieter Hillenbrand⁷, Nicholas Golledge³, Sidney Hemming⁸, Richard Levy³, Tina van de Flierdt¹

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Abstract:

Revealing when and where past West Antarctic Ice Sheet (WAIS) retreat occurred helps suggest the sensitivity of this ice sheet to future warming. Sediment provenance data offer an excellent tool for detecting WAIS retreat, but the appearance of West Antarctic seaways means that debris transport pathways and processes could change substantially during and following retreat. Changes to ice sheet basal conditions could also impact provenance signatures without significant changes to ice sheet extent. These complexities mean that a lack of provenance change at a given site could either be a consequence of a lack of ice sheet change, or because the site/proxy is insensitive. Here, we use the Tracing Antarctic Sediment Provenance (TASP) programme to predict the sediment provenance signature of various smaller-than-present Antarctic ice sheet configurations. Provenance signatures are traced offshore using the output of new regional ocean modelling through open West Antarctic seaways. Our results reveal which locations are sensitive to WAIS retreat in different sectors, helping target core sites and select provenance proxies. Changing ocean circulation is shown to be a major control on provenance records, but our results begin to disentangle this influence and allow us to reevaluate existing records to reveal past WAIS extent.

6. Mātauranga Māori in Antarctic science - A New Zealand Indigenous Perspective

Authors: Delane Luke¹, Riki Parata¹, Aimee Kaio¹, Prof Sandy Morrison², AP Natalie J Robinson¹

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Abstract:

Mātauranga Māori refers to the traditional knowledge of Aotearoa / New Zealand's indigenous people. Its purpose is to preserve culture and improve quality of life over time, by shaping identity and relationships with the natural environment. As a knowledge system, mātauranga is dynamic - integrating traditional and contemporary insights; multidisciplinary - reflecting practices of environmental stewardship and economic development; and holistic - encompassing human, natural, and spiritual realms.

New Zealand's Antarctic Science Platform (ASP) is placing a major emphasis on increasing Māori participation and investing in Māori-led research, using wānanga (structured discussions / workshops) to grow Māori participation and capability. Our ultimate aspiration is to successfully weave mātauranga Māori and biophysical science together, while respecting Māori sovereignty over their own data.

Here we present an overview of how these aspirations are being practically implemented in the ASP – a seven-year programme that forms the core of New Zealand’s Antarctic research portfolio. This includes embedding tikanga (correct practices) across the ASP programme; uplifting our research community in te ao Māori (Māori worldview); and designing new mechanisms for co-development of new projects to meet Māori needs such as timely provision of information for decision-making and building indigenous capability in Earth & Antarctic sciences. Three workstreams have been designed to give effect to these:

1. Design and implement a Māori-led research programme informed by Māori priorities and guided by the central research themes:

- whakapapa (history & heritage)
- kaitiakitanga (responsibilities and obligations)
- whanaungatanga (Māori participation)
- rangatiratanga (implications of change for Māori)
- auahatanga (innovation)

2. Identify and support research capability pathways for Māori through educational initiatives, scholarships, field-based learning, mentoring, and kaupapa Māori-aligned STEM initiatives.

3. Create tailored communication solutions to strengthen two-way research dissemination and knowledge transfer with Māori communities, other end-users, and wider audiences.

7. Linking phytoplankton diversity with bio-optical properties in the Ross Sea

Authors: Dr Antonia Cristi¹, Dr Matt Pinkerton¹, Mark Gall²

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Abstract:

Phytoplankton are a fundamental component of the marine food web and global elemental cycles; therefore, monitoring phytoplankton biomass and taxonomic composition is crucial for understanding shifts in the biological carbon pump and predicting ecosystem response to climate change. There is currently a need to better link in-situ measurements of bio-optical properties with phytoplankton taxonomy in order to improve our understanding of large-scale trends in biomass and phytoplankton functional group derived by remote sensing. This issue is particularly important in the Southern Ocean due to limited sampling. Here, we present high-resolution underway data collected during two summer voyages (2019 and 2021) from New Zealand to the Ross Sea. Sampling was conducted every six hours and spanned subtropical, subantarctic, and Antarctic waters. Continuous surface seawater measurements of bio-optical properties, including spectral absorption coefficients, were integrated with discrete sampling to assess DNA-based taxonomy, phytoplankton functional groups via high-performance liquid chromatography (HPLC) pigment analysis, and size structure based on size-fractionated Chlorophyll-a and flow cytometry. By integrating pigment, genetic, optical, and size-resolved observations, this study aims to provide a comprehensive description of phytoplankton community transitions from temperate to polar waters. The results will contribute to improved understanding of the Ross Sea ecosystem and support efforts to link better phytoplankton functional diversity with satellite observations.

8. SCARFISH: a new SCAR Action Group to coordinate Antarctic fish research

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Abstract:

SCARFISH is a new SCAR Action Group created to bring together the Southern Ocean fish research community around three aims: 1) Identify and address Southern Ocean fish knowledge gaps through coordinated and inclusive collaboration; 2) Integrate the SCAR community's expertise on Southern Ocean fish and the research needs of conservation and management bodies (e.g., the Commission for the Conservation of Antarctic Marine Living Resources, CCAMLR) to achieve their conservation objectives; and 3) Broaden the diversity of researchers engaged in Southern Ocean fish research. Since our establishment following the 2024 SCAR Open Science Conference, we have launched seven Working Groups based on community-driven interest and engagement:

- 1) Horizon Scan;
- 2) Biology and Life History;
- 3) Biogeography, Modelling, and Management tools;
- 4) Genomics, Physiology, and Pathology;
- 5) Fieldwork;
- 6) Data; and
- 7) Outreach.

In this presentation, we will discuss the goals, ongoing work, and outputs of each Working Group, in addition to activities and outputs of the wider Action Group (e.g., an opinion piece in a special issue of the Journal of Fish Biology on polar fish, as well as participation in CCAMLR meetings and in an International Union for Conservation of Nature (IUCN) Red List Workshop on Southern Ocean fish). We will also highlight opportunities for new members of the SCAR community to join SCARFISH, either through our mailing list or through our Working Groups. Finally, we will outline our planned timeline through 2028 and envisioned progression to Expert Group status, as part of our continuing goal to advance and integrate fish research with conservation and management.

9. Extending the satellite-based estimation of primary production by sea ice algae

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Abstract:

Sea ice algae in the Southern Ocean have strong ecological and biogeochemical significance, providing a lipid-rich food-resource and promoting carbon transfer to the seabed. Climate change is leading to substantial changes in sea ice formation and melt around Antarctica and this could

dramatically alter the quantity and timing of primary production by sea ice algae. In turn, this could affect many “keystone” Antarctic species such as krill and Antarctic silverfish, whose life cycles are intimately linked to sea ice and its algae, and their predators.

Biogeochemical modelling of sea ice algae is advanced, but recent changes to sea ice around Antarctica are currently poorly captured by sea ice models, making it challenging to understand the wider biological response. Our previous work has showed that a simple satellite-based approach of combining ice concentration, incident irradiance and surface albedo to estimate light intensity within sea ice closely matched estimates of epontic primary production from advanced biogeochemical models. This satellite-based approach provided month-specific, spatially-resolved estimates of primary production by sea ice algae over the period of satellite observation (1987–2017).

Here, we extend the light-based index of primary production by sea ice algae in three ways. First, we advance this approach from the month to the daily scale so that the spatially-heterogeneous alterations to the phenology (timing) of sea ice algae growth can be resolved in more detail. Second, we extend our analysis from 2017 to the present day by using alternative sources of satellite data. Third, we provide more validation of the satellite-based light index approach using in situ measurements and new biogeochemical models. Finally, in this presentation we consider how AI and new technology, including autonomous seacraft, could help improve our understanding of primary production by sea ice algae in the future.

10. Autocorrelation and affordability: how subsampling can help the SCAR Southern Ocean Continuous Plankton Recorder Survey to endure and expand

Authors: Dr Matthew H Pinkerton^{1,2}, Dr Svenja Halfter¹, Ms Karen V Robinson³, Dr John A Kitchener^{4,5}, Dr Kunio T Takahashi⁶, Dr Graham W Hosie⁷

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Abstract:

Monitoring zooplankton is critical as they are the main trophic link between primary producers and higher trophic levels, and they also facilitate the transfer of carbon to the deep ocean through respiration, excretion, egestion and death. The SCAR Southern Ocean Continuous Plankton Recorder (SO-CPR) survey was established in 1991 to characterise and track change in zooplankton in the Southern Ocean. Comprising 55,245 zooplankton samples from 911 CPR tows over a total of 276,308 nautical miles, this is one of the longest and most extensive biological sampling efforts in the world. Microplastic sampling from the SO-CPR commenced in 2008 for the Pacific Sector and here the data show that microplastic pollution is increasing and may be affecting zooplankton.

The SO-CPR survey is under pressure due to the squeeze on research budgets. Analysing SO-CPR samples in the laboratory is time-consuming and therefore expensive. Unlike in the North Atlantic CPR time-series, every 5 nautical mile sample of zooplankton collected from the Southern Ocean is analysed. Can subsampling help to reduce the cost? In this study we investigated the effect of 2:1, 3:1 and 5:1 subsampling on SO-CPR data quality.

Our study found that higher-abundance zooplankton groups were highly autocorrelated so that subsampling led to little loss of information. Lower-abundance zooplankton groups were less autocorrelated and subsampling consequently led to some loss of information, but only minor biases. Microplastic abundances had very low autocorrelation, but subsampling did not substantially bias mean abundances or trends. We conclude that 2:1 subsampling of SO-CPR samples will lead to little loss of information on both mean abundances (25 nautical mile scale) or trends (5° scale), whilst potentially reducing laboratory analysis costs substantially. Lower analysis

costs will help the SO-CPR survey maintain current regular transects and expand into under-sampled areas of the Southern Ocean in the future.

11. Southern Ocean Fish Modelling: A Community-Led Review of Approaches, Tools and Future Directions

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Abstract:

Marine Ecosystem Models (MEMs) have become a crucial tool for understanding, testing and integrating our knowledge of ecosystems. Whether simple or complex, data-driven or theory-based, spatially explicit or process-oriented, MEMs provide frameworks for representing ecological systems and exploring their responses to variable environmental conditions. MEMs also allow us to project likely ecosystem responses to climate change, thus giving us the opportunity to develop adaptive management plans and conservation measures. Research using models to investigate the role of fish in ecosystems is burgeoning, with particular focus on ecosystem responses to the combined pressures of fishing and climate change. The proliferation of modelling approaches, spanning multiple methods and spatio-temporal scales, has created an increasingly complex research landscape.

Through the newly established SCAR Fish Action Group (SCARFISH), the Southern Ocean fish modelling community aims to provide guidance for comparing and selecting MEMs suited to the needs of researchers, resource managers, policy makers, and conservation practitioners. To this end, the SCARFISH Biogeography, Modelling and Management (BMM) Working Group is co-developing a community-led review of Southern Ocean fish models that synthesises the current state of play, available tools, best practices, and key challenges, while identifying priority directions

for future research. This review is intended as a practical resource for these stakeholders, particularly for work on fish distributions, population dynamics, ecosystem processes, and responses and resilience to variability and change in the Southern Ocean. In this presentation, we provide an overview of the review process and its core components, and synthesise key findings emerging from this community effort. We also aim to stimulate discussion on priorities for future SCARFISH BMM Working Group activities and to encourage broad and diverse engagement from the Southern Ocean research community.