Paper No: 15	**Agenda item: 8.3**
SCAR SG	PSG
Person Responsible:	David Bromwich

SCAR Delegates Report 2020

Physical Sciences Group (PSG) 2018-20 Report

Summary

Report Author(s)

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Summary of activities from 2018-20

Near-term Variability and Prediction of the Antarctic Climate System (AntClimNow) Proposal Planning Group sponsored by PSG. Submitted its proposal to SCAR to be a Scientific Research Program on May 31, 2020.

Radio Sciences Research on AntarCtic AtmosphEre (**RESOURCE**). Proposal Planning Group proposal submitted March 2020.

Year of Polar Prediction in the Southern Hemisphere (**YOPP-SH**), partially supported by and certainly facilitated by SCAR, successfully completed its Special Observing Period, November 2018-February 2019.

Recommending termination of PACT AG (long past its wind-up date) and SnowANT AG (no activity). Remote Sensing AG requests a merge with Earth Observation AG who agrees. These are good developments as PSG has too many subgroups and reduces the budding overlap between subgroups.

Summary Budget 2019 to 2022

	2019	2020	**2021**	**2022**
	Allocated/Spent	Allocated/Spent	Request	Request
(US$)	32,500/11,187	28,500/5,580	32,500	28,500

Progress to date

Sub-group Outcomes to date

(*List all sub-groups [Expert, Action and other Groups] with one to three sentence summary of major activity or outcome*)

Sub-group	Activity/Outcome
ACCE EG	Awaiting report by Peter Convey of BAS. Former lead John Turner has stepped down from SCAR responsibilities.
ANTOS EG Joint with Life Sciences and Geosciences	Very active with proposed activities. Sites established and lots of coordination meetings.
ASPeCT EG	Continuing with their underway sea-ice description database. Online workshop July-August 2020.
EO EG	Very active with meetings. Antarctic place names proposed.
FRISP EG	Annual in-person research meetings in 2018 and 2019. Online meeting in June 2020.
GRAPE EG, Joint with Geosciences	Preparation and submission of RESOURCE Proposal Planning Group, submitted March 2020. Online workshop July 2020.
IPICS EG	Working on Oldest Ice drilling initiative. Open Science Conference delayed from October 2020 to October 2021.
ISMASS EG	Online session at European Geophysical Union in May 2020 on ice sheets and sea level.
OpMet EG	Actively monitoring weather and climate observations from the Antarctic. Participating in discussions on establishing an Antarctic Regional Climate Center.
SORP EG	Very active with meetings and publications.
ACA AG	Annual in-person research meetings held in 2018 and 2019. Online session planned for 2020.
ANGWIN AG	Active with meetings.
AntArchitecture AG Joint with Geosciences	Busy with meetings, papers and research.
PACT AG	Working on papers. Needs to be wound up as long past its expiration date.
Remote Sensing AG, Joint with Life Sciences	Requests a merger with Earth Observation EG who agrees. Great development to reduce the number of groups under PSG.
SnowANT AG	Inactive.
TATE AG	Active with meetings.

Sub-group Cash Flow

(From previous Delegates meeting to date)

Sub-group	Allocation	Amount spent 2018	2019	2020
ACA	2000		0	0
ACCE	4000		0	0
ANGWIN	3000		1561	0
AntArchitecture	2000		0	0
ANTOS	3600		0	0
ASPeCt	5400		0	5400
FRISP	3600		1693	180
GRAPE	4500		0	0
IPICS	6300		6300	0
ISMASS	4500		0	0
Earth Obs.	3000		0	0
OpMet	3600		756	0
Remote Sensing	2000		0	0
PACT	1000		0	0
SnowAnt	2000		0	0
SORP	3600		0	0
TATE	2000		877	0
Miscellaneous	4900		0	0

Future plans

Sub-group future plans

(*List all sub-groups [Expert, Action and other Groups] with one to three sentence summary of future plans*)

Sub-group	Planned activity
ACA	Develop a database of cloud, aerosol and precipitation observations, initially as metadata.
ACCE	ACCE update paper for a refereed journal
ANGWIN	Workshop planned for 2021
AntArchitecture	Building database of englacial layers/slopes across West and East Antarctica – papers and open access repository
ANTOS	ANTOS prospectus developed describing the purpose and value of ANTOS to potential funders. Database meeting – final design and implementation.
ASPeCt	Continuing development of the ASPeCt ship-based observation system and database for sea ice measurements taken by remote vessels (airborne and under ice), ship-based instruments and surface-based instruments and sampling.
FRISP	Annual in-person research meetings will be resumed when feasible.
GRAPE	Sessions at meetings, review paper submitted, web management and updating.

IPICS	Third Open Science Conference, Switzerland, October 2021
ISMASS	Workshop on recent ice-sheet changes planned in summer/autumn 2021 in Lincoln, UK / review paper. Organizing ISMIP6 that is designed to deliver projections of the ice sheet contribution to sea level rise.
Earth Obs.	ESA Earth Obs. for Polar Science Workshop, October 2020 – Write a scientific roadmap for major science challenges in the Polar regions that can be tackled using EO data. Coordinate with an Arctic focussed team to propose a complimentary IASC EO Working Group.
OpMet	Maintain website, update READER, continue implementing an Antarctic Regional Climate Centre.
Remote Sensing	Integration of remote sensing AG into the Earth Observation Action Group.
SORP	Holding regular telecons, planning next EG meeting (SORP-14) in 2021 along with workshop on sea ice fluxes.
TATE	Workshop in Malaysia and a session in Asian Forum for Polar Science in 2021.

Sub-groups recommended for closure

(*Provide full name, current leads, and brief explanation for closure*)

Sub-group	Leaders	Reasons for closure
PACT AG	Andrew Klekociuk and Gennadi Milinevsky	Way past its termination date.
SnowANT AG	Ghislain Picard	Inactive
Remote Sensing AG	Osama Mustafa and Hans-Ulrich Peter	Requests merge into EO AG who agrees.

New sub-groups being proposed

(*Provide full name, proposed leads, and cross-reference to establishment document*)

Sub-group	Leaders	Cross-reference SCAR Delegates WP
Antarctic Subglacial Environment Exploration (ASEE) joint SCAR Expert Group (Geosciences, Physical Sciences, and Life Sciences)	Pavel Talalay	

Scientific Research Programme Planning Groups

Radio Sciences Research on AntarCtic AtmosphEre

Lead Proponents: Lucilla Alfonsi (Italy), Nicolas Bergeot (Belgium

Contributors: Adriana Gulisano (Argentina), Fabien Darrouzet (Belgium), Eric Pottiaux (Belgium), Roeland Van Malderen (Belgium), Emilia Correia (Canada), P. T. Jayachandran (Canada), Guozhu Li (China), PR Shreedevi (ECR, China), Kirsti Kauristie (Finland), Edith Macotela (ECR, Finland), Jean Lilensten (France), Georg Heygster (Germany), Tanja Fromm (Germany), Janos Lichtenberger (Hungary), Giorgiana De Franceschi (Italy), Federica Marcucci (Italy), Federica Marcucci (Italy), Monia Negusini (Italy), Changsup Lee (ECR, Korea), Wojciech Jacek Miloch (Norway), Irina Zakharenkova (Russia), Pierre Cilliers (South Africa), Michael Kosch (South Africa), Stefan Lotz (South Africa), Mark Clilverd (UK), Iurii Cherniak (USA), Jade Morton (USA), Shasha Zou(ECR, USA).

Description:

The RESOURCE SRP aims to improve the current knowledge of the Antarctic atmosphere, also in relation to the Arctic environment in a bi-polar framework, achieved through the use of radio sensors and supported by complementary instrumentation. These measurements are obtained both through instruments principally designed for atmospheric observation and through ancillary observations extracted from other instrumentation such as magnetometers. Currently, several instruments working on radio and optical frequencies are extensively used to probe the atmosphere. These instruments include VLF, VHF, UHF, and HF active and passive devices, GNSS receivers, radio beacons, radiometers and microwave humidity sounders on satellites. Used independently and in combination, these devices have contributed significantly to the advancement of the understanding the physics of the neutral and ionized atmosphere. However, several questions remain open and need to be addressed with a synergistic approach requiring the involvement of various research groups in the field. The GRAPE Expert Group is one example of how synergy among the Antarctic sciences can be applied to gathering important scientific data for a number of applications from GNSS measurements.

While the users of radio devices often consider the atmospheric contribution to their radio measurements as a source of error that needs to be corrected, deleted, or mitigated, **atmospheric scientists who rely on radio techniques have a common interest: to isolate the atmospheric contribution and use it in the study of the near-earth space environment.**

RESOURCE aspires to such common goal to pursue three main scientific objectives:

1. To monitor the polar atmosphere
2. To investigate and better understand the polar atmosphere physics;
3. To support the sciences interested in removing the atmospheric contribution from their observations or mitigating the negative impact of atmospheric contributions to their observations.

Delegates meeting WP: *(not yet available)*

Budget

Planned use of funds for 2020 to 2022

(*one row per sub-group or other activity)*

Note these requests have been confused by the Covid-19 pandemic and the cancellation of the SCAR OSC in Hobart during 2020 and represent the best estimates during a time of high uncertainty. How the issue of unspent funds from 2019-2020 plays into these requests is not taken into account.

Year (YYYY)	Purpose/Activity	Amount (in USD)	Contact Name	Contact Email
2021-2022	ACA/Database development	3000	Tom Lachlan-Cope	tlc@bas.ac.uk
2021-2022	ACCE/Update paper	4000	Peter Convey	pcon@bas.ac.uk
2021-2022	ANGWIN/Meetings	3000	Tracy Moffat-Griffin	tmof@bas.ac.uk
2021-2022	AntArchitecture/Meetings	4000	Robert Bingham	r.bingham@ed.ac.uk
2021-2022	ANTOS/Meetings	3000	Craig Cary	caryc@waikato.ac.nz
2021-2022	ASPeCt/Meetings	5000	Marilyn Raphael	raphael@geog.ucla.edu
2021-2022	FRISP/Annual Workshop	3000	Adrian Jenkins	ajen@bas.ac.uk
2021-2022	GRAPE/Meetings	5000	Giorgiana de Francheschi	Giorgiana.defranceschi@ingv.it
2021-2022	IPICS	0	Tas van Ommen	Tas.Van.Ommen@awe.gov.au
2021-2022	ISMASS/two workshops	5000	Frank Pattyn	fpattyn@ulb.ac.be
2021-2022	Earth Obs/Meetings	4000	Anna Hogg	A.E.Hogg@leeds.ac.uk
2021-2022	OpMet/Meetings	4000	Steve Colwell	src@bas.ac.uk
2021-2022	Remote Sensing/SCAR OSC	2000	H.-U.Peter	bpe@uni-jena.de
2021-2022	SORP/Meetings	6000	Torge Martin	torge.martin@gmail.com
2021-2022	TATE/Meetings	4000	Sheeba Nettukandy Chenoli	sheeba@um.edu.my
2021-2022	Miscellaneous/ECR Activities	6000	David Bromwich	bromwich.1@osu.edu
TOTAL		61,000		

Membership

Leadership

Role	First Name	Last Name	Affiliation	Country	Email	Date Started	Date Term is to End
CO	David	Bromwich	Ohio State Univ.	USA	bromwich.1@osu.edu	2012	2020
Deputy-CO	Adriana	Gulisano	Dirección Nacional del Antártico	Argentina	adrianagulisano@gmail.com	2016	2020
Secretary	Steven	Colwell	British Antarctic Survey	UK	src@bas.ac.uk	2012	2020

*Please identify early-career researchers with * in first column*

Other members
See https://www.scar.org/science/psg/contact/

First Name	Last Name	Affiliation	Country	Email

*Please identify early-career researchers with * in first column*

Additional information (optional)

Please add any more detail here that you wish, on subgroup activities, papers published, etc, since the SCAR Delegates meeting in 2018.

Notable Papers
(*Five to ten most notable papers – see the example below, which includes a brief statement (shaded) indicating the link to the group*)

See EG and AG annual reports for notable papers.

Direct support from outside organisations received for your activities
(*Numbered list with values indicated if direct cash support. Please restrict in-kind support to substantive in-kind support only*)

The groups EGs and AGs under PSG receive support from a wide variety of international organizations that greatly leverage the modest funding allocated by SCAR.

Major collaborations your Science Group has with other SCAR groups and with organisations/groups beyond SCAR
(*Numbered list of substantive collaborations*)

Within SCAR

1. All groups within SCAR interact with PSG entities.

Outside SCAR

1. PSG EGs and AGs vigorously interact with the global scientific community.

Outreach, communication and capacity-building activities

See EG and AG annual reports for details.

SCAR Fellowship Reviewers
Please list one or more people (name and email address) from your SG who would be willing to serve as reviewers for the next few years, along with 1-3 keywords on their principal expertise.

First Name	Last Name	Email	Principal Expertise
David	Bromwich	Bromwich.1@osu.edu	Climate and weather
Adriana	Gulisano	adrianagulisano@gmail.com	Upper atmosphere
Steven	Colwell	src@bas.ac.uk	Operational Meteorology

Standing Scientific Group - Geosciences (including biogeochemistry)

1. Principal UK Researchers	Claire Allen, Amber Annett, Stephen Barker, Mike Bentley, Robert Bingham, Ian Hall, Katharine Hendry, Sian Henley, Claus-Dieter Hillenbrand, Kelly Hogan, Joanne Johnson, Tom Jordan, David Pearce, Victoria Peck, Teal Riley, Stephen Roberts, James Smith, Geraint Tarling
2. Major activities and progress since previous year involving UK personnel/infrastructure	Thwaites project update pending. See separate reports for SOOS and AntVolc.
3. Major future initiatives and actions involving UK personnel/infrastructure	A new National Capability project – BIOPOLE – has just started, formed from a consortium of 5 NERC institutes: the British Antarctic Survey (BAS), National Oceanography Centre (NOC), UK Centre for Ecology and Hydrology (UKCEH), British Geological Survey (BGS) and Centre for Polar Observation and Modelling (CPOM), led by Geraint Tarling at BAS. The aim of BIOPOLE is to understand how sea-ice loss and glacial melting in polar regions affect the chemical balance of the oceans and, in particular, their capacity to sequester carbon and to support ocean productivity. The project will combine field sampling, including the use of autonomous technology, and modelling efforts. BIOPOLE received £8.9M, started on 1st April 2022 and is funded for 5 years.
4. Policy outcomes	
5. Selected publications	*Gohl, K., Uenzelmann-Neben, G., Gille-Petzoldt, J., Hillenbrand, C. D., Klages, J. P., Bohaty, S. M., ... & IODP Expedition 379 Scientists. (2021). Evidence for a highly dynamic West Antarctic Ice Sheet during the Pliocene. Geophysical Research Letters, 48(14), e2021GL093103.* *Starr, A., Hall, I. R., Barker, S., Rackow, T., Zhang, X., Hemming, S. R., ... & Ziegler, M. (2021). Antarctic icebergs reorganize ocean circulation during Pleistocene glacials. Nature, 589(7841), 236-241.* *Hodson, A. J., Sabacka, M., Dayal, A., Edwards, A., Cook, J., Convey, P., ... & Pearce, D. A. (2021). Marked seasonal changes in the microbial production, community composition, and biogeochemistry of glacial snowpack ecosystems in the maritime Antarctic. Journal of Geophysical Research: Biogeosciences, 126(7), e2020JG005706.* *Tetzner, D. R., Allen, C. S., & Thomas, E. R. (2022). Regional variability of diatoms in ice cores from the Antarctic*

	Peninsula and Ellsworth Land, Antarctica. The Cryosphere, 16, 779-798. *Johnson, J. S., Venturelli, R. A., Balco, G., Allen, C. S., Braddock, S., Campbell, S., ... & Woodward, J. (2022). Existing and potential evidence for Holocene grounding line retreat and readvance in Antarctica. The Cryosphere, 16(5), 1543-1562.* *Chadwick, M., Allen, C. S., Sime, L. C., Crosta, X., & Hillenbrand, C. D. (2022). Reconstructing Antarctic winter sea-ice extent during Marine Isotope Stage 5e. Climate of the Past, 18(1), 129-146.* *Adams, J. R., Johnson, J. S., Roberts, S. J., Mason, P. J., Nichols, K. A., Venturelli, R. A., ... & Rood, D. H. (2022). New 10 Be exposure ages improve Holocene ice sheet thinning history near the grounding line of Pope Glacier, Antarctica. The Cryosphere Discussions, 1-27.* *Stokes et al., (in press – currently under embargo) Response of the East Antarctic Ice Sheet to Past and Future Climate Change, Nature*
6. Funding awards	National Capability Long Term Science (NC-LTS) program BIOPOLE (approx.. £8M).
7. Points for discussion at UKNCAR meeting	

UKNCAR Report: SCAR Ant-ICON - Integrated science to inform Antarctic and Southern Ocean Conservation

Antarctic and Southern Ocean environments are facing increasing pressure from multiple threats. The Antarctic Treaty System regularly looks to the Scientific Committee on Antarctic Research (SCAR) for the provision of independent and objective advice based on the best available science, to support decision-making, policy development and effective environmental management. The recently approved SCAR Scientific Research Programme Ant-ICON – *'Integrated Science to Inform Antarctic and Southern Ocean Conservation'* – will facilitate and coordinate high-quality transdisciplinary research to inform conservation and management of Antarctica, the Southern Ocean and the sub-Antarctic in the context of current and future impacts. The work of Ant-ICON focuses on three Research Themes examining (i) the current state and future projections of Antarctic systems, species and functions, (ii) human impacts and sustainability, (iii) socio-ecological approaches to Antarctic and Southern Ocean conservation, and one Synthesis Theme offering a synthesis of the research results specifically for decision-making and policy development purposes. Research outputs will address environmental challenges facing Antarctica and will offer the best available science to policy and advisory bodies including the Antarctic Treaty Consultative Meeting (ATCM), the Committee for Environmental Protection (CEP) and the Scientific Committee for the Conservation of Antarctic Marine Living Resources (SC-CAMLR).

1. Principal UK Researchers	Kevin Hughes (BAS), Jasmine Lee (BAS), Adrian Howkins (Bristol University),
2. Major activities and progress since previous year involving UK personnel/infrastructure	• The Ant-ICON Steering Committee has been established and preparations made for the establishment of an Advisory Group to ensure close integration with the rest of SCAR. • An academic paper is currently in review that describes the work and objectives of Ant-ICON. • A logo was developed via a competition for EMCRs. • An Ant-ICON membership directory has been established on the SCAR Ant-ICON page • Social media accounts have been set up and maintained for Ant-ICON on facebook and twitter • Ant-ICON has hosted two online workshops exploring the human dimensions of Antarctic conservation and management that were well attended by colleagues globally
3. Major future initiatives and actions involving UK personnel/infrastructure	• An in-person workshop to advance socio-ecological research objectives is planned for September 2022 at the Scott Polar Research Institute. • A mini-symposium on science to policy communication is planned for the SCAR Open Science Conference in August 2022 • A session is planned for the SCAR Open Science Conference on Human Impacts and Sustainability. • On-line workshops are planned to facilitate environmental reporting • Several academic publications on the science/policy interface are in progress.

4. Policy outcomes	• An Information Paper (IP) was presented at the ATCM's Committee for Environmental in Berlin (May 2022) that highlighted work undertaken at BAS during a SCAR Fellowship through Ant-ICON: United Kingdom and Uruguay. (2022). International response under the Antarctic Treaty System to the establishment of a non-native fly on the South Shetland Islands. Information Paper 25. Antarctic Treaty Consultative Meeting, 23rd May – 2 June 2022, Berlin, Germany. • United Kingdom. (2022). Consideration of climate change within the Antarctic Protected Areas System. Information Paper 22. Antarctic Treaty Consultative Meeting, 23rd May – 2 June 2022, Berlin, Germany.
5. Selected publications	Hughes, Kevin A., Convey, Peter, Turner, John. (2021) Developing resilience to climate change impacts in Antarctica: An evaluation of Antarctic Treaty System protected area policy. *Environmental Science & Policy*, 124. 12-22. 10.1016/j.envsci.2021.05.023 Hwengwere, K., Paramel Nair, H., Hughes, K.A. , Peck, L.S., Clark, M.S., Walker, C.A.. (2022) Antimicrobial resistance in Antarctica: is it still a pristine environment? *Microbiome*, 10. 13 pp. 10.1186/s40168-022-01250-x Remedios-De León, Mónica, Hughes, Kevin A., Morelli, Enrique, Convey, Peter. (2021) International response under the Antarctic Treaty System to the establishment of a non-native fly in Antarctica. *Environmental Management*, 67. 1043-1059. 10.1007/s00267-021-01464-z Pertierra, L.R., Santos-Martin, F., Hughes, K.A., Avila, C., Caceres, J.O., De Filippo, D., Gonzalez, S., Grant, S.M., Lynch, H., Marina-Montes, C., Quesada, A., Tejedo, P., Tin, T., Benayas, J. (2021) Ecosystem services in Antarctica: Global assessment of the current state, future challenges and managing opportunities. *Ecosystem Services*, 49. 16 pp. 10.1016/j.ecoser.2021.101299 Chignell SM, Myers ME, Howkins A, Fountain AG (2021) Research sites get closer to field camps over time: Informing environmental management through a geospatial analysis of science in the McMurdo Dry Valleys, Antarctica. PLoS ONE 16(11): e0257950. https://doi.org/10.1371/journal.pone.0257950 Adrian Howkins, Stephen Chignell, and Andrew Fountain (2021). 'Vanda Station, Antarctica: A Biography of the Anthropocene', Journal of the British Academy, 9(s6): 61–89. DOI https://doi.org/10.5871/jba/009s6.061
6. Funding awards	
7. Points for discussion at UKNCAR meeting	

INSTANT report June 2022

Mike Bentley, Liz Thomas, Claus-Dieter Hillenbrand

8. Principal UK Researchers	**Non-exhaustive list:** Bentley, Jamieson, McClymont, Paxman, Whitehouse (Durham) Hillenbrand, Thomas, Larter, Sime, Hogan, Smith, Hodgson, Perez, Johnson, Allen, Roberts (BAS) Siegert, Van de Flierdt (Imperial) Bingham, Hein (Edinburgh) Silvano (NOC)
9. Major activities and progress since previous year involving UK personnel/infrastructure	INSTANT is still developing action plans and writing review/white papers across a broad range of research areas. There are three themes (1) Atmosphere-Ocean-Ice interactions, (2) Earth-ice interactions and (3) Stakeholder-Science interactions, and collectively 11 sub-committees. UK has representation on the steering committee – Thomas (committee member) and Bracegirdle (representing AntClimNow). Theme 1 is Co-led by UK researchers (Thomas and Silvano). Several of the sub-committees have UK leadership involvement (e.g. Jamieson leads Antarctic Geological Boundary Conditions (ABC)) and there is UK involvement in every sub-committee, either as a member or steering committee member. INSTANT has a high proportion of ECRs, including in lead roles. Website launched - https://www.scar-instant.org/ Theme 1 seminar series launched – bi-monthly talks relating the Atmosphere-Ocean-Ice interactions. Talks online (https://www.youtube.com/channel/UCY-Jo9slQ2Lxqc-pt09IWuw?app=desktop). **Marine cruises:** The ITGC cruise of *NB Palmer* to the Thwaites and Dotson area took place in Feb-Mar 2022 with UK and US researchers who are involved in the INSTANT sub-committee Southern Ocean-Antarctic Chronology and Environmental Proxies (SOACEP) participating as shipboard and shorebased scientists on behalf of the the ITGC project THwaites Offshore Research (THOR) UK and German researchers involved in SOACEP also participated as shipboard and shorebased scientists in cruise PS128 with RV “Polarstern” to the East Antarctic margin (Weddell Sea to Prydz Bay)

	GLAcial Sedimentation School (GLASS): Interpreting past climate using Antarctic and Greenland sediment cores. Summer school in US, with UK participants (e.g. Damm-Johnsen) **Conferences:** INSTANT co-hosted EGU session G3.3 "Linking ice sheets, solid Earth and sea levels – observations, analysis and modelling of glacial isostatic adjustment" (May 2022)
10. Major future initiatives and actions involving UK personnel/infrastructure	Under Theme 1, there are planned white papers on ways forward for SOACEP (i) chronology and (ii) proxies, whilst a recent meeting of ABC started to outline some potential contributions around reconstructions of past ice sheet extent, flow directions, sediment distribution and the like. Probing the Solid Earth is seeking to run a workshop later in 2022 on future maintenance of GNSS networks in Antarctica. - -Clip-Ant (Climate Ice Sheet Processes in Antarctica, theme 1 INSTANT) workshop in September (date tbc) Topics: ice-sheet earth system model coupling to investigate LIG, ice shelf stability, ice-ocean interaction. An in-person INSTANT conference is being planned for September 2023. Plans being finalised and will be announced soon.
11. Policy outcomes	The UKNCAR white paper is in the INSTANT space: Bentley, M. et al. (2021) The future of UK Antarctic science: strategic priorities, essential needs and opportunities for international leadership, Grantham Institute Discussion Paper 9, 10pp, Imperial College London. Doi: https://doi.org/10.25561/9218.
12. Selected publications	The Uncertain Future of Antarctica's Melting Ice, *Eos*, Jan 2022 INSTANT, co-authored by Whitehouse) Stokes et al., (in press) Response of the East Antarctic Ice Sheet to Past and Future Climate Change, *Nature* IBCSO bathymetry released (https://www.bbc.com/news/science-environment-56424338). Many UK scientists (including R Larter, K Hogan, Silvano, A Fremand, H Pritchard, A Tate, P Fretwell, H Snaith, P Weatherall)
13. Funding awards	

14. Points for discussion at UKNCAR meeting	*The lack of in-person meetings means it can be very difficult to keep track of the full gamut of activity in INSTANT across 11 sub-committees, some of which have already sub-divided their work due to the breadth of scope. Progress in developing white papers etc should accelerate when we have the business meetings around the SCAR OSC in August 2022 as well as starting to meet around the fringes of the growing number of in-person meetings that are starting to revive. In-person meetings are considered as essential not only in terms of efficacy but also because their virtual counter parts have to be restricted in duration due to the requirement of spanning all time zones and they bear the danger of being exclusive due to the technical constraints on active participation* *Special issue planned (The Cryosphere and Climate of the Past) – UK led papers already proposed but other papers will be welcome.* *Theme 1 seminar series- next talk 6th July. Volunteers always welcome (contact Liz (lith@bas.ac.uk)*

UKNCAR report on the SCAR Scientific Research Programme Near-term Variability and Prediction of the Antarctic Climate System (AntClimNow)

1. Principal UK Researchers	Tom Bracegirdle, co-chair Rachel Cavanagh (BAS), Steering Committee member Liz Thomas (BAS), Steering Committee member
2. Major activities and progress since previous year involving UK personnel/infrastructure	AntClimNow (https://www.scar.org/science/antclimnow/home/) will investigate prediction of near-term conditions in the Antarctic climate system on timescales of years to decades. These time scales are highly relevant across multiple disciplines and to a range of key stakeholders, whilst aligning strongly with scientific priorities identified as part of the SCAR Horizon Scan. After being approved at the start of 2021, there are a number of AntClimNow activities now in progress. Key points are: 1. Monthly science talks are a successful activity for engaging membership and the wider community. 2. This year AntClimNow is sponsoring two international workshops and co-sponsoring a session at a third workshop. a. The AntClimNow-funded Firn Workshop is taking place currently (end of June 2022), see https://www.colorado.edu/lab/icesheetclimate/firn-workshop. b. A workshop on improving the use of observational data in modelling of the Antarctic climate system will take place at BAS in September 2022. c. AntClimNow are co-sponsoring a polar session at the atmospheric rivers conference in Chile in October 2022, see https://cw3e.ucsd.edu/iarc2022_ars_and_polar_meteorology_and_climate/ 3. The membership is continuing to grow. There are members based in 21 different countries, illustrating the strong international dimension. Eleven are based in the UK. 4. Three data stewardship and development grants have been awarded. The aim of this is to improve accessibility and coordination of climate related data. 5. Current initiatives in development include: a. An effort to compile a list of Antarctic Climate Indicators, to provide an easily-accessible snapshot of the current state of the Antarctic Climate System. b. Develop an annual update of science relevant to AntClimNow. In this first year the initial aim is an

	internal document, but with scope to expand to a more widely-disseminated document in future years.
6. Major future initiatives and actions involving UK personnel/infrastructure	The September workshop noted above will take place at BAS headquarters in Cambridge.
7. Policy outcomes	None as yet.
8. Selected publications	None at this early stage in the project.
9. Funding awards	None
10. Points for discussion at UKNCAR meeting	

UKNCAR Reporting - IPICS

1. Principal UK Researchers	Liz Thomas, Eric Wolff, Rob Mulvaney, Thomas Bauska, Rachael Rhodes
2. Major activities and progress since previous year involving UK personnel/infrastructure	IPICS conference planning – four yearly meeting for the international ice core community to be held in Crans-Montana, October 2022. Over 300 abstracts submitted. Large UK presence in the presentations and organising committee. Beyond EPICA oldest ice (BE-OI) –First season of drilling started in 2021/22, international team (no UK participants). Retrieved 107 m firn core, placement of a fluid-tight casing. Rapid access drilling (RADIX) reached a depth of 322 m. BE-OI ExCom meeting in Venice, April 2022. Consortium and ExCom meeting attended by UK participants in person and virtually. Eric Wolff, Rob Mulvaney, Louise Sime, Liz Thomas, Christoph Nehrbass-Ahles, Thomas Bauska, Rachael Rhodes. SIWHA drilling project funded – New ice core collaboration between UK-India, and Norway to retrieve a 500 m ice core from coastal Droning Maud Land. NERC funded component, "Sea Ice and Westerly wind in the Holocene in coastal Antarctica to better constrain CO2". UK research team – Liz Thomas (PI), Thomas Bauska, Racheal Rhodes, Dieter Tetzner, Julius Rix, James Veale, Diana Vladimirova, Jack Humby.UK research team – Liz Thomas (PI), Thomas Bauska, Rachael Rhodes, Dieter Tetzner, Julius Rix, James Veale, Diana Vladimirova, Jack Humby. WACSWAIN – For the Skytrain Ice Rise core, the age model is almost complete and shows that the core contains most of the last interglacial in good order. This is being interpreted in terms of the stability of the Ronne Ice shelf and WAIS in the last interglacial. The second WACSWAIN core at Sherman island reaches beyond 1000 years and will make a contribution to the IPICS2K project for a site near to the vulnerable Amundsen Sea glaciers. The data and core will provide a resource for many other projects. UK research team – Eric Wolff (PI), Sentia Goursaud, Mackenzie Grieman, Helene Hoffmann, Christoph Nehrbass-Ahles, Rachael Rhodes, Isobel Rowell (U Cambridge), Jack Humby, Amy King, Robert Mulvaney, Julius Rix, Louise Sime, Liz Thomas (BAS).

	Ice core proposed as potential marker for the Anthropocene "GSSP site" – A BAS ice core, drilled in the Antarctic Peninsula, is proposed as one of 12 candidate sites to mark the onset of the Anthropocene. The final data from all 12 sites was presented at a meeting in Berlin, May 2022. The Anthropocene working group will vote in December 2022 to decide which site will be proposed for consideration by the International Commission on Stratigraphy (ICS) and the Subcommission on Quaternary Stratigraphy (SQS). UK research team – Liz Thomas (PI), Daniel Emanuelsson, Diana Vladimirova, Dieter Tetzner, Jack Humby (BAS), Simon Turner & Neil Rose (UCL), Andy Cundy (NOC).
3. Major future initiatives and actions involving UK personnel/infrastructure	IPICS conference – October 2022 SIWHA –Ice core drilling campaigns 2022/23 and 2023/24. BE-OI – ice core drilling campaigns 2022/23, 2023/24 and 2024/25.
4. Policy outcomes	
5. Selected publications	Erhardt, T., (and otherS inc Mulvaney, R., Thomas, E.R.) (2022) High-resolution aerosol concentration data from the Greenland NorthGRIP and NEEM deep ice cores. Earth System Science Data, 14. 1215-1231. 10.5194/essd-14-1215-2022 Grieman, M. M., H. M. Hoffmann, J. D. Humby, R. Mulvaney, C. Nehrbass-Ahles, J. Rix, E. R. Thomas, R. Tuckwell, and E. W. Wolff (2021), Continuous flow analysis methods for sodium, magnesium and calcium detection in the Skytrain ice core, *J. Glaciol.*, *68*(267), 90-100, doi:10.1017/jog.2021.75. Mulvaney, R., J. Rix, S. Polfrey, M. Grieman, C. Martìn, C. Nehrbass-Ahles, I. Rowell, R. Tuckwell, and E. Wolff (2021), Ice drilling on Skytrain Ice Rise and Sherman Island, Antarctica, *Ann. Glaciol.*, *62*(85-86), 311-323, doi:10.1017/aog.2021.7. Tetzner, D R., Thomas, E R., Allen, C S., Permattei, Alma. (2021) Evidence of recent active volcanism in the Balleny Islands (Antarctica) from ice core records. Journal of Geophysical Research: Atmospheres, 126. 20 pp. 10.1029/2021JD035095 Tetzner, Dieter R., Allen, Claire S., Thomas, E R.. (2022) Regional variability of diatoms in ice cores from the Antarctic Peninsula and Ellsworth Land, Antarctica. The Cryosphere, 16. 779-798. 10.5194/tc-16-779-2022 Thomas, ER., Gacitúa, G, Pedro, J B., King, ACF, Markle, B, Potocki, M, Moser, DE. (2021) Physical properties of shallow ice cores from Antarctic and sub-Antarctic islands. The Cryosphere, 15. 14 pp. 10.5194/tc-15-1173-2021
6. Funding awards	IPICS-Several early career travel grants have been awarded to UK recipients NERC-SIWHA [NE/W001535/1] (2022-2027)
7. Points for discussion at UKNCAR meeting	

UKNCAR Reporting - OpMet

8. Principal UK Researchers	Steve Colwell
9. Major activities and progress since previous year involving UK personnel/infrastructure	Contribution of extra radio sonde ascents from Rothera as part of the World Meteorological Organisation Year of Polar Prediction for the Southern Hemisphere (YOPP-SH) Antarctic winter campaign.
10. Major future initiatives and actions involving UK personnel/infrastructure	Create an archive of all of the high-resolution radiosonde ascents for the current YOPP-SH campaign (mid-April – mid-July 2022)
11. Policy outcomes	
12. Selected publications	
13. Funding awards	
14. Points for discussion at UKNCAR meeting	

UKNCAR Reporting June 2022 - AntVolc

15. Principal UK Researchers	*JL Smellie (Leicester), Teal Riley (BAS), Philip Leat (BAS), Alex Burton-Johnson (BAS)*
16. Major activities and progress since previous year involving UK personnel/infrastructure	GeolSocLond **Memoir on 'The geochemistry and geophysics of the Antarctic mantle.**' (Memoir #56); on-track & should be completed by end-July 2022. An illustrated **booklet on Antarctic volcanism**, aimed at primary school-age children, is now completed (outreach activity using SCAR funds to AntVolc during Covid lockdown). *The first of its type for SCAR?*
17. Major future initiatives and actions involving UK personnel/infrastructure	As all the original AntVolc deliverables are complete or near-complete, it is still my intention (planned from the outset of AntVolc) to disband the Expert Group, in line with SCAR policy of retiring groups over time. However, the future of AntVolc shall be discussed with its members, probably late-2022. No action on possible initiative aimed at establishing unequivocally the presence of number & location of subglacial volcanoes beneath the WAIS and potential for affecting ice stability, raised at the UK Antarctic Science Scoping Meeting in March 2021
18. Policy outcomes	**SCAR White Paper:** Planned White Paper review of the present state and future prospects for volcanic studies in Antarctica is late but largely complete. Currently awaiting activity from the AntVolc Chair. The intention is to publish it in a mainstream volcanological journal before the end of 2022. *Another first for a SCAR Expert Group?*
19. Selected publications [in no order]	Hopfenblatt, J., Geyer, A., Aulinas, M., Álvarez-Valero, A.M., Sánchez, A.P., Giralt, S. and **Smellie, J.L.** 2022. DecTephra: A new database of Deception Island's tephra record (Antarctica). Journal of Volcanology and Geothermal Research, 425, 107516; doi.org/10.1016/j.jvolgeores.2022.107516 Sanchez, G., Halpin, J.A., Gard, M., Hasterok, D., Stål, T., Raimondo, T., Peters, S., **Burton-Johnson, A**. (2021) PetroChron Antarctica: A geological database for interdisciplinary use. *Geochemistry, Geophysics, Geosystems*, 22. 14 pp. 10.1029/2021GC010154
20. Funding awards	None
21. Points for discussion at UKNCAR meeting	None

UKNCAR Reporting - SCATS

22. Principal UK Researchers	Dr Susie Grant (SC-ATS Chief Officer), Dr Tom Bracegirdle (SC-ATS Committee Member/Physical Sciences representative) (British Antarctic Survey), Prof Pete Convey (ACCE Report co-author) – plus many contributors from other SCAR groups.
23. Major activities and progress since previous year involving UK personnel/infrastructure	SC-ATS coordinates the provision of SCAR's scientific advice to the Antarctic Treaty System (Antarctic Treaty Consultative Meeting, Committee on Environmental Protection, Commission for the Conservation of Antarctic Marine Living Resources) – drawing upon expertise from across all SCAR programmes and affiliated groups. SCAR participated in the CCAMLR Scientific Committee and Commission meetings (online, Oct 2021) as an invited Observer, and presented papers on ocean acidification, climate change and the Antarctic Environments Portal to the CCAMLR Scientific Committee. SCAR participated in the CEP/ATCM (Berlin, May 2022) as an invited Observer, and presented papers on climate change (ACCE report, Chown et al 2022 – see below), tourism, the UN Decade of Ocean Science, the Antarctic Environments Portal, and Antarctic Fellowship and Scholarship schemes (with CCAMLR, COMNAP and IAATO). During 2021/22, SC-ATS also contributed to CEP Intersessional Contact Groups on i) developing an Action Plan for designation of the emperor penguin as a Specially Protected Species, and ii) the further development of a Climate Change Response Work Programme.
24. Major future initiatives and actions involving UK personnel/infrastructure	Participation in CCAMLR Scientific Committee and Commission meetings (Oct 2022) and CEP/ATCM (May 2023) – ongoing development of advice and provision of information as requested by these bodies on topics including: climate change, emperor penguin specially protected species designation, impact of plastics in polar environments, design of an environmental monitoring programme to assess impacts of tourism, environmental baseline survey methodologies, systematic sampling for chemical contamination, earthquake risk in the Antarctic Peninsula region, non-native species identification, tourism and wilderness values.
25. Policy outcomes	The Antarctic Climate Change and the Environment Decadal Synopsis report (Chown et al., 2022) was widely

	welcomed by the Antarctic Treaty Parties at ATCM XLIV, and resulted in policy actions including endorsement of the ACCE report recommendations, and agreement to hold a full-day joint session of the CEP and the ATCM (with SCAR and COMNAP) in 2023 to further consider their implementation.
26. Selected publications	Chown, S.L., Leihy, R.I., Naish, T.R., Brooks, C.M., **Convey, P.**, Henley, B.J., Mackintosh, A.N., Phillips, L.M., Kennicutt, M.C. II & **Grant, S.M.** (Eds.) (2022) Antarctic Climate Change and the Environment: A Decadal Synopsis and Recommendations for Action. Scientific Committee on Antarctic Research, Cambridge, United Kingdom. https://scar.org/library/scar-publications/occasional-publications/5758-acce-decadal-synopsis/
27. Funding awards	
28. Points for discussion at UKNCAR meeting	

UKNCAR Report: *SCAR Action Group,* AntArchitecture

29. Principal UK Researchers	Robert Bingham (University of Edinburgh; steering committee chair); Neil Ross (Newcastle University; steering commitee); David Ashmore (University of Liverpool); Tom Jordan (British Antarctic Survey); Carlos Martin (British Antarctic Survey); Kate Winter (Northumbria University); Martin Siegert (Imperial College); Julian Dowdeswell (University of Cambridge); Julien Bodart (PhD student, University of Edinburgh); Rebecca Sanderson (PhD student, Newcastle University)
30. Major activities and progress since previous year involving UK personnel/infrastructure	**Precis:** This SCAR Action Group was established in 2018 with the basic remit of developing a continent-wide, age-depth model of Antarctica's ice using the internal layers and surfaces (Antarctica's internal "Architecture") imaged by multiple radar-sounding surveys undertaken across Antarctica over the last five decades. Alongside the UK representatives and members listed above, the full steering committee and core members includes around 40 scientists spread globally. Thanks to SCAR support, a website and mailing list were established, and the website in particular provides much information beyond this short report: https://www.scar.org/science/antarchitecture/home/ **Progress against 4-year goals set in summer 2018** (goals in black**,** progress in red): 1. Years 1-2 (2018-20): Identify with numerical modellers the data formats required to drive models. Identify best format and practices for lodging and sharing data on radar-imaged internal architecture. Converge on standards for metadata and data formats, and nomenclature. Undertake radar-system intercomparison exercises where overlapping areas have been surveyed with different instruments. Develop a document outlining the optimised processing flow for internal layering analysis of different datasets, which will also guide future data collection. 2. Milestone at end of Year 2: Produce a white paper, intended for submission to a relevant interdisciplinary, peer-reviewed journal, e.g. Global and Planetary Change, Climate of the Past, Frontiers of Earth Sciences, outlining the need for an Antarctic radar-layers database, the potential applications, and methods for achieving it. Activities in the bullet points above will underpin this activity. • Many of the datasets and passages of writing were prepared and on track for assembly into the white paper as the pandemic struck. A writing workshop to finalise the paper planned for April 2020 was cancelled, and for much of 2020-21 activity was stalled because the lead convenor had to prioritise pandemic childcare and staff and student welfare at the

	University of Edinburgh as a result of his Head of Institute role. We expect late 2022 will finally provide the opportunity to bring together the group to finalise the white paper. • In the transition from 2021-22 we planned to reconvene (=hold for the first time) our in-person group at EGU in Vienna, but when the assembly changed its dates this prevented us again because many of the group could not attend the revised dates in May. In place of this the group convened online on 8 April 2022 to update each other on some progress with respect to Item 1 above. This was useful, but what we need is to identify time to reconvene as a white-paper writing group (as originally planned for April 2020) and this opportunity does not look likely (due to various steering committee commitments, e.g. to Antarctic fieldwork) until 2023. Years 3-4 (2020-21): Compile the first pan-Antarctic database of ice-sheet stratigraphy from radar internal architecture, in a form suitable for informing numerical models, and informed by ice-core age-depth profiles. • Steady progress being made, exemplified by some publications listed in section 5. • Julien Bodart's secondment to BAS during 2021, part of the initiative to release >20 years of the aerogeophysical data, has contributed particularly through his familiarisation with internal layering throughout various PASIN datasets across West and East Antarctica. Milestone at end of Year 4: Publication of an online dataset and paper reporting the 3D internal architecture of the Antarctic Ice Sheet. • Progress is being made towards this, but the pandemic has essentially caused a major delay to most members' contributions. As a result we are applying to SCAR for a 4-year extension of the Action Group.
31. Major future initiatives and actions involving UK personnel/infrastructure	Future plans reported in section above. No infrastructure required. Good opportunities for some future PhD projects in UK institutions, potentially grant/PDRA opportunities.
32. Policy outcomes	Not at that stage.
33. Selected publications	Ashmore, D.W.; R.G. Bingham, N. Ross, M.J. Siegert, T.A. Jordan and D.W.F. Mair (2020) Englacial architecture and age-depth constraints across the West Antarctic Ice Sheet. Geophysical Research Letters, 47, e2019GL086663. Bodart, J.A.; R.G. Bingham, D.W. Ashmore, N.B. Karlsson, A.S. Hein and D.G. Vaughan (2021) Age-depth stratigraphy of Pine Island Glacier inferred from airborne radar and ice-core chronology. Journal of Geophysical Research, 126, e2020JF005927. Fremand, A.; J.A. Bodart, T.A. Jordan, F. Ferraccioli, C. Robinson, H.F.J. Corr, H.J. Peat, R.G. Bingham and D.G. Vaughan (2022) British Antarctic Survey's aerogeophysical data: Releasing 25

	years of airborne gravity, magnetic, and radar datasets over Antarctica. Earth System Science Data, in discussion. Delf, R.J.; D.M. Schroeder, A. Curtis, A. Giannopoulos and R.G. Bingham (2020) A comparison of automated approaches to extracting englacial-layer geometry from radar data across ice sheets. Annals of Glaciology, 61, 231-241. Ross, N.; H. Corr and M. Siegert (2020) Large-scale englacial folding and deep-ice stratigraphy within the West Antarctic Ice Sheet. The Cryosphere, 14, 2103-2114.
34. Funding awards	None yet, attempts pending publication of white paper.
35. Points for discussion at UKNCAR meeting	Mostly this report is to raise awareness. Unfortunately although we have made some progress over 2021-22 there is no question that our Action Group has been badly affected by the pandemic, and the fact that we were still unable to assemble in-person over the reporting period. We are in the process of applying to SCAR for a 4-year extension of the Action Group to allow us to meet the initially agreed milestones and further expand the international reach of the group. As part of this we will be refreshing the Steering Committee to expand its international reach and explicitly incorporate some early-career researchers.

UKNCAR Reporting – ADMAP, RINGS

36. Principal UK Researchers	Tom Jordan, Julien Bodart, Alice Frémand
37. Major activities and progress since previous year involving UK personnel/infrastructure	Interest to ADMAP/RINGS/AntArchitecture: Release of processed line aerogeophysical data from the BAS archive (~2004 to present) via new Polar Airborne Geophysics Data Portal (https://www.bas.ac.uk/project/nagdp/) with associated publication, readme and user guides. Includes magnetic, gravity and radar bed picks, and radar images, all geo-referenced and quality checked. RINGS workshop (27-30th Jun 2022) to clarify the current knowledge gaps at the ice-sheet margin and assess the impacts of new data filling these knowledge gaps, and developing a set of protocols to collect, analyse, and share comprehensive airborne geophysical data.
38. Major future initiatives and actions involving UK personnel/infrastructure	Interest to ADMAP/RINGS/AntArchitecture: Innovate UK: Protecting Environments with UAV Swarms. Demonstrator project taking geophysically equipped large UAV (100 kg payload) to Rothera/Sky Blu in 2023/24. Including magnetics, gravity and radar. Science targets identified, but others welcome (contact tomj@bas.ac.uk).
39. Policy outcomes	
40. Selected publications	*Frémand, Bodart et al. 2022 British Antarctic Survey's Aerogeophysical Data: Releasing 25 Years of Airborne Gravity, Magnetic, and Radar Datasets over Antarctica. Earth System Science Data (Discussions). https://doi.org/10.5194/essd-2022-49 (ADMAP/RINGS/AntArchitecture)* *Jordan et al An embayment in the East Antarctic basement constrains the shape of the Rodinian continental margin. Commun Earth Environ 3, 52 (2022). https://doi.org/10.1038/s43247-022-00375-z (ADMAP)*
41. Funding awards	*Innovate UK: Protecting Environments with UAV Swarms.*
42. Points for discussion at UKNCAR meeting	

UKNCAR Reporting – SCAR EDI

Provide up to two pages of information following the structure below, only filling out those sections where there is new information to report.

43. Principal UK Researchers	Pilvi Muschitiello (Secretary), Huw Griffiths & Morgan Seag (Leadership Steering Group) and many UK general members
44. Major activities and progress since previous year involving UK personnel/infrastructure	In 2020, a scoping group was convened to investigate the best way forward for SCAR in addressing Equality, Diversity and Inclusion (EDI) issues. At their meeting in March 2021, SCAR Delegates approved the formation of the EDI Action Group and the formal Group proposal was agreed in May 2021 by the SCAR Executive Committee. The leadership of the Action Group is decided from within the volunteers from the community, and the leadership team will work with the Executive Committee and Secretariat, as well as the Capacity Building, Education and Training Committee. Chief Officer - Dr Adriana María Gulisano (Argentina) Deputy Chief Officer - Dr Zia Madani (Japan) Secretary - Pilvi Muschitiello (UK) The EDI Action Group is tasked with broadly looking at how EDI issues can be effectively dealt with within SCAR and what practical actions are relevant for the organization.
45. Major future initiatives and actions involving UK personnel/infrastructure	Following the work of the scoping group, a number of specific activities and areas to be addressed have been identified: Reviewing high level ambition through e.g. mission statements; A community-wide survey to gauge understanding and experience of EDI issues; Working with partners on setting recommendations for Codes of Conduct that can be referenced by individual national programmes; Reviewing all SCAR literature and communications; Advise on review of SCAR Medals nominations and evaluations processes; Audit of existing information about diversity from attendance, leadership positions etc.; Linking with partners and other relevant initiatives to learn from existing best practice.
46. Policy outcomes	

47. Selected publications	
48. Funding awards	
49. Points for discussion at UKNCAR meeting	Raising awareness of the group

UKNCAR Report 2022 - SCAGI

Provide up to two pages of information following the structure below, only filling out those sections where there is new information to report.

1. Principal UK Researchers	1) Louise Ireland, BAS. UK representative to SCAGI.
2. Major activities and progress since previous year involving UK personnel/infrastructure	1) <u>SCAGI meetings and leadership</u> There have been no SCAGI meetings since July 2020. Paul Morin (US Polar Geospatial Center) has stepped down from his role as co-chair since being appointed in 2020. It is understood that co-chair Prof Li Fei, (Wuhan University, China) will be organising a SCAGI meeting in October 2022, and a new co-chair will be appointed to replace Paul. 2) <u>Antarctic Digital Database (ADD)</u> There has been one update of the ADD in the past year; v7.5 in May 2022. This release included ongoing improvements to the coastline datasets, including the entire coast of Dronning Maud Land, the Brunt Ice Shelf, the Ronne-Filchner Ice Shelf and the Conger Ice Shelf, which are areas that have all undergone significant change in the past year. There were also other smaller changes including the addition of some islands in the Rhyolite Islands group, in George VI Sound. Work to improve data access is also ongoing through the inclusion of coastline and contour datasets in the ArcGIS Living Atlas of the World. Planning for the next releases has begun. Improvements to metadata and attributes are scheduled for v8, May 2023, together with a large coastline update from the Australian Antarctic Territory, following discussions with AAD. v7.6 will be scheduled for November 2022 in the meantime and will include ongoing updates to datasets as required. 3) <u>SCAR Air Operations Planning Maps Series</u> This is a series of maps designed for planning and situational awareness for Antarctic Air Operations. The UK released new maps for the 2021/22 season, providing updates and improvements to the previous editions released in 2019. 4) <u>SCAR place names</u> All new names designate by the UK Antarctic Placenames Committee have been submitted for inclusion in the SCAR Composite Gazetteer, including a few outside of BAT (in the unclaimed sector) with consultation from US ACAN.
3. Major future initiatives and actions involving UK personnel/infrastructure	A virtual SCAGI meeting is being planned for October 2022.
4. Policy outcomes	n/a

5. Selected publications	- SCAR Air Operations Planning Maps Series. - V7.5 of SCAR Antarctic Digital Database. https://www.add.scar.org/ - News article published by BAS announcing v7.5 of ADD and inclusion in ArcGIS Living Atlas: https://www.bas.ac.uk/media-post/bas-mapping-data-included-in-global-collection/
6. Funding awards	n/a
7. Points for discussion at UKNCAR meeting	n/a

UKNCAR Reporting Template - SOOS

Provide up to two pages of information following the structure below, only filling out those sections where there is new information to report.

1. Principal UK Researchers	Dr Sian Henley (U. Edinburgh), Dr Andrew Meijers (BAS)
2. Major activities and progress since previous year involving UK personnel/infrastructure	Major contributions to Southern Ocean Observing System (SOOS) and UK representation on SOOS Executive Committee (Henley) and Scientific Steering Committee (Meijers). Focuses on international collaborations around Southern Ocean science, observations, data, technology, infrastructure, advocacy, policy and communications. Strong contribution to Southern Ocean Action Plan for UN Decade of Ocean Science for Sustainable Development.
3. Major future initiatives and actions involving UK personnel/infrastructure	Major ongoing and forthcoming projects focusing on infrastructure and technology development for Southern Ocean observing and data systems – links to UK Government priorities in ocean observing and NZOC project. Promoting and enhancing Equity, Diversity and Inclusion in marine science – links to many UK activities, e.g. Challenger Society EDI group. Major international conference on all aspects of the Southern Ocean, Hobart, September 2023 – good opportunity for UK community, especially ECRs after limited networking during Covid restrictions. Delivery of Southern Ocean Action Plan for UN Ocean Decade – strong links to UK-based activities.
4. Policy outcomes	In the last year, this has included one Side Event in the Blue Zone of COP26 (co-hosted with MEASO initiative, November 2021) and an intervention at the forthcoming UN Oceans conference (June 2022).
5. Selected publications	SOOS Science and Implementation Plan, 2021-2025 https://www.soos.aq/images/soos/about_us/DRAFT_ScienceandImplementationPlan2021_2025.pdf
6. Funding awards	Funding from University of Tasmania, Tasmanian Government, CSIRO, Swedish Polar Research Secretariat, Antarctica New Zealand, TUBITAK Polar Research Institute (Turkey), University of Cape Town. Supported by SCOR and SCAR.
7. Points for discussion at UKNCAR meeting	Visibility for UK roles in internationally collaborative Southern Ocean science and policy frameworks and activities. Increasing UK engagement, especially opportunities for ECRs.

16/06/2020

EG-BAMM Annual Report to the SCAR

2020-2021

Mark Hindell and Yan Ropert-Coudert on behalf of the EG-BAMM group

EG-BAMM has been in existence for 10 years, after being reviewed and renewed by the SCAR delegates in 2017. The group maintained several of its usual activities in 2020 and 2021, participating in several international fora, such as CCAMLR and SOOS, as well as being part of several SCAR programs, most notably SCATS, ANT-Eco and ANT-Era. However, the COVID19 situation has also curtailed several activities, most notably delaying the implantation of three new working groups (cetaceans, functional responses and demography), but we anticipate these will begin in 2022.

This will be the last year that Hindell and Ropert-Coudert will be CI and secretary. Their replacements have been nominated and after approval from the SCAR Delegates will commence at the OSC in 2022.

The new leadership team is:

Chief Officer, Associate Professor Michelle La Rue, University of Cantebury, New Zealand

Deputy Chief Officer, Dr Ryan Reisinger, University of Southampton, UK

Secretarty, Manuela Bassio, Universidade Federal do Rio Grande do Norte, Brazil

Below are the specific reports for activities that are part of EG-BAMM:

A. RETROSPECTIVE ANALYSIS OF ANTARCTIC TRACKING DATA

PIs: Mark Hindell (University of Tasmania, Australia), Yan Ropert-Coudert.

The RAATD program core team presented information papers on the outcomes of the study for ATCM and CCAMLR to facilitate their spatial management planning decisions. One additional paper was published (Reisinger, R. R., et al. (2022). "Predator-derived bioregions in the Southern Ocean: Characteristics, drivers and representation in marine protected areas." Biological Conservation 272: 109630. The RAATD dataset has also been used by other members of the SCAR community and forms the basis of several presentations at this years OSC

B. TAG RE-SIGHTS

There is on-going demand for EG-BAMM to coordinate tag and band re-sights. This year we continued to circulate photos to the broad EG-BAMM membership we were able to successfully identify the individual animals. This is an important scientific and also outreach activity, as often the re-sights are made by members of the public. Due to increasing demand for this capacity and the time constraints it imposed on the group, it has been proposed to develop an on-line tag re-sight portal as part of the EG-BAMM website. This portal will serve the EGBAMM scientific community but will also receive inputs from tourists as sightings from non-scientists have been increasing and represent a potentially useful contribution. We are requesting $1000 in funding to help with this.

C. EDUCATION AND OUTREACH

In terms of Education and outreach, work has been conducted with the Association of Polar Early Career Scientists (APECS) and Polar Educators International (PEI). Antarctic biodiversity activities by scientists and educators were noted at the PEI 2022 workshop (Iceland) that had 32 participants from 10 countries, addressing issues such as climate change. POLAR WEEKS (APECS and PEI activity that connects polar scientists and schools), with talks on Antarctic biodiversity and science, engaged 18 000 students, 600 teachers/educators and 50 scientists in Portugal in cooperation > 10 countries worldwide in the last 2 years. Efforts have been put for early career scientists from life sciences to apply for SCAR grants (e.g. Webinars in English/Portuguese on SCAR grants). The relevance of EG-BAMM research related to conservation has also been shown in an educational context within the Intercessional Contact Group on Education and Outreach of the Antarctic Treaty, expressed by 2 posts in the forum. EGBAMM members were also engaged in the Southern Ocean Action Plan (UN Decade of Ocean science Sustainable Development) from an outreach perspective.

D. WILDLIFE HEALTH

The WG has maintained several virtual meetings along these years to work on the development of a health surveillance strategy for Antarctic Wildlife. This work is still in progress.

Following the COVID-19 pandemic, the WG quickly began to work on a risk assessment about the probability of infection of SARS-COV-2 to Antarctic wildlife. This activity was included in the SCAR COVID-19 project with the Working Package 6 “Antarctic Wildlife”. The work concluded in a paper published in the journal Science of Total Environment 755: 143352. In addition, the conclusions of this work was spread to several organizations as SCAR, COMNAP, IAATO and an Informative Paper was presented to the Antarctic Treaty Meeting in 2021. Finally, a video about the risk assessment was upload in the SCAR Youtube channel. The guidelines outlined in the paper for preventing the spread of SARS_CoV_2 to wildlife was incorporated into the IAATOs regulations and will again be employed this season.

The working group is also involved in many wildlife health related projects:

- ECOPATHS ('Ecology of the transmission of pathogens in south-polar vertebrates: surveillance, understanding and implication for conservation of biodiversity'). French subantarctic islands, 2022-2025. Funding (General call of French National Research Agency - ANR). Lead by Thierry Boulinier

- REMOVE_DISEASE ('Conservation and restoration of degraded insular biodiversity: impacts of the removal of introduced mammals on the dynamics of infectious diseases in seabirds across islands of the Southern Ocean'). French subantarctic islands, Marion Island and Falkland Islands, 2022-2025.

Funding via the BiodivRestore call of Biodiversa/Water JPI). Web site: https://removedisease.fr/. Lead by Thierry Boulinier.

- PERPANTAR (Personality in Antarctic Penguins). This project includes testing hypothesis about the potential relationships between personality and health in Antarctic penguins. Funded by the Spanish Research Agency. Lead by Andrés Barbosa

- Field-Based Disease Surveillance Project. This project is developing field-based disease surveillance tools for Albatrosses and Petrels in the Southern Ocean. This project is led by Meagan Dewar and Tom Hart and is funded by Agreement on the Conservation of Albatrosses and Petrels.

- Parasite-host interactions in a context of global climate change: health status of petrels in an Antarctic ecosystem. Lead by Julia Inés Diaz. Funded by the Agencia Nacional de Promoción de la Investigación, el Desarrollo Tecnológico y la Innovación (Ministerio de Ciencia, Tecnología e Innovación de la República de Argentina).

- Australian Antarctic Territory continues to report monthly to the National Wildlife Health Information System as part of Australia's general wildlife health surveillance arrangements. Lead by Rupert Woods.

- Contribution of introduced species to multi-host epidemiological dynamics" with a focus on pathogen transmission between introduced mammals and native seabirds and marine mammals of subantarctic islands. Lead by Amandine Gamble.

Publications

The members of the WG have published 21 peer-review papers about health issues in Antarctic wildlife.

EG-BAMM BUDGET REQUEST 2022

1- Support for COs to attend SCAR Biology in 2023: $5000
2- Support for Tag-resight on-line interface: $1000

Total: $6000

SCAR Sub-Group	**EGABI**
SG / SC	LS
Person Responsible:	xxx

XXXVII SCAR Delegates Meeting

India, September 2022

Expert Group on Antarctic Biodiversity Informatics

2020-22 Report

Summary

Report Author(s)
Ben Raymond (Australia), Anton Van de Putte (Belgium), Zephyr Sylvester (USA), and the EGABI core group

Summary of activities from 2020-22

The Expert Group on Antarctic Biodiversity Informatics was formed in 2012, and its initial 8-year term extended in 2020 for two years to 2022. The extension was accompanied by a change in leadership (office-holders and new core group members) and a refocusing of the group's mission and terms of reference towards tools and resources for data access, integration, analysis, and synthesis, and enabling the community to produce and utilize those resources. In March 2021 we held an online information session and established a mailing list.

The COVID-19 pandemic was a challenge for our group, as of course it was for everyone. Nevertheless, we collectively managed some good outcomes with collaborations on various projects (see projects and publications below), and continued development of tools, primarily R packages for data access, analysis, and visualization.

In the latter part of 2022 we will look to continue our current projects and also help the community re-establish links post-pandemic. We will use EGABI funds to offer some small travel bursaries and a data visualisation (or similar) competition with some small prizes. These will be focused on, but not exclusive to, early-career researchers and those from countries with developing Antarctic programs.

Renewal request

EGABI has reached the end of its current term. However, it is clear that the need for data-focused science tools and capabilities continues to grow at a rapid pace. The various EGABI projects that are underway and the potential for continued, valuable community outputs means that EGABI is extremely

well placed to continue to lead and assist the Antarctic science community in this area.

We therefore request a renewal of the group for an additional 8 year term to 2030. See the "Future plans" section, below, for work plans for the remainder of 2022 and into 2023. Work plans for later years will be developed in response to emerging needs, opportunities, and directions of the broader Antarctic and Southern Ocean communities.

Summary Budget 2021 to 2024

	2021	**2022**	**2023**	**2024**
	Spent	Carryover plus allocation	Request	Request
(US$)	2568	4787	2000	2000

Progress to date

(*Summarize your group's activities and plans in the tables below and, in each case, provide your sub-group name in the left-hand column to assist Science Group COs in compiling their reports*)

Sub-group Outcomes Summary

Sub-group	Activity/Outcome/Benefit/Achievement
EGABI	The SCAR/rOpenSci collaboration. rOpenSci is a non-profit initiative that promotes open and reproducible research, by developing and promoting R software tools that lower the barriers to working with scientific data sources, creating social infrastructure through a welcoming and diverse community, and building the capacity of software users and developers. EG-ABI started collaborating with rOpenSci in 2017. During 2021 and 2022, EGABI has been working with the SCAR ImPACT (persistent organic pollutants) group (CI Susan Bengtson-Nash) to collate data on POPs in the Southern Ocean, and build an interactive web application for researchers to visualise this data. At the time of writing (June 2022) this app is in an early but operational form. On the basis of this work, we reached out to the Plastic action group (Ilaria Corsi) to extend this work to a similar app for microplastics. This work is anticipated to be completed in late 2022 or early 2023.
EGABI	The RAATD project. Since 2015, EGABI has been collaborating with EGBAMM and the broader Antarctic science community on the Retrospective Analysis of Antarctic Tracking Data project. The first papers from RAATD were published in 2020 (and reported in our last report to Delegates) but collaborations stemming from this work continue, and have led to new publications using the RAATD data set and methodologies (see publications list, below). In October 2021 a workshop took place in collaboration with CESAB (the Centre for the Synthesis and Analysis of Biodiversity, France), to look at continued follow-up projects to RAATD.
EGABI	(With EGBAMM) The Diet and Energetics Database continues to prove useful to the Southern Ocean research community (see publications below). We have begun discussions with the chief editor and editorial board of Polar Biology on a mechanism to make it easier for authors of diet/energetics papers in Polar Biology to get their data into the SCAR database. The editors are supportive of this idea, which will increase data availability for the community and potential for new science. One hurdle to this idea, and to the maintenance

	and continued entry of data into this database more generally, is the time required for data reformatting and entry. We propose to ease some of this burden by using EGABI funds for data entry. This data entry work can be primarily aimed at early career researchers and those from countries with developing Antarctic programs, thereby also acting as a conduit for those researchers to the wider community of diet/energetics researchers.
EGABI	Spatial modelling. A number of groups in the SCAR community are developing and applying methods for spatial biodiversity modelling, including species distribution and habitat selectivity models. Given the wide applicability and interest in these techniques, EGABI is working to improve collaboration within the community by helping with communication, access to software and data, and sharing of expertise. EGABI will engage researchers within the community with an interest in spatial modelling to establish project need, scope and format.
EGABI	The Register of Antarctic Species is an authoritative inventory of Antarctic And Southern Ocean Organisms. EGABI is engaged with this project, primarily via biodiversity.aq, with particular attention to supporting researchers to use RAS in their wider biodiversity analysis workflows. One of the aspects we are further exploring is the inclusion of trait data into RAS, which can be of particular interest in mechanistic modeling approaches.

Sub-group Cash Flow

(Since previous report to Delegates in 2020)

Sub-group	Allocation	Amount spent		
		2020	2021	2022
EGABI	To ImPACT for data entry		820	

Future plans

Planned activities in 2022 to 2024

Sub-group	Planned activity

EGABI	In conjunction with the ImPACT and Plastic groups, we will finish the R/Shiny data visualisation apps.
EGABI	Continued data entry into the Diet and Energetics Database, and maintenance/extension of the associated R software packages.
EGABI	Community development has been, and continues to be, an vitally important theme of EGABI workplans. Refer to our 2017 report to EXCOM and workshops, outreach activities, and collaboration spaces established since then. We propose to use part of our 2022 fund allocation for travel bursaries, to help researchers to reconnect after the pandemic, and to work on any kind of biodiversity informatics-related collaborations. We are also planning to run a data visualisation (or similar) competition online later in 2022, with some small prize money. Details are yet to be finalized, but the competition will be structured to encourage collaboration and connections across researchers and disciplines. See “Planned use of funds”, below. Early-career and researchers from countries with developing Antarctic programs will be encouraged to apply for these.
EGABI	Follow-on activities from the RAATD project will continue, with varying levels of involvement from EGABI members. Examples include: Following on the RAATD post-CESAB meeting, a postdoctoral fellow, Anne-Sophie Bonnet-Lebrun from the French CNRS laboratory Centre d’Etudes Biologiques de Chizé (on an ASOC contract), has been tasked to work on the use of RAATD data into a wider scheme. Her first task is to evaluate the overall data availability (all taxa combined) in the Southern Ocean. Once this assessment is done she will use the data available to define the ecogeographical regions that are relevant to all taxa for conservation purposes. Sarah Becker and Cassandra Brooks (UC Boulder) are coordinating some complementary work on identifying areas that meet the KBA (key biodiversity area) criteria in the Southern Ocean, using (in part) the RAATD data sets. An initial workshop will be undertaken during the SCAR 2022 conference, with participation of EG-ABI members.
EGABI	The spatial modelling project will move into a community engagement phase, soliciting collaboration and input from researchers actively working in biodiversity modelling areas. Resources (papers, software, data, tutorials and other guides) and a communication forum will be established and populated.
EGABI	Other EGABI activities will continue as required, including contributions to the Register of Antarctic Species, maintaining the SCAR GitHub presence, and engaging with the broader community through Slack and other mechanisms.

Planned use of funds for 2022 to 2024

Year (YYYY)	Purpose/Activity	Amount (in USD)	Contact Name	Contact Email
2022	Travel bursaries (4 @ 500 USD each)	2000		
2022	Data entry for the Diet and Energetics Database (estimated 70 hours @ 30USD per hour, with the work spread across two or three people)	2100		
2022	Data visualisation competition prize money	650		
2023	Data entry for the Diet and Energetics Database	1500		
2023	Travel/workshop support	500		
2024	Data entry for the Diet and Energetics Database	1500		
2024	Travel/workshop support	500		
Total				

Any additional detail on funds usage and desired results/outcomes

Percentage of the budget to be used for support of early-career researchers

2022: 50%

2023: 50%

2024: 50%

Percentage of the budget to be used for support of scientists from countries with developing Antarctic programmes

2022: 50%

2023: 50%

2024: 50%

Membership

Leadership

Role	First Name	Last Name	Affiliation	Country	Primary Language	Email	Date Started
Chief Officer	Ben	Raymond	Australian Antarctic Division	Australia	English	ben.raymond@aad.gov.au	2012
Deputy chief officer, SCADM liaison	Anton	Van de Putte	Royal Belgian Institute of Natural Sciences and Université libre de Bruxelles	Belgium			2012
Secretary*	Zephyr	Sylvester	University of Colorado Boulder	USA			2021
Communications officer*	Svenja	Halfter	Institute for Marine and Antarctic Studies, University of Tasmania	Australia	German/English	Svenja.Halfter@utas.edu.au	2021
Core group member*	Briannyn	Woods	Institute for Marine and Antarctic Studies, University of Tasmania	Australia	English	Bree.Woods@utas.edu.au	2021
Core group member	Claudia	Andrade Díaz	University of Magallanes	Chile		claudia.andrade@umag.cl	2022
Core group member	Huw	Griffiths	British Antarctic Survey	UK	English	hjg@bas.ac.uk	2012
Core group member	Kerstin	Jerosch	Alfred Wegener Institute	Germany	German	Kerstin.Jerosch@awi.de	2018
Core group member	Lucas	Krüger	Instituto Antártico Chileno	Chile			2021
Core group member, EGBAMM liaison	Yan	Ropert-Coudert	CNRS CEBC-La Rochelle Université; French Polar Institute	France	French	yan.ropert-coudert@cebc.cnrs.fr	2012

*(Please identify early-career researchers with * in first column)*

Other members

EGABI is an inclusive group and membership is open to anyone. Members are welcome to engage with EGABI to whatever degree suits them, from actively collaborating in EGABI projects, participating in selected workshops and other events, or simply observing communication on the mailing list or other information channels.

Additional information (optional)

(Please add any more detail here that you wish on your sub-group activities, papers published, etc.)

Notable Papers

(*Five to ten most notable papers – see the example below, which includes a brief statement (shaded) indicating the link to the group*)

1. Reisinger R, et al. (2021) Habitat model forecasts suggest potential redistribution of marine predators in the southern Indian Ocean. Diversity and Distributions https://doi.org/10.1111/ddi.13447

   A followup paper from the RAATD project that looks at the potential shift of important southern Indian Ocean habitat under climate change scenarios.
2. France, Australia, Belgium, Germany, the United Kingdom, the United States, and South Africa (2021) Information Paper IP049: The Retrospective Analysis of Antarctic Tracking Data identifies Areas of Ecological Significance in the Southern Ocean. ATCM XLIII and CEP XXIII 2021, Paris, France / Online

   and

   France, Australia, Belgium, Germany, the United Kingdom, the United States, and South Africa (2021) Working Paper WP51: The Retrospective Analysis of Antarctic Tracking Data (RAATD): Areas of Ecological Significance in the Antarctic marine environment. ATCM XLIII and CEP XXIII 2021, Paris, France / Online

   Papers to the ATCM and CEP on the RAATD project outcomes.
3. Reisinger R, et al. (in press) Predator-derived bioregions in the Southern Ocean: characteristics, drivers and representation in Marine Protected Areas. Biological Conservation

   Another followup paper from the RAATD project.
4. Schaafsma FL, et al. (2022) Allometric relationships of ecologically important Antarctic and Arctic zooplankton and fish species. Polar Biology https://doi.org/10.1007/s00300-021-02984-4

   A compilation, including new data, of length-weight and other allometric equations. This publication built on and contributed to the SCAR Diet and Energetics database.
5. Brooks CM, et al. (2020) Progress towards a representative network of Southern Ocean protected areas. PLoS ONE https://doi.org/10.1371/journal.pone.0231361

   An analysis of the coverage of current and proposed MPAs in the Southern Ocean, considering (amongst other things) the pelagic and benthic bioregionalisation analyses that EGABI members have previously contributed to.
6. Van de Putte AP, et al. (2021) From data to marine ecosystem assessments of the Southern Ocean: achievements, challenges and lessons for the future. Frontiers in Marine Science. https://doi.org/10.3389/fmars.2021.637063

   A contribution from EGABI members to the MEASO special issue, touching on informatics considerations in the context of marine ecosystem monitoring and assessment.
7. Neder C, Fofonova V, Androsov A, Kuznetsov I, Abele D, Falk U, Schloss IR, Sahade R, Jerosch K (2022) Modelling suspended particulate matter

dynamics at an Antarctic fjord impacted by glacier melt. Journal of Marine Systems 231. https://doi.org/10.1016/j.jmarsys.2022.103734

EGABI member paper, which serves to translate the changing environment at the WAP due to glacier melt into numbers, and thus to establish protection measures.

8. Woods B, Trebilco R, Walters A, Hindell M, Duhamel G, Flores H, Moteki M, Pruvost P, Reiss C, Saunders RA, Sutton C, Gan Y-M, Van de Putte A (2022) Myctobase, a circumpolar database of mesopelagic fishes for new insights into deep pelagic prey fields. Scientific Data. https://doi.org/10.1038/s41597-022-01496-y

   A database of mesopelagic fish trawl data, available via the R package ecosystem being developed by EGABI and collaborators.

Direct support from outside organisations received for your activities

(*Numbered list with values indicated if direct cash support. Please restrict in-kind support to substantive in-kind support only*)

None in 2020-2022

Major collaborations your group has with other SCAR groups and with organisations/groups beyond SCAR

(*Numbered list of substantive collaborations*)

Within SCAR

1. ImPACT and Plastic-AG, R/Shiny apps as mentioned above
2. EGBAMM, Diet and Energetics Database and the RAATD project (and follow-on activities)
3. SCAR Antarctic biodiversity Portal - biodiversity.aq

Outside SCAR

1. rOpenSci, for R software development and community resources
2. CoastCarb. Kerstin Jerosch is co-leader of the CoastCarb Data Information System work package. Elements of this (particularly the online visualisation and analysis tool development) share commonalities with EGABI activities.

Outreach, communication and capacity-building activities

(Brief highlights of any activities undertaken since the last report to SCAR Delegates in 2020).

- In March 2021 we held an online EGABI information session
- In October 2021 a workshop took place in collaboration with CESAB, to look at follow up projects to RAATD.

Contributions to equality, diversity, and inclusion (EDI)
(Any specific actions the group has undertaken to advance EDI within the group and/or within SCAR)

Selection of the new EGABI core group was conducted with a view to balanced representation across gender, career stage, scientific background, and geographic location.

EGABI events are run under a code of conduct (e.g. https://github.com/SCAR/EGABIcourse19/blob/master/coc.md) that celebrates and promotes diversity and inclusion.

SCAR fellowship reviewers

(As part of SCAR's Capacity Building efforts, such as the Fellowships and Visiting Scholar Awards, we are looking for people from all the SCAR groups to form a 'review panel' so if applications in your field are submitted we have people to contact to help assess relevant applications. Please list one or more people (name and email address) from your group who would be willing to serve as reviewers for the next few years, along with 1-3 keywords on their principal expertise.)

First Name	Last Name	Email	Principal Expertise
Ben	Raymond	ben.raymond @aad.gov.au	modelling, analytics, data synthesis

SCAR Sub-Group	**xxx**
SG / SC	PS / LS / GS / SC-HASS
Person Responsible:	xxx

XXXVII SCAR Delegates Meeting

India, September 2022

SCAR KRILL ACTION GROUP

2020-22 Final Report

Summary *(no more than one page)*

Recent findings on Antarctic krill, *Euphausia superba* have demonstrated that, even after almost 100 years of research on this species, there remain crucial gaps in our understanding of its life history, response to climate variability, spatial dynamics, and the environmental mechanisms that drive variability of its lifecycle throughout the Southern Ocean (SO).

CCAMLR is an international organization established in response to increasing commercial interest in Antarctic krill resources, a keystone component of the Antarctic ecosystem and a history of over-exploitation of several other marine resources in the Southern Ocean. CCAMLR had a working group focusing solely on krill in its early years but there is no longer a working group within CCAMLR that solely considers krill biology and ecology. The CCAMLR Scientific Committee has emphasised the need for a mechanism to better incorporate the relevant science being done on krill into CCAMLR. Thus, a SCAR Krill Action Group (SKAG) was initiated in 2018 to become a prime conduit between CCAMLR and the wider krill science community. SKAG provides a forum to guide research directions, promote collaboration, improve understanding of krill biology and ecology, and through the SCAR Standing Committee on the Antarctic Treaty System, will assist in providing critical scientific information relevant to krill fishery management. Furthermore, the group will provide a forum for an information exchange on upcoming cruises and funding opportunities, as well as lab facilities for experimental krill work, and will serve as a platform for the development of future international collaborative research proposals and programs.

Since 2020 SKAG has developed to an established body to transfer krill science which is important for management into CCAMLR and beyond such as the new established Science Industry Forum (SIF) and NGOs like WWF and PEW. In addition, SKAG has a close interaction with, and provides input to, the existing SCAR group Integrating Climate and Ecosystem Dynamics in the Southern Ocean - ICED, by performing joint workshops and papers, which greatly enhanced the opportunities for the ECRs to connect with peers and experts internationally and nurture collaboration. The role of SKAG as prime source for providing information on krill biology and ecology and as a conduit to facilitate collaboration becomes even more important in understanding and managing the SO ecosystem and its fishery in the changing environment. Due to this circumstances we like to continue with SKAG as SCAR Krill Expert Group in 2023. An application is submitted tto the heads of the Life Science Group.

Report Author(s)

SKAG Board:

Prof. Dr. Bettina Meyer (Germany)

Dr. So Kawaguchi (Australia)
Dr. Simeon Hill (United Kingdom)
Dr. Angus Atkinson (United Kingdom)
Prof. Dr. Kim Bernard (United States of America)
Dr. Ryan Driscoll (United States of America)
Dr. Zephyr Sylvester (United States of America)
Dr. Javier Arata (Canada)
Dr. Steve Parker (Australia)

Summary of activities from 2020-22

In 2020

- *The biggest challenge in 2020 was the onset of the COVID 19 pandemic and how to manage it in terms of continuing group activities such as workshops, meetings, etc.*

- *Writing of a policy paper, published October 2020, that used existing krill long-term data on krill abundance and distribution, both to identify data gaps that can help improve CCAMLR krill management, and to identify ways in which the missing data can be collected using fisheries (https://doi.org/10.1038/s43247-020-00026-1).*

- *Reporting policy paper outputs to the scientific committee of CCAMLR.*

- *In November, starting to organise the SKAG annual workshop in April 2021, in cooperation with the WWF.*

In 2021

- *SKAG online workshop in cooperation with the WWF, 26-30 April 2021: "Evaluating change within the krill-based food web and developing solutions for the future sampling of krill", doi: 10.5281/zenodo.4776335.*

- *Policy paper writing from the workshop outputs: "Detecting change in Antarctic krill stocks: from the age of sail to the space age". The paper has been initially drafted and will be submitted to Communications Earth and Environment in autumn 2022.*

- *Joint ECR modeling workshop with the SCAR Group Integrating Climate and Ecosystem Dynamics of the Southern Ocean (ICED), 17-20 May 2021: Using models to improve our. understanding of Antarctic krill and their ecological role in the Southern Ocea,*

- *Reporting workshop output to CCAMLR WG EMM and the SC-CCAMLR*

In 2022

- *SKAG online workshop 7-11March 2022: Variability in krill recruitment, and its implication for modelling and fishery management.*

- *Creating a SKAG Newsletter and a SKAG Logo*

- *Finalysing the policy paper from the workshop outputs in 2021, "Detecting change in Antarctic krill stocks: from the age of sail to the space age", which will be submitted to Communications Earth and Environment in autumn 2022.*

- *Reporting workshop output to CCAMLR WG EMM and the SC-CCAMLR*

Summary Budget 2020 to 2022

	2020	2021	2022
	Spent None	2000$ spent to support another Life Science Group + annual budget of 3,000$	Allocated 3,968$ from 2021 + annual budget of 3,000$
(US$) available	2,968$	3,968$	6,968$

Progress to date

(*Summarize your group's activities in the tables below and, in each case, provide your sub-group name in the left-hand column to assist Science Group COs in compiling their reports*)

Sub-group Outcomes/Achievements Summary

Outcomes/Achievements Summary

	Outcome/Achievement
SKAG	Policy paper Meyer et al. 2020, Communications Earth & Environment:https://doi.org/10.1038/s43247-020-00026-1 22 Web of Science citations and 6290 article accesses in the 20 months since publication.
SKAG	SKAG online workshop in cooperation with the WWF 26-30 April 2021: Evaluating change within the krill-based food web and developing solutions for the future sampling of krill https://doi.org/10.5281/zenodo.4776335 Workshop attended by 127 participants from 19 countries, of whom 46 were ECR's.
SKAG and ICED	Joint ERC modeling workshop with the SCAR Group Integrating Climate and Ecosystem Dynamics of the Southern Ocean (ICED), 17-20 May 2021: Using models to improve our. understanding of Antarctic krill and their ecological role in the Southern Ocean, https://doi.org/10.5281/zenodo.6780069 Joint ICED-SKAG online Session in AGU Open Sciences Meeting, 2-4 March 2022. 'The role of Southern Ocean ecology in the Earth system: Integrating across scales, disciplines, and methods'.
SKAG	SKAG online workshop in March 2022, https://doi.org/10.5281/zenodo.6780075
SKAG	Comment CCAMLR Scientific Committee Chair, Dr. Dirk Welsford: While many of the world's krill experts participate in CCAMLR, it is also a fact that significant expertise and knowledge exists outside of the regular attendees to CCAMLR meetings. SKAG performs an important bridge between CCAMLR and this broader scientific community to ensure CCAMLR bases its decisions on the best available science.

Sub-group Cash Flow

(Since previous report to Delegates in 2020)

Sub-group	Allocation	Amount spent		
		2020	2021	2022
SKAG	2968$ in 2020 3000€ in 2021 3000$ in 2022	None	2000$ to other Life Science Group	None

Notable Papers

(*Three most notable papers, if applicable – see the example below, which includes a brief statement (shaded) indicating the link to the group*)

1. Meyer, B., Atkinson A., & Bernard, K., et al. 2020 Successful ecosystem-based management of Antarctic krill should address uncertainties in krill recruitment, behaviour and ecological adaptation, *Commun Earth Environ* **1,** 28. https://doi.org/10.1038/s43247-020-00026-1

Linkages

Direct support from outside organisations received for your activities

(*Numbered list with values indicated, if direct cash support. Please restrict in-kind support to substantive in-kind support only*)

NONE

Major collaborations your group has with other SCAR groups and with organisations/groups beyond SCAR

(*Numbered list of substantive collaborations*)

Within SCAR

1. ICED

Outside SCAR

1. CCAMLR
2. Marine Ecosystem Assesment of the Southern Ocean (MEASO)
3. Science Industry Forum (SIF)

Outreach and Capacity Building

Outreach, communication and capacity building activities

(Brief highlights of any activities undertaken since the last report to SCAR Delegates in 2020).

Communication and outreach in SKAG is organised by ECRs* who are represented in our board (Kim Bernard, Ryan Driscoll*, Zephyr Sylvester*). They created the SKAG Newsletter “The KRILL Reader” which is published biannually and the SKAG logo. In addition, ECRs from SKAG and ICED organised the joint ICED-SKAG modelling workshop in May 2021 and the ECR sessions at our annual SKAG workshop.

Contributions to equality, diversity, and inclusion (EDI)

(Any specific actions the group has undertaken to advance EDI within the group and/or within SCAR)

NONE

Membership

In total 78 members and 40 of them ECRs

Leadership

Role	First Name	Last Name	Affiliation	Country	Primary Language	Email	Date Started
Chair	Bettina	Meyer	Alfred-Wegener Institute - Helmholtz Centre for Polar and Marine Research	DE	German	bettina.meyer@awi.de	2019
Chair	So	Kawaguchi	Australian Antarctic Division	AU	English	So.kawaguchi@aad.gov.au	2019
Krill research and related management	Angus	Atkinson	Plymouth Marine Laboratory	UK	English	aat@pml.ac.uk	2021
Krill research and related management	Simeon	Hill	British Antarctic Survey	UK	English	sih@bas.ac.uk	2018
Communication and outreach	Kim	Bernard	Oregon State University	US	English	kim.bernard@oregonstate.edu	2022
Communication and outreach	Ryan*	Driscoll	Alfred-Wegener Institute - Helmholtz Centre for Polar and Marine Research	DE	English	ryan.driscol@awi.de	2020
Communication and outreach	Zephyr *	Sylvester	University of Colorado Boulder	US	English	zesy2348@colorado.edu	2021
Fishing Industry coordinator	Javier	Arata Soto	Association of Resonsible Krill harvesting companies	CA	English	javier.arata@ark-krill.org	2019
CCAMLR Science representative	Steve	Parker	CCAMLR Secretariat	AU	English	Steve.parker@ccamlr.org	2022

*(Please identify early-career researchers with * in first column)*

Other members

First Name	Last Name	Affiliation	Country	Primary Language	Email	Date Started
Marina	Abas	Dirección Nacional del Antártico	AR	Spanish	ahk@mrecic.gob.ar	2021
Alexis*	Bahl	University of British Columbia	CA	English	abahl@eoas.ubc.ca	2022
Dominik*	Bahlburg	Technical University of Dresden	DE	German	dominik.bahlburg@tu-dresden.de	2019
Anna*	Belcher	British Antarctic survey	UK	English	annbel@bas.ac.uk	2019
Susan	Bengtson Nash	Griffith University	AU	English	s.bengtsonnash@griffith.edu.au	2020
Andrew	Brierley	University of St Andrews	UK	English	asb4@st-andrews.ac.uk	2019
Nile*	Bunger	University of Arizona Environmental Science Student	US	English	nile.bunger@gmail.com	2021
Giovanni*	Canduci	CNR National Research Council	IT	Italian	giovanni.canduci@cnr.it	2019
Emma	Cavan	Imperial College London	UK	English	e.cavan@imperial.ac.uk	2022
Thomas Y.	Chen*	Association for Computing Machinery	US	English	thomaschen7@acm.org	2021
Megan*	Cimino	UC Santa Cruz/NOAA	US	English	megan.cimino@noaa.gov	2021
Laurence	Clarke	Australian Antarctic Division	AU	English	laurence.clarke@aad.gov.au	2020
Jack*	Conroy	Virginia Institute of Marine Science	US	English	jaconroy@vims.edu	2020
Stuart	Corney	Institute for Marine and Antarctic Studies	AU	English	Stuart.Corney@utas.edu.au	2020
Andrea	De Felice	IRBIM CNR	IT	Italian	andrea.defelice@cnr.it	2019
Elling*	Deehr Johannessen	Norwegian Polar Institute	NO	English	elling.johannessen@npolar.no	2021
Tracey*	Dornan	British Antarctic Survey	UK	English	tarna70@bas.ac.uk	2021
Sara*	Driscoll	Alfred-Wegener Institute - Helmholtz Centre for Polar and Marine Research	US	English	sara.driscoll@awi.de	2019
Jaime	Färber Lorda	Centro de Investigación Científica y de Educación Superior de Ensenada (CICESE)	MX	Spanish	jfarber@cicese.mx	2020
Sophie	Fielding	British Antarctic Survey	UK	English	sof@bas.ac.uk	2019
Wilhelm	Hagen	University of Bremen	DE	German	whagen@uni-bremen.de	2020
Svenja*	Halfter	University of Tasmania	AU	English	Svenja.Halfter@utas.edu.au	2021
Nicole*	Hellessey	Georgia Institute of Technology	US	English	n.hellessey@gmail.com	2022
Luis	Huckstadt	University of Exeter	UK	English	L.Huckstadt@exeter.ac.uk	2019

Lukas*	Hüppe	Alfred-Wegener Institute - Helmholtz Centre for Polar and Marine Research	DE	German	lukas.hueppe@awi.de	2021
Mary K.*	Kane	Plymouth Marine Laboratory/University of Rhode Island	UK/US	English	marykatkane@gmail.com	2019
Lucas*	Krüger	Instituto Antártico Chileno	CL	Spanish	lkruger@inach.cl	2021
Sara*	Labrousse	Laboratoire d'Océanographie et du Climat: Expérimentations et approches numériques - Sorbonne-Université	FR	French	sara.labrousse@gmail.com	2020
Cecliia M.*	Liszka	British Antarctic Survey	UK	English	ceclis56@bas.ac.uk	2019
Hui*	Liu	Shanghai Ocean University	CH	Chinese	hui.liu_blue@foxmail.com	2020
Zijun*	Liu	Shanghai Ocean University	CH	Chinese	zijunliu1990@foxmail.com	2020
Anna	MacDonald	Australian Antarctic Division	AU	English	anna.macdonald@aad.gov.au	2022
Enrique	Marschoff	Instituto Antártico Argentino	AR	Spanish	marschoff@hotmail.com	2019
Dale	Maschette*	Institute of Marine and Antarctic Science	AU	English	dale.maschette@aad.gov.au	2019
Jessica*	Melvin	Institute for Marine and Antarctic Studies (IMAS) and University of Tasmania (UTAS)	AU	English	jessica.melvin@utas.edu.au	2019
Katharina*	Michael	ICBM, Carl von Ossietzky University of Oldenburg	DE	German	katharina.michael@uol.de	2019
Saleem Hasly*	Mohamed	STS Organization	LK		haslymohamed@gmail.com	2021
Eugene	Murphy	British Antarctic Survey, Cambridge, UK	UK	English	ejmu@bas.ac.uk	2019
Schuyler*	Nardelli	Rutgers University	US	English	nardelli@marine.rutgers.edu	2020
Denise*	O'Sullivan	CSIRO	AU	English	d.osullivan019@gmail.com	2022
Nora-Charlotte*	Pauli	Carl von Ossietzky University Oldenburg	DE	German	npauli@awi.de	2019
Frances Anne*	Perry	Plymouth Marine Laboratory	UK	English	franki1@btinternet.com	2019
Keith	Reid			English	keith.reid@ccamlr.org	2019
Christian	Reiss	NOAA Antarctic Ecosystem Research Division	US	English	christian.reiss@noaa.gov	2020
Angelika	Renner	Institute of Marine Research	NO	English	angelika.renner@hi.no	2020
Georgia*	Robson	Centre for Environment, Fisheries and Aquaculture Science	UK	English	georgia.robson@cefas.co.uk	2020
Emilce Florencia*	Rombolá	Instituto Antártico Argentino	AR	Spanish	rombola_emilce@hotmail.com	2019
Mercedes (Mecha)	Santos	Instituto antártico Argentino	AR	Spanish	mechasantos@yahoo.com.ar	2019
Ryan Alexander	Saunders	British Antarctic Survey	UK	English	ryaund@bas.ac.uk	2021

Fokje*	Schaafsma	Wageningen Marine Research	NL	English	fokje.schaafsma@wur.nl	2020
Hyoung Chul	Shin	Korea Polar Research Institute	KR	Korean	hcshin@kopri.re.kr	2019
Kirsten B.*	Steinke	Oregon State University	US	English	steinkki@oregonstate.edu	2020
Leonie	Suter	Australian Antarctic Division	AU	English	leonie.suter@aad.gov.au	2021
Aleksandr*	Sytov	VNIRO	RU	Russian	sytov@vniro.ru	2021
Geraint	Tarling	British Antarctic Survey	UK	English	gant@bas.ac.uk	2019
Stephane	Thanassekos	CCAMLR		English	stephane.thanassekos@ccamlr.org	2020
Maya*	Thomas	Virginia Institute of Marine Science	US	English	mithomas@vims.edu	2021
Sally	Thorpe	British Antarctic Survey	UK	English	seth@bas.ac.uk	2019
Philip N.	Trathan	British Antarctic Survey	UK	English	pnt@bas.ac.uk	2019
Rebecca*	Trinh	Lamont-Doherty Earth Observatory	US	English	rtrinh@ldeo.columbia.edu	2021
Anton	Van de Putte	Royal Belgian Institute for Natural Sciences	BE	Belgian	avandeputte@naturalsciences.be	2019
Devi*	Veytia	Institute of Marine and Antarctic Studies	AU	English	devi.veytia@utas.edu.au	2019
Patti	Virtue	IMAS, University of Tasmania	AU	English	virtue@utas.edu.au	2021
Joseph	Warren	Stony Brook University	U	English	joe.warren@stonybrook.edu	2021
Michael Joseph*	Wethington	Stony Brook University	USA	English	wethington.michael@stonybrook.edu	2021
Mei*	Xue	Shanghai Ocean University	CN	Chinese	mei_xue@foxmail.com	2020
Emma	Young	British Antarctic Survey	UK	English	eyoung@bas.ac.uk	2019
Haiting*	Zhang	Shanghai Ocean University	CN	Chinese	zh_ting@163.com	2020
Guoping	Zhu	Shanghai Ocean University	CN	Chinese	gpzhu@shou.edu.cn	2020

*(Please identify early-career researchers with * in first column)*

Final recommendations to Delegates *(half page)*

Final future research recommendations

(What should SCAR's priorities be for future research in this area? Note that this section should not be used to propose new groups, for which a separate process should be followed with advice from your Science Group leader(s))

Final procedural recommendations

(Please include here any operational insights that you would like to share with the Delegates, drawn from your experiences of running this sub-group.)

SCAR Sub-Group	**xxx**
SG / SC	PS / LS / GS / SC-HASS
Person Responsible:	xxx

XXXVII SCAR Delegates Meeting

India, September 2022

ImPACT-AG

2020-22 Report

Summary

Chemical pollution continues to represent a major global threat, with the UN naming chemical pollution as one of three Planetary Crises faced today, alongside climate change and biodiversity loss. The global significance of this threat was underscored by the G7 commitment to establishing an International Panel for Chemical Pollution (IPCP) by 2024. As with climate change, the Earth's Polar regions play a pivotal role as sentinels of global chemical pollution and the work of ImPACT continues to work to fill an important gap in the Antarctic context for the generation, collation, and communication of policy-ready advice. This task, however, is beyond the scope of a SCAR Action Group and as such development of a larger Antarctic Monitoring and Assessment Programme (AnMAP), with associated baseline funding, is underway. AnMAP implementation was an explicit foundation goal of ImPACT, hence there is unresolved uncertainty surrounding the ideal path forward for the ImPACT Action Group. In light of this, the group is seeking an interim extension of 1 year to resolve AnMAP and ImPACT transition and placement within the SCAR framework.

Report Author(s)

Susan Bengtson Nash (Australia)

Summary of activities from 2020-22

(Please provide highlights of your group's progress since the last report to SCAR Delegates in 2020, covering major activities/achievements, upcoming activities and key challenges faced).

The main activities of 2020-2022 for the group are summarised below:

1. ImPACT have continued to hold twice yearly whole WG and task-specific meetings. Today we have 36 members representing from 18 countries.

2. ImPACT commenced their activities by collating two databases, **i)** A sample database that new projects could refer to for circum-polar collaboration and scope, and **ii)** An active projects database that members may use to navigate Antarctic access and samples via collaborators.

3. In 2021 ImPACT produced a white paper, a horizon scan of chemical pollution research needs in the Antarctic context, for the 2021 Antarctic Treaty Meetings. This article is in preparation as a Perspective paper for the Lancet Planetary Health.

4. Supplementary SCAR funding was secured to create an interactive pollution mapping tool in collaboration with EGABI (Expert Group on Antarctic Biodiversity Informatics (EG-ABI). The supplementary funding secured the literature review and data entry for all POP literature and led to a collaboration with the PLASTICS group to commence data entry for plastics also. The map is available for viewing here: https://aad.aad-science.cloud.edu.au/app/sopopp/

5. In line with the goals of ImPACT to scaffold towards an Antarctic Monitoring and Assessment Programme (AnMAP) body, modelled on the Arctic Monitoring and Assessment Programme, UN endorsement of AnMAP as an Ocean Decade Activity was secured.

6. Further submissions resulting from the January, 2022 "*ACT Now - Legacy and Emerging Contaminants in Polar Regions"* workshop were made to the Antarctic Treaty CEP meetings in Berlin, and ImPACT have been asked to respond to these submissions, reporting on AnMAP activities.

7. ImPACT will host the 2022 SCAR Open Science Conference Session "*Chemicals of Emerging Antarctic Concern; A rising tide in a warming climate*."

8. An outcome of the Antarctic Treaty Meetings feed-back was a suggestion of hosting a multiple stakeholder workshop. This activity is planned for late 2022.

ImPACT Chair, Susan Bengtson Nash, has throughout 2021/22 met with Suzie Grant, Chief Officer of SC-ATS; Yan Ropert-Coudert, former Chief Officer of SCAR Life Sciences, and Birgit Njaastad, Chair of the CEP, to discuss the logical placement of AnMAP within the SCAR structure. The most promising model appears to be a 'SOOS-type' body and this option is being explored further. As there is considerable activity underway, and as it is yet unclear what model would best serve science-policy needs (i.e. AnMAP replacement of ImPACT, or transition of ImPACT to an Expert Group, representing the scientific contributions to AnMAP products), it is proposed that ImPACT be extended as an Action Group for a further 1 year interim period.

Summary Budget 2021 to 2024

	2021	2022	**2023**	**2024**
	Spent	Allocated	Request	Request
(US$)	$4,500	$10,771	$2,500	

Progress to date

(*Summarize your group's activities and plans in the tables below and, in each case, provide your sub-group name in the left-hand column to assist Science Group COs in compiling their reports*)

Sub-group Outcomes Summary

Sub-group	Activity/Outcome/Benefit/Achievement
ImPACT	Sample Database
ImPACT	Active Project Database
ImPACT	SC-ATS Information Paper (Horizon Scan of Chemical Pollution Research Needs in Antarctica)
ImPACT	Interactive pollution mapping tool developed with EGABI
ImPACT	UN Ocean Decade endorsement for the Antarctic Monitoring and Assessment Programme (AnMAP)
ImPACT	Hosting of SCAR Open Science Conference Session on Emerging Contaminants

Sub-group Cash Flow

(Since previous report to Delegates in 2020)

Sub-group	Allocation	Amount spent		
		2020	2021	2022
ImPACT	Interactive Map (research officer hours for data entry)		$14,305	

Future plans

Planned activities in 2022 to 2024

Sub-group	Planned activity
ImPACT	Multiple Stakeholder Workshop

Planned use of funds for 2022 to 2024

Year (YYYY)	Purpose/Activity	Amount (in USD)	Contact Name	Contact Email
2022	Multiple stakeholder workshop and outcome reporting	$2,500	Susan Bengtson Nash	s.bengtsonnash@griffith.edu.au
Total				

Any additional detail on funds usage and desired results/outcomes

Percentage of the budget to be used for support of early-career researchers

2022:

2023:

2024:

Percentage of the budget to be used for support of scientists from countries with developing Antarctic programmes

2022:

2023:

2024:

Membership

Leadership

Role	First Name	Last Name	Affiliation	Country	Primary Language	Email	Date Started
Chief Officer / Chair	Susan	Bengtson Nash	Griffith University	Australia	English	s.bengtsonnash@griffith.edu.au	2017
Co-Chair Officer	Pernilla	Bohlin/Nizzetto	NILU	Norway	Norwegian	Pernilla.bohlin-nizzetto@nilu.no	2017

*(Please identify early-career researchers with * in first column)*

Other members

Name	Affiliation	Email	Country
Cristobal Galban-Malagon	Universidad Mayor, Chile	cristobalgalban@yahoo.es	chile
Simonetta Corsolini	University of Siena, Italy	corsolini@unisi.it	Italy
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Roger Fuoco	University of Pisa, Italy	roger.fuoco@unipi.it	Italy
Alessandra Cincinelli	University of Florence	alessandra.cincinelli@unifi.it, acincinelli@hotmail.com	Italy
Jordi Dachs	Institute for Environmental Assessment and Water Research, Spain	jordi.dachs@idaea.csic.es	Spain

Ana Cabrerizo	Institute for Environmental Assessment and Water Research, Spain	ana.cabrerizo@idaea.csic.es	Spain
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Christophe Walgraeve		christophe.walgraeve@ugent.be	Belgium

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Anette Kuster	German environment agency	Anette.Kuester@uba.de	Germany
Anoop Tiwari		anooptiwari@ncpor.res.in	India and Goa
Magosia Scopinska	Gdansk University	szopinska.malgorzata@gmail.com	Poland
Zaneta Polkowska	Gdansk University	zanpolko@pg.edu.pl	Poland
Ralf Ebinghaus	Helmholtz-Zentrum Hereon	ralf.ebinghaus@hereon.de	Germany
Zhiyong Xie	Institute of Coastal Environmental Chemistry, Helmholtz-Zentrum Hereon	zhiyong.xie@hereon.de	Germany
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Nico van den Brink	Wageningen University and Research	nico.vandenbrink@wur.nl	Netherlands

*(Please identify early-career researchers with * in first column)*

Additional information (optional)

(Please add any more detail here that you wish on your sub-group activities, papers published, etc.)

Notable Papers

(*Five to ten most notable papers – see the example below, which includes a brief statement (shaded) indicating the link to the group*)

1. Persistent Organic Chemicals in Antarctica: A horizon scan of priority challenges. 2021, Scientific Committee for Antarctic Research (SCAR) submission to the Committee for Environmental Protection (CEP) of the Antarctic Treaty.

This work communicates the priorities and recommendations for future chemical pollution research in the Antarctic context.

Direct support from outside organisations received for your activities

(*Numbered list with values indicated if direct cash support. Please restrict in-kind support to substantive in-kind support only*)

Major collaborations your group has with other SCAR groups and with organisations/groups beyond SCAR

(*Numbered list of substantive collaborations*)

Within SCAR

1. EGABI, PLASTICS – Collaboration on development of the interactive pollution mapping tool.

Outside SCAR

1. Arctic Monitoring and assessment Programme (AMAP) – ImPACT continues to work closely with the AMAP Secretariat and contributors for the co-design and development of AnMAP.

Outreach, communication and capacity-building activities

(Brief highlights of any activities undertaken since the last report to SCAR Delegates in 2020).

Act Now – Legacy and Emerging Contaminants in Polar Regions (attendance by Rainer Lohmann, Susan Bengtson Nash, Pernilla Bohlin Nizzetto)

AMAP workshop on remote vs. distant sources (attendance by Rainer Lohmann, Susan Bengtson Nash, Pernilla Bohlin Nizzetto, Simonetta Corsolini, Nicoletta Ademollo and Zaneta Polkowska)

Contributions to equality, diversity, and inclusion (EDI)
(Any specific actions the group has undertaken to advance EDI within the group and/or within SCAR)

ECR co-Chair of SCAR Open Science Conference Session hosted by ImPACT is PhD student, Andrea Zimbelli.

SCAR fellowship reviewers

(As part of SCAR's Capacity Building efforts, such as the Fellowships and Visiting Scholar Awards, we are looking for people from all the SCAR groups to form a 'review panel' so if applications in your field are submitted we have people to contact to help assess relevant applications. Please list one or more people (name and email address) from your group who would be willing to serve as reviewers for the next few years, along with 1-3 keywords on their principal expertise.)

First Name	Last Name	Email	Principal Expertise

SCAR Sub-Group	**BEPSII**
SG / SC	LS
Person Responsible:	Jacqueline Stefels

XXXVII SCAR Delegates Meeting

India, September 2022

Biogeochemical Exchange Processes at Sea-Ice Interfaces

BEPSII – Expert Group

2020-22 Report

Summary *(no more than one page)*

In 2018, BEPSII became an Expert Group under the Life Sciences. BEPSII is also endorsed by SOLAS (the Surface Ocean-Lower Atmosphere Study), CliC (Climate and Cryosphere) and receives funding from these programs and occasionally also from IASC (International Arctic Science Committee), in addition to from SCAR.

Due to the pandemic all meetings in the current reporting period were held online. As a result, there were no meeting costs and it was decided to use the funds to increase the support of young scientists through the organization of a new ECS exchange program between BEPSII-affiliated labs and through the organization of a BEPSII sea-ice field school, which took place from 14-23 May 2022 at the Canadian High Arctic Research Station (CHARS), Cambridge Bay, Canada.

Further ongoing activities within BEPSII are:

- data collations of specific variables (DIC & TA, nutrients, POC/N, DOC/N) from historic sea-ice expeditions from around Antarctica, with the aim to validate sea-ice biogeochemistry models and to estimate the distribution of these key biogeochemical properties in both Antarctic and Arctic sea ice;
- production of community-based position analyses and policy documents on sea-ice associated (eco)systems with an emphasis on the impact of biogeochemical processes; and
- collaboration with other sea-ice associated science communities, through new project and networking proposals (e.g., the new CIce2Clouds SCOR working group).

Report Author(s)

Jacqueline Stefels, the Netherlands

Jeff Bowman, USA

Summary of activities from 2020-22

(Please provide highlights of your group's progress since the last report to SCAR Delegates in 2020, covering major activities/achievements, upcoming activities and key challenges faced).

Highlights:

- Following detailed evaluations, data collations, observation and model studies, BEPSII applied its collective expertise to compile several policy relevant community science

papers, two of which were published in 2020. In 2021, a synthesis of climate change impacts on sea-ice ecosystems and associated ecosystem services was published in *Elementa: Science of the Anthropocene* (Steiner et al. 2021). The main outcomes of the three publications have been compiled into a **policy brief**, which has been circulated widely and received significant international attention including at the COP26 Cryosphere Pavilion. (see below for references)

- The 2021 **synthesis of the sea-ice ecosystem and associated ecosystem services** highlights that: 1. The sea-ice ecosystem supports all four ecosystem service categories; 2. sea-ice ecosystems meet the criteria for ecologically or biologically significant marine areas (EBSAs); 3. global emissions driving climate change are directly linked to the demise of sea-ice ecosystems and its ecosystem services; and 4. the sea-ice ecosystem deserves specific attention in the evaluation of marine protected area planning. The ongoing changes in the polar regions have extreme impacts on sea-ice ecosystems and associated ecosystem services. While the response of sea-ice associated primary production to environmental change is regionally variable, the effect on ice-associated mammals and birds are predominantly negative, subsequently impacting human harvesting and cultural services in both polar regions. Conservation can help protect some species and functions. However, the key mitigation measure is a reduction in carbon emissions.
- A **joint BEPSII-CATCH (Cryosphere and Atmospheric Chemistry) SCOR working group** was launched in November 2021 (SCOR-WG 163: *CIce2Clouds:* Coupling of ocean-ice-atmosphere processes: from sea-Ice biogeochemistry to aerosols and Clouds). The new WG aims to better link the communities and help improve understanding and model parameterizations of biogeochemical processes in sea-ice regions, which may impact the local and global climate and are insufficiently represented in current earth system models.
- In February/March 2021, a small sea ice **inter-comparison experiment** for CO_2 flux took place in Saroma-ko Lagoon, Hokkaido Japan. Nomura et al. compared the CO_2 flux data measured by the different type of chambers. In addition, equipment such as air–sea ice CO_2/CH_4 flux chambers and an eddy covariance system, a trace metal analyzer, and a pump and sampler for environmental DNA were tested.
- A major field inter-comparison experiment was conducted in May 2022 at CHARS, Cambridge Bay, Canada. This experiment lasted 6 weeks and included more than 15 scientists and examined methods for measuring gas fluxes, gas concentrations, primary production, and biomass. This experiment was the last intercomparison experiment carried out by the ECV-Ice SCOR working group.
- The May 2022 inter-comparison experiment was associated with the **BEPSII field school**, to efficiently make use of scientists/teachers available for both activities. The field school was extremely successful. Although we got the green light only 3 months before the event, over 100 students and Early Career Researchers (ECRs) applied for the 30 places available.
- Both in 2020 and 2021, the **annual BEPSII meetings** were held online. Various discussion sessions, science presentations and specific ECR sessions were organized in an around-the-world set-up. These were well received, but there was also a general feeling that an in-person meeting every now and then is needed to stimulate creativity and collaboration. It was decided for the future to try to organize in-person meetings every second year in association with a relevant science meeting and use the funds for an ECR exchange program in alternate years.
- In 2020, a new BEPSII Special Feature of *Elementa Science of the Anthropocene* was opened: Insights into Biogeochemical Exchange Processes at Sea Ice Interfaces (BEPSII-2). Currently 8 papers have been published within this feature.

Summary Budget 2021 to 2024

	2021	2022	**2023**	**2024**
	Spent	Allocated	Request	Request
(US$)	$ 2000	$ 10 771	$ 4000	$ 4000

Progress to date

(*Summarize your group's activities and plans in the tables below and, in each case, provide your sub-group name in the left-hand column to assist Science Group COs in compiling their reports*)

Sub-group Outcomes Summary

Sub-group	Activity/Outcome/Benefit/Achievement
BEPSII	As an outcome of a 3-day side meeting of the POLAR2018 conference, the BEPSII community published a paper describing a policy-oriented position analysis on the future of Arctic sea-ice biogeochemistry and ice-associated ecosystems (Lannuzel et al. 2020, *Nature Climate Change*)
BEPSII	Publication of a commentary from the BEPSII community on Implications of Sea-Ice Management for Arctic Biogeochemistry (Miller et al. 2020, *EOS*)
BEPSII	Publication of a synthesis paper on the role of sea ice in supporting ecosystems and ecosystem services (N. Steiner et al. 2021, *Elementa Science of the Anthropocene*)
BEPSII	Launch of a new special issue in the journal *Elementa - Science of the Anthropocene*: 2020-2022. So far with 8 published papers. (https://online.ucpress.edu/elementa/collection/8273/Special-Feature-Insights-into-Biogeochemical)
BEPSII	In 2021, a *Policy Brief* was distributed through our sponsor networks and at the COP26 Cryosphere Pavilion.
BEPSII	Many BEPSII members participated in the year-round Arctic sea-ice expedition MOSAiC (Multidisciplinary drifting Observatory for the Study of Arctic Climate as part of the BGC Team; https://mosaic-expedition.org/expedition/). Oct. 2019 – Oct. 2020
BEPSII	February/March 2021, a sea-ice inter-comparison experiment for CO_2 flux measurements, Saroma-ko Lagoon, Hokkaido Japan. (Nomura et al. 2022, *Bulletin of Glaciological Research*)
BEPSII	A joint method inter-comparison experiment in Cambridge Bay, Canada, May 2022 (B. Else and ECV-Ice SCOR working group)
BEPSII	A BEPSII field school for early career scientists in Cambridge Bay, Canada, May 2022 (L. Tedesco et al.)
BEPSII	Initiation of a joint BEPSII-CATCH (Cryosphere and Atmospheric Chemistry) SCOR working group aiming to improve our understanding and model parameterizations of biogeochemical processes in ocean - sea-ice - atmosphere systems. Nov. 2021
BEPSII	24-28 August 2020 around-the-world online annual meeting + ECS meeting on 21 August. Approx. 65 subscribers
BEPSII	23-27 August 2021 around-the-world online annual meeting + ECS meeting on 20 August. Approx. 85 subscribers

Sub-group Cash Flow

(Since previous report to Delegates in 2020)

Sub-group	Allocation	Amount spent 2020	2021	2022
BEPSII	$ 4000	-	$ 2000	$ 10 771*

* Due to a very generous re-allocation of unspent funds within the LS-SG community, we were able to use these funds for the organisation of the BEPSII field school, in May 2022.

Future plans

Planned activities in 2022 to 2024

Sub-group	Planned activity
BEPSII	An updated synthesis on the sea-ice carbon pump (BEPSII carbon cycle experts, led by Sebastien Moreau (Norway), in preparation)
BEPSII	Data collation and synthesis on nutrients in landfast Antarctic sea ice has been initiated by Sian Henley (UK)
BEPSII	Data collation & synthesis on POC/DOC/PON/DON in Antarctic sea ice and Chlorophyll-*a* in Arctic sea ice has been delayed, but is still in the pipeline
BEPSII	A policy-oriented position analysis “Antarctic sea-ice change: Biogeochemical and Ecological Consequences” (Klaus Meiners et al. Australia)
BEPSII	Publication of a review “Polar Seas and Sea Ice” as a contribution towards a SOLAS – special issue in *Elementa: Science of the Anthropocene.* (Else, Lannuzel, Willis et al.)
BEPSII	Production of a Special Collection “Antarctica and the Southern Ocean” in *Frontiers for Young Minds.* Lead by BEPSII ECR member Pat Wongpan (Australia) and Letizia Tedesco (Finland)
BEPSII	Preparing for a joint BEPSII-CATCH field campaign in the Antarctic to assess biogeochemical exchange processes between ocean, sea ice and the atmosphere. Collaborative effort within the new CIce2Clouds working group.
BEPSII	Coordinating an Ice Algae Model Intercomparison Project Phase 2 (IAMIP2) by Hakase Hayashida (Japan)
BEPSII	Special session on emerging technologies for sea-ice biogeochemical measurements and monitoring at the 2023 International Glaciological Society Symposium on Sea Ice, Bremerhaven, Germany, June 4-9.

Planned use of funds for 2022 to 2024

Year (YYYY)	Purpose/Activity	Amount (in USD)	Contact Name	Contact Email
2023	In-person annual meeting in San Diego, CA, USA	$ 4000	Jeff Bowman	jsbowman@ucsd.edu
2024	ECR exchange program	$ 4000	Jacqueline Stefels	j.stefels@rug.nl
Total		$ 8000		

Any additional detail on funds usage and desired results/outcomes

2023: The in-person meeting is associated with the Gordon Research Conference on Polar Marine Science.

2024: Every second year, the annual meeting will be online, so that funds can be spent on an exchange program for ECRs, between BEPSII-associated labs. The 2 ECRs on the BEPSII Steering Committee will lead the award process.

Percentage of the budget to be used for support of early-career researchers

2022: 100%

2023: ~50%

2024: 100%

Percentage of the budget to be used for support of scientists from countries with developing Antarctic programmes

2022: ~5%

2023: ~10%

2024: ~20%

Membership

Leadership

Role	First Name	Last Name	Affiliation	Country	Primary Language	Email	Date Started
Co-chair	Jacqueline	Stefels	University of Groningen	Netherlands	Dutch	j.stefels@rug.nl	Sept. 2016
Co-chair	Jeff	Bowman	Scripps Institute of Oceanography	USA	English	jsbowman@ucsd.edu	Sept. 2016
ASPeCT liason	Klaus	Meiners	Australian Antarctic Division	Australia	German	Klaus.Meiners@aad.gov.au	Sept. 2016
member	Maria	van Leeuwe	University of Groningen	Netherlands	Dutch	m.a.van.leeuwe@rug.nl	Sept. 2016

*(Please identify early-career researchers with * in first column)*

Other members (These members are BEPSII steering committee members, together with two of the SCAR EG members. In addition, there are ~200 people on the mailing list)

First Name	Last Name	Affiliation	Country	Primary Language	Email
Nadja	Steiner	Fisheries & Oceans Canada	Canada	German	Nadja.Steiner@ec.gc.ca
Martin	Vancoppenolle	LOCEAN – UPMC, Paris	France	French	martin.vancoppenolle@locean-ipsl.upmc.fr
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*(Please identify early-career researchers with * in first column)*

Additional information (optional)

(Please add any more detail here that you wish on your sub-group activities, papers published, etc.)

Notable Papers

(*Five to ten most notable papers – see the example below, which includes a brief statement (shaded) indicating the link to the group*)

Selected top publications:

D. Lannuzel, L. Tedesco, M. van Leeuwe, K. Campbell, H. Flores, B. Delille, L. Miller, J. Stefels, P. Assmy, J. Bowman, K. Brown, G. Castellani, M. Chierici, O. Crabeck, E. Damm, B. Else, A. Fransson, F. Fripiat, N.-X. Geilfus, C. Jacques, E. Jones, H. Kaartokallio, M. Kotovitch, K. Meiners, S. Moreau, D. Nomura, I. Peeken, J.-M. Rintala, N. Steiner, J.-L. Tison, M. Vancoppenolle, F. Van der Linden, M. Vichi, P. Wongpan (2020) The future of Arctic sea-ice biogeochemistry and ice-associated ecosystems. *Nature Climate change* https://doi.org/10.1038/s41558-020-00940-4

This paper is the outcome of a 3-day side meeting of the POLAR2018 conference and describes BEPSII's community view on the future of Arctic sea-ice biogeochemistry and ice-associated ecosystems.

L. Miller, F. Fripiat, S. Moreau, D. Nomura, J. Stefels, N. Steiner, L. Tedesco, M. Vancoppenolle (2020) Implications of sea ice management on Arctic sea ice biogeochemistry. *EOS*, 101, https://doi.org/10.1029/2020EO149927.

This work provides a commentary from the BEPSII community on Implications of Sea-Ice Management and geo-engineering for Arctic biogeochemistry.

NS Steiner, J Bowman, K Campbell, M Chierici, E Eronen-Rasimus, et al. (2021) Climate change impacts on sea-ice ecosystems and associated ecosystem services, *Elem Sci Anth* 9 (1), https://doi.org/10.1525/elementa.2021.00007

This paper is a synthesis on the role of sea ice in supporting ecosystems and ecosystem services in both polar regions.

Steiner, N., Stefels, J., Bowman, J. S., Castellani, G., Crabeck, O., Delille, B., Else, B., Flores, H., Fripiat, F., Lannuzel, D., Meiners, K., Miller, L., Moreau, S., Nomura, D., Tedesco, L., & Vancoppenolle, M. (2021). **BEPSII Arctic Policy Brief**. https://doi.org/10.5281/zenodo.5595254

This Policy Brief was drafted by the BEPSII SSC to summarise the main outcome of the above mentioned papers and was used as input for COP26.

O. Crabeck, K. Campbell, S. Moreau, M. Thomas. 2021. The movement of CO_2 through the frozen world of sea ice. 2021. *Frontiers for Young Minds*. 9:516072. doi: 10.3389/frym.2020.516072

This is an outreach publication for kids.

Direct support from outside organisations received for your activities

(*Numbered list with values indicated if direct cash support. Please restrict in-kind support to substantive in-kind support only*)

Organisation	Support in 2020	Support in 2021	Support in 2022
SOLAS		€ 2000	$ 5,000
CLiC		CHF 3000	CHF 6,000
IASC			€ 8,500
SCOR (ECVice)			€ 8,000
NSF-OPP			$ 11,944

Major collaborations your group has with other SCAR groups and with organisations/groups beyond SCAR

(*Numbered list of substantive collaborations*)

Within SCAR

1. ASPeCT

Outside SCAR

1. SOLAS
2. CLiC
3. IASC
4. SCOR
5. CATCH
6. SOOS

Outreach, communication and capacity-building activities

(Brief highlights of any activities undertaken since the last report to SCAR Delegates in 2020).

Contributions to *Frontiers for Young Minds* (publication in 2021 and plans for a collection of ~15 papers; see above), to engage kids in the wonders and importance of polar science in general and sea ice as a habitat and as a key player in climate control in particular.

Communication & Outreach:

Social media:

- BEPSII mailinglist: bepsii@lists.scar.org at http://lists.scar.org/mailman/listinfo/bepsii
- BEPSII website: www.BEPSII.org (links from the SCAR website refer to this site)
- BEPSII Twitter profile: @BEPSII_seaice

Policy Brief published in 2021 (see scientific highlights, above)

Our ECRs are involved in the production of a Special Feature on Antarctic research in *Frontiers for Young Minds.*

Capacity building activities:

- BEPSII field school in May 2022 (see above)
- Since 2020, 2 early career researchers have joined the steering committee, as a means to ensure succession planning and integrate ideas from the next generation of polar leaders. After their terms on the SSC, we hope they will continue to engage in the scientific foci of BEPSII, including new leadership roles. The ECR assignments are for two years and are selected by evaluation of applications to the SCC following a public call. At the end of 2021, two new ECR steering committee members were appointed.

Contributions to equality, diversity, and inclusion (EDI)
(Any specific actions the group has undertaken to advance EDI within the group and/or within SCAR)

In 2021, members of the BEPSII Steering committee represented 10 countries, with a 50/50 women/men balance. The steering committee has included 2 early career researchers since 2020.
With this diverse leadership team, the BEPSII community aims to express inclusiveness and openness to the global research community. Inclusion of researchers in developing countries who have an interest in polar and sea-ice research is problematic, which is at least partly due to the fact that relatively few developing countries have a strong polar research program. Researchers from South Africa are well embedded in BEPSII, and through the new SCOR working group CIce2Clouds, scientists from India and Chile are now also involved.

SCAR fellowship reviewers

(As part of SCAR's Capacity Building efforts, such as the Fellowships and Visiting Scholar Awards, we are looking for people from all the SCAR groups to form a 'review panel' so if applications in your field are submitted we have people to contact to help assess relevant applications. Please list one or more people (name and email address) from your group who would be willing to serve as reviewers for the next few years, along with 1-3 keywords on their principal expertise.)

First Name	Last Name	Email	Principal Expertise
Maria	Van Leeuwe	m.a.van.leeuwe@rug.nl	Phytoplankton ecophysiology

SCAR Sub-Group	**PLASTIC AG**
SG	LS
Person Responsible:	Ilaria Corsi, Clara Manno

XXXVII SCAR Delegates Meeting

India, September 2022

PLASTIC AG

2020-22 Report

Summary

Plastic pollution has become a global environmental issue, reaching even the most pristine and remote wildernesses of our planet, including the Southern Ocean (SO). The SO plays a major role in global oceanic circulation and provides fundamental ecosystem services to our planet, as for instance being responsible for 40% of the global carbon uptake. Being well adapted to extreme but stable environmental conditions, with unique phenotypic traits, Antarctic species are considered more vulnerable to environmental changes and pollution, compared to species from lower latitudes. Thus, more evidence of plastic pollution in the SO poses a serious threat to marine biodiversity. To date, little has been done to effectively assess the amount of plastic entering the Antarctic environment from within and outside the SO. Understanding the sources of plastics and quantifying the scale of the problem are necessary in order to minimize environmental risks and impacts on biodiversity. Data and sample collection from Polar regions are difficult to obtain due to their remoteness and difficulty of access. For this reason, it is crucial to develop common actions and strategies to increase spatial and temporal data coverage in order to improve our understanding of the fate and behaviour of plastics and their effects on the SO ecosystems. Under the umbrella of the Scientific Committee on Antarctic Research (SCAR), the action group on “Plastic in Polar Environments” (SCAR PLASTIC AG) was launched at POLAR2018 in Davos (Switzerland). 78 participants from 20 different countries attended the launch meeting (https://www.scar.org/library/science-4/life-sciences/plastic/5180-plastic-workshop-2018). In October 2019 the PLASTIC-AG guested the first International Workshop “Plastic in the Polar Environment: sources, impacts and solutions” at the University of Hull (UK) (https://www.scar.org/scar-news/plastic-news/workshop-report-2019). Since then the SCAR PLASTIC AG has established a strong network of scientists (currently 172 members) dealing with plastic pollution in Polar Regions with the aim to: (1) assess the occurrence, distribution, source and fate of plastics, (2) promote best practice protocols for monitoring; (3) evaluate their impact on ecosystems and (4) propose mitigation to limit plastic pollution in collaboration with for instance IAATO, COMNAP and other bodies and initiatives.

Report Author(s)

Elisa Bergami (Italy), Ilaria Corsi (Italy), Clara Manno (UK), Cath Waller (UK), Claire Waluda (UK)

Summary of activities from 2020-22

Activities/achievements

1. 2021_Special issue of Environment International (Elsevier, IF 7.943) entitled “Plastics in Polar Regions”. Guest editors (Ilaria Corsi & Elisa Bergami). This special issue includes 10 key research papers from the Plastic-AG community on plastic pollution in the Arctic and Antarctica. A selection of these are listed in Additional Information below.
2. 2021_Establishment of Plastic AG Early Career Researcher network (currently more than 25 members) for sharing activities, upcoming events and opportunities.
3. February 2021_Creation of PLASTIC AG official social media accounts @PlasticPolar on Facebook and Twitter and @plastic.ag on Instagram to promote PLASTIC AG and general SCAR activities and share latest achievements and future initiatives of the AG (public awareness/networking).
4. March 2021_International Symposium on Plastic in the Arctic and the Sub-Arctic region (Online event): participation in the International Panel Discussion “Sources and transport of microplastic to the Arctic and Sub-Arctic”.
5. May 2021_SETAC Europe XXXI Annual Meeting: session dedicated to “Plastic in the Southern Ocean”.
6. From August 2021 to May 2022_Co-chaired the Southern Ocean UN Decade Working Group “A clean ocean where sources of pollution are identified, reduced or removed” which is one of the key challenges identified by the UN facing the global Ocean.
7. From August 2021 to May 2022_Contribution to the delivering of the Southern Ocean Decade Action Plan. The Southern Ocean Action Plan will, as part of the UN Ocean Decade, deliver in achieving the UN Agenda 2030 and its Sustainable Development Goals in a polar context.
8. March 2022_International Panel Discussion "Plastic pollution in the Southern Ocean: a global outlook", under the umbrella of the UN Ocean Decade initiative “A Healthy and Resilient Ocean”.

<u>On going activities</u>

1. Preparation of a perspective paper focusing on SO plastic research priorities, gaps and challenges in the context of SO decade Action plan
2. Update SCAR online database on macro- and microplastics (hosted by SOOS), available at: https://www.soosmap.aq/
3. Contribute to an up-to-date and open access online interactive map resource on contaminants (POPs and microplastics) in the Antarctic environment, in collaboration with ImPACT AG.
4. Generate the first SCAR PLASTIC projects network repository (with direct link on SCAR PLASTIC AG webpage on all the SO plastic-related projects).

Template below as an example.

A	B	C	D	E	F	G	H	I	J
			SCAR PLASTIC AG PROJECT REPOSITORY						
Project Name	Principal investigator	Webpage	Funding	Duration	1-2 sentences description	Logo	Topics (5 keywords)	Contact email	

5. Organization of the 2nd SCAR PLASTIC AG Workshop (scheduled to take place in Siena (Italy) in 2023 hosted by the University of Siena, Department of Physical, Earth and Environmental Sciences). Expected in Spring 2023.
6. Increase EDI and ECRs participation in PLASTIC AG activities providing support for travel grants and/or registration waivers in order to attend 2023 AG Workshop.
7. Include a dedicated EDI networking session in the PLASTIC AG Workshop scheduled in 2023.

Key challenges faced:

The second AG workshop (University of Siena, 2021) was canceled due to covid-19 pandemic. However, the AG has continued to produce content/papers and attract new membership. We would like to extend the AG for a further 2 years (see 2021 report for a detailed justification) in order to achieve all scheduled activities, particularly as there are a number of projects and ideas in progress.

Summary Budget 2021 to 2024

	2021	**2022**	**2023**	**2024**
	Spent	Allocated	Request	Request
(US$)	1,000 transferred to ImPACT AG for the interactive map activity (Bengston-Nash)	1,802	2,800	2,800

*In our 2021 Report we requested to transfer the 2020 balance to fund a second AG meeting in 2022 alongside an extra $1,000 per year to support ECR and countries with developing Antarctic programmes.
We have been able to save money in our 2018-2020 budget by (a) obtaining sponsorship from commercial companies (see summary budget), (b) securing sponsorship from the EEI, University of Hull for the AG meeting in October 2019 and (c) not funding ECR travel to SCAR 2020 due to covid-19. In the 2021 Report we proposed to use $2,802 underspend from 2020 to fund an extension to the group in 2021 and 2022, with a request for an additional $2,800 per year over the two years.

Progress to date (see summary of activities listed above)

(*Summarize your group's activities and plans in the tables below and, in each case, provide your sub-group name in the left-hand column to assist Science Group COs in compiling their reports*)

Sub-group Outcomes Summary

Sub-group	Activity/Outcome/Benefit/Achievement

Sub-group Cash Flow

(Since previous report to Delegates in 2020)

Sub-group	Allocation	Amount spent		
		2020	2021	2022

Future plans (see summary of activities listed above)

Planned activities in 2022 to 2024

Sub-group	Planned activity

Planned use of funds for 2022 to 2024

Year (YYYY)	Purpose/Activity	Amount (in USD)	Contact Name	Contact Email
2022	SCAR Plastic projects repository	1,000	Elisa Bergami	elisa.bergami@unimore.it
2023	2nd Workshop in Siena (Italy) including also travel grant support for participation of EDI and ECRs	1,802 (residual 2022)+2,800	Ilaria Corsi	ilaria.corsi@unisi.it
2024	Perspective paper	1,800 (publication fees)	Clara Manno	clara.manno@bas.uk

Total		**7,402**		

Any additional detail on funds usage and desired results/outcomes

2023: 45% to organize and attend the 2nd Workshop in Siena (Italy)
2024: 100% perspective paper

Percentage of the budget to be used for support of early-career researchers

2023: 30% for fellowships to allow ECRs to attend the 2nd Workshop in Siena (Italy)

Percentage of the budget to be used for support of scientists from countries with developing Antarctic programmes

2023: 25% for dedicated fellowships to attend the 2nd Workshop in Siena (Italy)

Membership

See websites for leadership and other members details (https://www.scar.org/science/plastic/members/)

Leadership

Role	First Name	Last Name	Affiliation	Country	Primary Language	Email	Date Started

*(Please identify early-career researchers with * in first column)*

Other members

First Name	Last Name	Affiliation	Country	Primary Language	Email

*(Please identify early-career researchers with * in first column)*

Additional information

Notable Papers

1. Caruso G., Bergami E., Singh, Corsi I. 2022. Plastic occurrence, sources and impacts in Antarctic environment and biota. Water Biology and Security, 1, 100034. https://doi.org/10.1016/j.watbs.2022.100034.

This review paper provides a state of the art on plastic occurrence, sources and impact on the Antarctic environment. It was the outcome of the 2021 activities of the AG.

2. Manno C., Peck L.V., Corsi I., Bergami E. 2022. Under pressure: nanoplastics as a further stressor for sub-Antarctic pteropods already tackling ocean acidification. Marine Pollution Bulletin, 174, 113176. https://doi.org/10.1016/j.marpolbul.2021.113176

This work addresses the combined exposure to nanoplastics and ocean acidification in a key species of Antarctic marine environment. It was the outcome of the scientific collaboration between AG steering committee members.

3. Buckingham, J. W., Manno, C., Waluda, C. M., & Waller, C. L. (2022). A record of microplastic in the marine nearshore waters of South Georgia. Environmental Pollution, 306, 119379. https://doi.org/10.1016/j.envpol.2022.119379

This work provides first information on Microplastic contamination on the waters around South Georgia.

4. Cappello S., Caruso G., Bergami E., Macrì A., Venuti V., Majolino D., Corsi I. 2021. New insight into the structure and function of prokaryotic communities colonizing plastic debris collected in King George Island (Antarctica). Journal of Hazardous Materials, 414, 125586. https://doi.org/10.1016/j.jhazmat.2021.125586

This work provides first evidence of microbial colonization of two plastic debris of different polymer composition and size in King George Island (Antarctica). It was the outcome of the scientific collaboration between members of the AG.

5. Bergami E., Rota E., Birarda G., Vaccari L., Corsi I. 2020. Plastics everywhere: first evidence of polystyrene fragments inside the common Antarctic collembolan Cryptopygus antarcticus. Biology Letters, 16, 20200093.

This work provides the first field-based evidence of microplastics entering Antarctic terrestrial food webs. It is related to the outcomes of the Impacts Working Group of the PLASTIC-AG Workshop in Hull, October 2019.

6. Horton A. A. and Barnes D.K.A. 2020. Microplastic pollution in a rapidly changing world: implication for remote and vulnerable ecosystems. Science of the Total Environment, 738, 140349. https://www.sciencedirect.com/science/article/pii/S0048969720338717

This discussion paper considers the implications of microplastics as a multi-stressor for vulnerable marine ecosystems (including the deep sea and coastal Antarctica), in combination with other anthropogenic contaminants and global environmental change.

7. Jones-Williams K., Galloway T., Cole M., Stowasser G., Waluda C., Manno C. 2020. Close encounters - microplastic availability to pelagic amphipods in Sub-Antarctic and Antarctic surface waters. Environment International, 140, 105792. https://doi.org/10.1016/j.envint.2020.105792

This work provides comparative concentrations of microplastics in surface waters and pelagic amphipods from a Sub-Antarctic - Western Antarctic Peninsula transect, demonstrating that even low concentrations of microplastics are potentially encountered by near-surface dwelling zooplankton.

8. Le Guen C., Suaria G., Sherley R.B., Ryan P.G., Aliani S., Boehme L., Brierley A.S. 2020. Microplastic study reveals the presence of natural and synthetic fibres in the diet of King Penguins (Aptenodytes patagonicus) foraging from South Georgia. Environment International, 134, 105303. https://doi.org/10.1016/j.envint.2019.105303

This article demonstrates the presence of natural and synthetic microfibers in the diet of King Penguins (Aptenodytes patagonicus) foraging from South Georgia

9. Suaria G., Perold V., Lee J.R., Lebouard F., Aliani S., Ryan, P.G., 2020. Floating macro-and microplastics around the Southern Ocean: Results from the Antarctic Circumnavigation Expedition. Environment International, 136,105494. https://doi.org/10.1016/j.envint.2020.105494

This work presents the results of a floating macro- and microplastics survey carried out in the Southern Ocean during the Antarctic Circumnavigation Expedition.

10. Waluda C.M., Staniland I.J., Dunn M.J., Thorpe S.E., Grilly E., Whitelaw M., Hughes K.A. 2020. Thirty years of marine debris in the Southern Ocean: annual surveys of two island shores in the Scotia Sea. Environment International 136, 105460. https://doi.org/10.1016/j.envint.2020.105460

This work provides an analysis of one of the longest time series of beached debris in the Southern Ocean and links the work of the SCAR AG with the CCAMLR marine debris program.

Direct support from outside organisations received for your activities

(*Numbered list with values indicated if direct cash support. Please restrict in-kind support to substantive in-kind support only*)

Major collaborations your group has with other SCAR groups and with organisations/groups beyond SCAR

Within SCAR

1. SOOS
2. ImPACT
3. AnTEco

Outside SCAR

1. European Polar Board (EPB)
2. International Association of Antarctica Tour Operators (IAATO)
3. Association of Arctic Expedition Cruise Operators (AECO)
4. Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR)
5. Energy and Environment Institute (EEI), University of Hull
6. Association of Polar Early Career Scientists (APECS)
7. SCOR working group, Floating Litter and its Oceanic TranSport Analysis and Modelling (FLOTSAM)
8. Polar Educators International (PEI)
9. Sila.lu (Zero Waste Luxembourg)
10. Polar.lu (Luxembourg's Polar program)
11. Service de Coordination de la Recherche et de l'Innovation pédagogiques et technologiques (SCRIPT) from the Ministry of Education => Ministère de l'Éducation nationale, de l'Enfance et de la Jeunesse.
12. Antarctic Logistics and Expeditions (ALE)
13. Antarctic Monitoring and Assessment Programme (AnMAP)

Outreach, communication and capacity-building activities

1. Selected talks and public outreach activities from the AG committee:

- June 2022: Projects funded by the Italian National Program of Antarctic Research on plastics (SCAR LS Italian delegates meeting).
- June 2022: Show case and talk "The fate of microplastic in the Southern Ocean" for CHANEL delegates.
- May 2022: Show case and talk "Source of plastic pollution in Antarctica" for BERRY GLOBAL delegates.
- May 2022: Microplastics in Antarctica (Dialogos Antarcticos, Conferencia Italian Embassy in Uruguay, Las investigacion cientifica en las bases de Italia y Uruguay).
- May 2022: Pint of Science, synergistic impact of microplastic and other polluttant in the Southern Ocean
- March 2022: Ocean Decade laboratory Activity, talk-PLastic Pollution in Southern Ocean: a global outlook in the context of the UN Ocean Decade

- October 2021: participation to the Ice Worlds Festival of Polar Science. National Maritime Museum Greenwich, London (public outreach)
- September 2021: The plastic human footprint in Antarctica. (European Researchers' Night at the Italian Antarctic Museum, Siena)
- May 2021: The Emerging Issue of Plastic Pollution in Antarctica. Contribution to the project "Antarctic Resolution", edited by Giulia Foscari/UNLESS, Lars Müller Publishers, pp. 992.
- May 2021: Plastics in polar environments: main findings and ongoing studies of the 4 years PLANET project in Antarctica. SETAC Europe 2021.
- March 2021: The SCAR Plastic in Polar Environments Action Group: International cooperation on plastic pollution at the poles (International Symposium on Plastic in the Arctic and the sub-Arctic region).
- September 2020: Environment and microplastics: news from Antarctica. ESOF EuroScience Open Forum 2020 (CERIC-ERIC invited talk).
- September 2020: Together for the environment. Public awareness project promoted by the Italian Income Revenue Authority (Emilia-Romagna region: invited talk).

Contributions to equality, diversity, and inclusion (EDI)

The AG steering committee embraces EDI and Open Science principles. In 2019, we assigned travel grants to Early Career Researchers (ECRs) based on EDI values to allow people with diverse background, knowledge, and life experiences to attend the 2019 SCAR PLASTIC-AG Workshop at Hull (UK). Selected ECRs belonging to emerging and high-income countries were able to attend from Europe, North and South America as well as Western Asia, meeting experts in polar sciences and plastic pollution and actively participating in the working group discussions.

In 2022 we were unable to assign grants for ECRs as the AG Workshop was postponed to 2023 due to the pandemic. However, we have been promoting EDI in the online panel discussions organised within the UN Ocean Decade satellite activities (REF to this), allowing all participants to comment, express their opinion and interact with speakers using the Q/A box. Such an interactive platform was well received by all the participants (link to the minutes: https://www.scar.org/science/plastic/session/).

In line with these initiatives undertaken within the AG, we aim to further support EDI and networking activities, involving stakeholders in the PLASTIC AG Workshop scheduled for 2023 in Siena (Italy). Other dedicated EDI actions promoted in the framework of PLASTIC AG include 1 EDI student internship (4 months, 2021 - 2022) funded by British Antarctic Survey with the project: "Abundance of Microplastic around South Sandwich Islands" and EDI student mentoring and talk during the Polar Horizons program 2021 under the umbrella of The Diversity in Polar Science Initiative.

SCAR fellowship reviewers

(As part of SCAR's Capacity Building efforts, such as the Fellowships and Visiting Scholar Awards, we are looking for people from all the SCAR groups to form a 'review panel' so if applications in your field are submitted we have people to contact to help assess relevant applications. Please list one or more people (name and email address) from your group who would be willing to serve as reviewers for the next few years, along with 1-3 keywords on their principal expertise.)

First Name	Last Name	Email	Principal Expertise
Elisa	Bergami	elisa.bergami@unimore.it	ecotoxicology, marine ecology, environmental and antropogenic stressors, plastic pollution
Ilaria	Corsi	ilaria.corsi@unisi.it	ecotoxicology, ecological risk assessment, environmental pollution
Clara	Manno	clanno@bas.ac.uk	Marine ecology, biological oceanography, environmental antropogenic stressors

SCAR Sub-Group	ANTOS
SG / SC	PS / LS / GS / SC-HASS
Person Responsible:	xxx

XXXVII SCAR Delegates Meeting

India, September 2022

Name of SCAR Sub-Group

2020-22 Report

Summary

Report Author(s)

S. Craig Cary & Vonda Cummings (NZ)

Summary of activities from 2020-22

Major activities and achievements

1. Invited Talks. During the pandemic and series of global lockdowns meetings continued to be held on-line. Over this period of time ANTOS continued to get the word out that a biology centric monitoring initiative was developing that would provide the guidance and hopefully support the establishment of cross continent integrated climate monitoring network. Members of the committee presented invited talks at four conferences including one seeking to develop a similar system across the sub-Antarctic – Sub-ANTOS.
2. Technical Manual Development – the central spine of ANTOS is to design and install 25 dedicated monitoring nodes in or near per-selected biological sentinel sites. The key quality of these nodes is that the monitoring hardware is identical – every parameter being measured is measured in the same way at every sentinel site in both the terrestrial and marine systems. To achieve this, we needed to find a vendor that could develop the off-shelf capability and supply the equipment with a detailed manual of operation. After almost three years of exploring options, we found a vendor in Canada (Hoskins Scientific), who, with continued input from ANTOS, has developed three scalable monitoring systems (Tier 1-3) for both near-shore and terrestrial deployment and their respective manuals.
3. One of the greatest aspirations for ANTOS has been to attract the funding to support the installation of Tier 3 systems in 25 cross continental locations so that we could take the inevitable burden of costs off the shoulders of either individual researchers or National Programs and insure long-term persistence. Over the past two years we began this process through an opportunity in Australia to attract philanthropic support for over $10M. ANTOS rallied behind

Dana Berstrom (AAD) and Prof. Sharron Robinson (University of Wollongong) in developing the proposal that is currently in review. The timing was perfect as it motivated the finishing of the technical manual and the development of a draft prospectus.

4. ANTOS was represented at two US NSF-supported workshops. (A). Developing an Antarctic Biorepository (Jan 2-4, 2022). (B). Developing a submarine fiber optic telecommunications cable from New Zealand to McMurdo Station with terabit-scale networking capability. (The cable infrastructure can also serve as a scientific platform [a Scientific Monitoring And Reliable Telecommunications "SMART" cable] with capability to monitor ocean conditions and seismic activity) (June 29-July 1, 2021).
5. Research proposals are increasingly including ANTOS systems in their science plans. For example, a proposal submitted to the BelSPO Impuls 2022 call (Verleyen) includes installing a long-term monitoring site in Yûboku Valley incorporated into the ANTOS programme and network.
6. The installation of 25 Tier 3 marine and terrestrial nodes in 25 sentinel sites – is aspirational. ANTOS fully supports the individual researchers and national programs installing smaller systems is areas of interest. ANTOS currently has six Tier one terrestrial (NZ, Italy) and three Tier 2 marine (NZ) systems installed. During the past two years ANTOS has written letters to support applications in Italy, Argentina, and Australia to install four Tier 1 and a Tier 3 terrestrial system in designated sentinel sites.
7. Committee members have been invited to attend and participate at five international conferences, symposia, and/or workshops that focus on aspects of monitoring climate change in Antarctica and the sub-Antarctic.

Upcoming Activities

1. Development of the ANTOS Prospectus: Targeting different audiences, including (i) the Antarctic community, (ii) policy makers, and (iii) operators/logistics, and philanthropists. The Prospectus will describe the purpose and value of ANTOS to potential funders.
2. Analysis of ANTOS Survey II: the survey was designed and launched in April 2020-21. It targeted participants of Survey I to gain more detailed information on the data stream available (incl. frequency and duration of measurements, observed environmental/ecological responses) and participants views on the uniqueness/value of different sites. We currently have a PhD student (Bringham Young University, USA) working up the data from both surveys into a publication.
3. The Committee developed a "Decision Tree" to help make the rational decisions on the choice of sites. Once the survey data have been fully analysed (see #2 above), a sub-set of the ANTOS committee will use the Decision Tree to pick the 25 sites. These will then be revealed to the nominees at the SCAR Biology meeting in New Zealand next year.
4. Field Survey Protocol Development. Critical to the installation of any ANTOS system into a Sentinel site is the need for and intensive baseline biological survey. We can only monitor change if we know where we have started. The development of the Field Survey Manuals was supported by an internal grant to

Prof. Sharon Robinson from Wollongong University. The manuals are in their final stages of development and will be soon sent out for peer-review.

Key challenges faced:

The impacts from Covid described in our 2020 report have continued and even increased as the global Pandemic continued. Every individual involved in ANTOS has been impacted. Scheduled meetings have been cancelled or postponed due to the closure of boarders and inability to travel. Several workshops had been planned for 2021 and 2022. These workshops were to finalise (i) the KOPRI-hosted database, (ii) review the second survey results, (iii) choose 25 priority ANTOS Sentinel Sites, (iv) develop the prospectus that will be used to fund raise for the ANTOS programme, and (v) to present the above to the SCAR community in 2024. The COVID impact is likely to put us back about 2 years in our projected achievements and spending especially considering that the 2022 OSC will be virtual - we had scheduled a major workshop to present the sentinel sites and manuals. That said, the delay will provide more time for the analysis of the survey data, development of manuals, and prospectus. Our hope would be to launch a fundraising campaign based on these outputs over the next 12 months and to run a comprehensive final workshop at the SCAR OSC in 2024.

Summary Budget 2021 to 2024

	2021	2022	**2023**	**2024**
	Spent	Allocated	Request	Request
(US$)	0	3000	8000	8000

US$5100 unspent from 2020 and 2021 was reallocated to BEPSII and /imPACT (at the request of Life Sciences).

Progress to date

Sub-group Outcomes Summary

Sub-group	Activity/Outcome/Benefit/Achievement
ANTOS	Letters of support requested (and provided) for national programmes wanting to incorporate ANTOS in their research programmes.
ANTOS	Terrestrial and Marine technical Manuals for constructing and installing ANTOS nodes have been completed (Hoskins). This was possible through the development of continued communication with our systems integrator in Canada
ANTOS	ANTOS was presented at the 'Power for Ocean Sensing: Creating Dialogue around Power Capabilities and Needs' webinar, hosted by the University Marine Energy Research Community (https://umerc-us.org/page/about), in May 2022. A recording is available at https://youtu.be/G6O9cPaxIok
ANTOS	ANTOS presented at the - Sub-Antarctic Connections and Climate Change Symposium Oct 4-6, 2021. Invited Talk
ANTOS	ANTOS presented at the APECS Workshop SCAR 2020 - Logistical Collaborations. Aug 13th, 2020. Invited talk
ANTOS	ANTOS presented at the EU-PolarNet 2 Workshop, June 7th. Invited Talk

Sub-group Cash Flow

(Since previous report to Delegates in 2020)

Sub-group	Allocation	Amount spent		
		2020	2021	2022
ANTOS	3500	0		
ANTOS	3000		0	
ANTOS	3000			0

US$5100 unspent from 2020 and 2021 was reallocated to BEPSII and imPACT (at the request of Life Sciences in November 2021).

Future plans

Planned activities in 2022 to 2024

Sub-group	Planned activity
ANTOS	ANTOS prospectus developed describing the purpose and value of ANTOS to potential funders.
ANTOS	Database meeting – final design and implementation – bring online all current ANTOS installations
ANTOS	Multiple workshops to finalise drafts of ANTOS terrestrial and marine protocol, guideline, and technical manuals (2020-2023). These will be reviewed by the community before final versions are released (by Feb 2024)
ANTOS	Submit proposals for philanthropic support

Planned use of funds for 2022 to 2024

Year (YYYY)	Purpose/Activity	Amount (in USD)	Contact Name	Contact Email
2022	Database meeting (Korea)	2000	Charles Lee & Soon Gyu Hong	charles.lee@waikato.ac.nz polypore@gmail.com
2022	Prospectus development and printing	2000	Craig Cary & Dana Bergstrom	caryc@waikato.ac.nz dana.bergstrom@aad.govt.au
2023	Analyse survey data and prioritise 25 sentinel sites	3000	Byron Adams & Vonda Cummings	byron_adams@byu.edu vonda.cummings@niwa.co.nz
2023	SCAR Biology	6500	Craig Cary & Vonda Cummings	caryc@waikato.ac.nz vonda.cummings@niwa.co.nz
2024	Finalise all documents and hold workshop at OSC	6000	Vonda Cummings & Craig Cary	vonda.cummings@niwa.co.nz caryc@waikato.ac.nz
Total				

Any additional detail on funds usage and desired results/outcomes

Please note that these are wishful projections as much will depend on the global COVID situation and our ability to travel. We will attempt to do as much as we can with teleconferencing but nothing replaces face to face to get action and results.

Percentage of the budget to be used for support of early-career researchers

2022: 30%

2023: 30%

2024: 30%

Percentage of the budget to be used for support of scientists from countries with developing Antarctic programmes

2022: 30%

2023: 30%

2024: 30%

Membership

Leadership

Role	First Name	Last Name	Affiliation	Country	Primary Language	Email	Date Started
Co-Chair	Craig	Cary	U. Waikato	NZ	English	caryc@waikato.ac.nz	8/2014
Co Chair	Vonda	Cummings	NIWA	NZ	English	vonda.cummings@niwa.co.nz	8/2014
Secretary	*Megumu	Tsujimoto	MPR	Japan	Japanese	megumutsujimoto@gmail.com	8/2014

*(Please identify early-career researchers with * in first column)*

Other members

First Name	Last Name	Affiliation	Country	Email	Primary Language
Byron	Adams	Bringham Young University	USA	byron_adams@byu.edu	English
*Charles	Lee	Waikato University	NZ	cklee@waikato.ac.nz	English
Dana	Bergstrom	Australian Antarctic Division	Australia	dana.bergstrom@aad.gov.au	English
Dolores	Deregibus		Argentina	dolidd@yahoo.com	Spanish
Eli	Verleyen		Belgium	Elie.Verleyen@UGent.be	French
Marcela	Libertelli	Instituto Antártico Argentino	Argentina	mlibertelli5@yahoo.com.ar	Spanish
Peter	Convey	BAS	UK	pcon@bas.ac.uk	English
Sharon	Robinson	University of Wollongong	Australia	sharonr@uow.edu.au	English
Soon Gyu	Hong	KOPRI	Korea	polypore@gmail.com	Korean
Stefano	Schiaparelli	University of Genoa/Italian National Museum	Italy	stefano.schiaparelli@unige.it	Italian
Steve	Colwell	PSG rep	UK	src@bas.ac.uk	English
Mauro	Guglielmin	ANTPAS rep	Italy	mauro.guglielmin@uninsubria.it	Italian

*(Please identify early-career researchers with * in first column)*

Additional information (optional)

NA

Notable Papers

Advances have been made in methods for analysis of seafloor community data obtained using remotely deployed cameras (Montes Herrera et al. 2022; Marini et al. 2022; Menna et al. 2022). This sampling and analysis is crucial for gathering underpinning biological information that the environmental data collected using the ANTOS Tier systems supports.

Montes-Herrera, J.C., Cimoli, E., **Cummings, V.**, Hill, N., Lucieer, A., Lucieer, V. (2021). Underwater Hyperspectral Imaging (UHI): A review of systems and applications for proximal seafloor ecosystem studies. *Remote Sensing* 13, 3451. https://doi.org/10.3390/rs13173451

Marini S., Federico B., Lorenzo C., Bordone A., **Schiaparelli S.**, Peirano A. (2022) Long-term Automated Visual Monitoring of Antarctic Benthic Fauna. *Methods in Ecology and Evolution*. https://doi.org/10.1111/2041-210X.13898

Menna F., Nocerino E., Malek S., Remondino F., **Schiaparelli S.** (2022) A combined approach for long-term monitoring of benthos in Antarctica with underwater photogrammetry and image understanding. *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, 43, 935-943.

The four papers listed below all are considering the impact of warming on terrestrial Antarctic ecosystems. Each of these studies either describes new approaches to understanding biological responses to predicted warming or provides foundational biological data in key locations that are likely to be considered as ANTOS sentinel sites.

Wagner, M., Brunauer, G., Bathke, A.C., **Cary, S.C**., Fuchs, R., Sancho, L.G., Türk, R., and Ruprecht, U. (2021). Macroclimatic conditions as main drivers for symbiotic association patterns in lecideoid lichens along the Transantarctic Mountains, Ross Sea region, Antarctica. *Scientific Reports*. doi:/10.1038/s41598-021-02940-6

Monteiro, M.R., Marshall, A.J., Hawes, I., **Lee, C.K., McDonald, I.R., and Cary, S.C.** (2022). Geochemically Defined Space-for-Time Transects Successfully Capture Microbial Dynamics Along Lacustrine Chronosequences in a Polar Desert. *Frontiers in Microbiology*. doi:/10.3389/fmicb.2021.783767

Bottos, E.M., Laughlin, D.C., Herbold, C.W., **Lee, C.K., McDonald, I.R., and Cary, S.C.** (2020.) Abiotic factors influence patterns of bacterial diversity and community composition in the Dry Valleys of Antarctica. *FEMS Microbiology Ecology*. doi:/10.1093/femsec/fiaa042

Levy, J., **Cary, S.C.**, Joy, K., and **Lee, C.K.** (2020). Detection and community-level identification of microbial mats in the McMurdo Dry Valleys using drone-based hyperspectral reflectance imaging. *Antarctic Science*. doi:/10.1017/s0954102020000243

Direct support from outside organisations received for your activities

In kind. Deployment of 3x Marine tiers in McMurdo Sound in 2021 was achieved with the support of the New Zealand Antarctic Science Platform, the National Institute of Water and Atmospheric Research, New Zealand, and Antarctica New Zealand - instruments and logistics >> NZD$100K

Major collaborations your group has with other SCAR groups and with organisations/groups beyond SCAR

NA

Outreach, communication and capacity-building activities

ANTOS presented at the APECS Workshop SCAR 2020 - Logistical Collaborations. Aug 13th, 2020. Invited talk

Committee members have reviewed SCAR fellowship proposals.

Contributions to equality, diversity, and inclusion (EDI)

NA

SCAR fellowship reviewers

(As part of SCAR's Capacity Building efforts, such as the Fellowships and Visiting Scholar Awards, we are looking for people from all the SCAR groups to form a 'review panel' so if applications in your field are submitted we have people to contact to help assess relevant applications. Please list one or more people (name and email address) from your group who would be willing to serve as reviewers for the next few years, along with 1-3 keywords on their principal expertise.)

First Name	Last Name	Email	Principal Expertise
Craig	Cary	caryc@waikato.ac.nz	Microbial ecology
Vonda	Cummings	vonda.cummings@niwa.co.nz	Marine ecology, benthos, ecophysiology

SCAR Sub-Group	**xxx**
SG / SC	PS / LS / GS / SC-HASS
Person Responsible:	xxx

XXXVII SCAR Delegates Meeting

India, September 2022

EG-Continuous Plankton Recorder and the SCAR Southern Ocean CPR Survey (SO-CPR)

2020-22 Report

Summary

Report Author(s)
Kunio T. Takahashi (JAPAN)
John A. Kitchener (AUSTRALIA)

Summary of activities from 2020-22

Since the last report 2020, we have completed over 20 CPR tows during the 2020/21 and 2021/22 Antarctic field season. Due to the influence of COVID-19, each country reduced the Southern Ocean research, so the number of towing was about half of the normal level.
As a task of the EG-CPR of ten years, we published a special report on the "Status and Trends of Southern Ocean Zooplankton" to SCAR Britten in June 2021. This report brings together all information from 25 years of the SO-CPR Survey into one report. This report also identifies any trends (seasonal or long-term) in relation to changes in abundance, shifts in distribution, timing of events, or changes in composition and community composition.
Our important future task for maintaining high quality data is developing and enhancing the skills of current and new technicians. We have held standards workshop by technicians form each country every two years, but due to the influence of COVID-19, we have not been holding them for the past three years. It is difficult to hold online because we need to actually observe the sample. We are planning to hold a workshop in 2023. The purpose of the workshop is to ensure that high standards of data quality are being maintained, in terms of species identification and methodology, among the main analysts of the SO-CPR survey, and to discuss future training methods and a future roadmap for the SO-CPR program. We also aim to publish SO-CPR processing manuals and zooplankton counting rulebooks for the purpose of training for new technicians.

Summary Budget 2021 to 2024

	2021	2022	**2023**	**2024**
	Spent	Allocated	Request	Request
(US$)	0	0	3000	0

Progress to date

(*Summarize your group's activities and plans in the tables below and, in each case, provide your sub-group name in the left-hand column to assist Science Group COs in compiling their reports*)

Sub-group Outcomes Summary

Sub-group	Activity/Outcome/Benefit/Achievement
EG-CPR	Published a Zooplankton Status Report in SCAR Britten

Sub-group Cash Flow

(Since previous report to Delegates in 2020)

Sub-group	Allocation	Amount spent		
		2020	2021	2022
EG-CPR	3000	0	0	0

Future plans

Planned activities in 2022 to 2024

Sub-group	Planned activity
EG-CPR	Standards workshop

Planned use of funds for 2022 to 2024

Year (YYYY)	Purpose/Activity	Amount (in USD)	Contact Name	Contact Email
2022				
2023	Standards workshop	3000	Kunio Takahashi	takahashi.kunio@nipr.acjp

2024				
Total				

Any additional detail on funds usage and desired results/outcomes

The SCAR funding provides the opportunity to bring the various groups together to ensure that their taxonomic analysis, sampling methodology, quantitative analysis methodology and data quality remains at the highest common standard. The SCAR funding does not cover all costs of the workshops, but does provide very useful seed money to leverage additional support. It is difficult to define the precisely the percentage of future funds that will be directed to early career scientist, or scientists with developing Antarctic programmes.

Percentage of the budget to be used for support of early-career researchers

2022:0%

2023:?

2024:?

Percentage of the budget to be used for support of scientists from countries with developing Antarctic programmes

2022:0%

2023:?

2024:?

Membership

Leadership

Role	First Name	Last Name	Affiliation	Country	Primary Language	Email	Date Started
Chair	Kunio	Takahashi	NIPR	Japan	Japanese	takahashi.kunio@nipr.ac.jp	2012
Deputy Chair	John	Kitchener	AAD	Australia	English	John.kitchener@awe.gov.au	08/2016

*(Please identify early-career researchers with * in first column)*

Other members

First Name	Last Name	Affiliation	Country	Primary Language	Email
Karen	Robinson	NIWA	NZ	English	Karen.robinson@niwa.co.nz
Marianne	Wootton	SAHFOS	UK	English	mawo@sahfos.ac.uk
Hans	Verheye	DHA	South Africa		hans.verheye@gmail.com
Philippe	koubbi	UPMC	France		phiippe.koubbi@upmc.fr
Erik	Muxagata	URG	Brazil		e.muxagata@gmail.com
Julie	Hall	NIWA	NZ	English	j.hall@niwa.co.nz
Ben	Raymond	AAD	Australia	English	Ben.Raymond@aad.gov.au
Graham	Hosie	SAHFOS	Australia	English	Graham.hosie@iinet.net.au

*(Please identify early-career researchers with * in first column)*

Additional information (optional)

(Please add any more detail here that you wish on your sub-group activities, papers published, etc.)

Notable Papers

(*Five to ten most notable papers – see the example below, which includes a brief statement (shaded) indicating the link to the group*)

1. Ryan F. Heneghan, Jason D. Everett, Patrick Sykes, Sonia D. Batten, Martin Edwards, Kunio Takahashi, Iain M. Suthers, Julia L. Blanchard, Anthony J. Richardson (2020) A functional size-spectrum model of the global marine ecosystem that resolves zooplankton composition. Ecological Modelling. DOI: 10.1016/j.ecolmodel.2020.109265

This is the scientific paper that used our dataset for a functional size-spectrum model of the global marine ecosystem. They suggested that including zooplankton complexity in ecosystem models could be key to better understanding the distribution of fish biomass and trophic efficiency across the global ocean.

2. Leonie Suter, Andrea Maree Polanowski, Laurence John Clarke, John Andrew Kitchener, Brue Emerson Deagle (2020) Capturing open ocean biodiversity: Comparing environmental DNA metabarcoding to the continuous plankton recorder. Molecular Ecology. DOI: 10.1111/mec.15587

This work assessed whether eDNA metabarcoding could capture similar Southern Ocean zooplankton biodiversity as conventional CPR bulk sampling. They suggested that eDNA metabarcoding could become an efficient tool for monitoring open ocean biodiversity with refinement and standardization of methodology.

3. Kunio T. Takahashi and Graham W. Hosie (2021) The status and trends of Southern Ocean zooplankton based on the SCAR Southern Ocean Continuous Plankton Recorder (SO-CPR) survey. SCAR Bulletin, No. 206, 97p.

This report brings together all information from 25 years of the SO-CPR Survey into one report. This report also identifies any trends (seasonal or long-term) in relation to changes in abundance, shifts in distribution, timing of events, or changes in composition and community composition.

4. Kunio T. Takahashi, Tomomi R. Takamura and Tsuneo Odate (2021) Zooplankton communities along a Southern Ocean monitoring transect at 110°E from three CPR surveys (Dec 2014, Jan 2015, Mar 2015). Polar Biology 44: 1069-1081. DOI: 10.1007/s00300-021-02862-z

This work provides a temporal variability of zooplankton community structure using CPR data collected along Japanese monitoring transect in three months during 2014/15 seasons.

5. Max Campbell, David Schoeman, William Venables, Rana Abu-Alhaija, Sonia Batten, Sanae Chiba, Frank Coman, Claire Davies, Martin Edwards, Ruth Eriksen, Jason Everett, Yutaka Fukai, Mitsuo Fukuchi, Octavio Esquivel Garrote, Graham Hosie, Jenny Huggett, David Johns, John Kitchener, Philippe Koubbi, Felicity McEnnulty, Erik Muxagata, Clare Ostle, Karen Robinson, Anita Slotwinski, Kerrie Swadling, Kunio Takahashi, Mark Tonks, Julian Uribe-Palomino, Hans Verheye, William Wilson, Marco Worship, Atsushi Yamaguchi, Zhang Wuchang, and Anthony Richardson (2021) Testing Bergmann's Rule in marine copepods. Ecography 44: 1283-1295. DOI: 10.1111/ecog.05545

This is the scientific paper that used our dataset for a near-global comparative analysis on marine copepods to test Bergaman's rule. Their results provide strong support for Bergaman's rule in copepods, but empahsises the importance of other drivers in modifying this pattern.

Direct support from outside organisations received for your activities

(*Numbered list with values indicated if direct cash support. Please restrict in-kind support to substantive in-kind support only*)

Each national partner in the SO-CPR Survey financially support their own tows, logistics, analysis and contributions to the database.

Major collaborations your group has with other SCAR groups and with organisations/groups beyond SCAR

(*Numbered list of substantive collaborations*)

Within SCAR

1. The SO-CPR database is hosted by the Australian Antarctic Division Data Centre. The data are transmitted to SCAR's biodiversity.aq.

Outside SCAR

1. Global Alliance of CPR Surveys (GACS)
   The SO-CPR Survey is a founding member of the Global Alliance of CPR Surveys (GACS). The general goal of GACS is to understand changes in plankton biodiversity at ocean basin scales through a global alliance of CPR surveys

2. Our data are transmitted to other data portals such as Ocean Biogegraphic Information System (OBIS), Southern Ocean Observing System (SOOS), Global Ocean Observing System (GOOS), Atlas of Living Australia, and the data are offered to Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR).

Outreach, communication and capacity-building activities

(Brief highlights of any activities undertaken since the last report to SCAR Delegates in 2020).

Over the last decade, EG-CPR has conducted numerous training workshops in Australia, Japan, New Zealand, UK, Brazil, and South Africa. A standardisation workshop for the current team of SO-CPR analysts was held on December 2018 to confirm that consistent and high standards of species

identification, methodology, and data quality were being maintained amongst the main analysts in the SO-CPR Survey. Small training sessions have been conducted for those participating in Australia's and Japan's Antarctic programme.

Contributions to equality, diversity, and inclusion (EDI)
(Any specific actions the group has undertaken to advance EDI within the group and/or within SCAR)

SCAR fellowship reviewers

(As part of SCAR's Capacity Building efforts, such as the Fellowships and Visiting Scholar Awards, we are looking for people from all the SCAR groups to form a 'review panel' so if applications in your field are submitted we have people to contact to help assess relevant applications. Please list one or more people (name and email address) from your group who would be willing to serve as reviewers for the next few years, along with 1-3 keywords on their principal expertise.)

First Name	Last Name	Email	Principal Expertise
Kunio	Takahashi	takahashi.kunio@nipr.ac.jp	Marine Biology

Scientific Committee on Antarctic Research
Proposal for a *SCAR Krill Expert Group*

Name of the Proposed Group: SCAR Krill Expert Group (SKEG)

Name(s) of the lead proponent(s)

Prof. Dr. Bettina Meyer
Dr. So Kawaguchi
Dr. Simeon Hill
Dr. Angus Atkinson
Prof. Dr. Kim Bernard
Dr. Ryan Driscoll
Dr. Zephyr Sylvester
Dr. Javier Arata
Dr. Steve Parker

Sponsoring Science Group(s) or Standing Committee(s): Life Sciences

Summary

Recent findings on Antarctic krill, *Euphausia superba,* the central prey in the Southern Ocean food web, have demonstrated that even after almost 100 years of research on this species, there remain crucial gaps in our understanding of its life history, response to climate variability, spatial population dynamics, and the environmental mechanisms that drive its life cycle throughout the Southern Ocean. Increasing commercial interest in Antarctic krill resources in the 1970s followed over-exploitation of other marine resources in the Southern Ocean. Concerns about the potential ecosystem impacts of krill fishing led to the establishment of the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), an international organization responsible for managing Southern Ocean fisheries and conservation of the wider ecosystem that depends on fished species. The krill fishery grew rapidly in the 1980s and remains responsible for over 90% of the fishery catch in the Southern Ocean. Historically CCAMLR has received scientific advice on Antarctic krill only from the official delegations of CCAMLR member countries, representing a small subset of the overall community of krill researchers. CCAMLR's Scientific Committee has emphasized the need for a mechanism to better incorporate the results of relevant krill research into fishery management decisions. Thus, the SCAR Krill Action Group (SKAG) was initiated in 2018 to become a prime conduit between CCAMLR and the wider krill science community in SCAR and beyond.

SKAG now provides a forum to (1) guide the direction of krill-related research; (2) promote international collaboration among both senior krill scientists and early career researchers (ECRs); (3) improve understanding of krill biology and ecology; (4) serve as a conduit between scientists and the krill fishing industry; and (5) through the SCAR Standing Committee on the Antarctic Treaty System, assist in providing critical scientific information to CCAMLR that are relevant to krill fishery management. Furthermore, the group provides a forum for information exchange on upcoming cruises and funding opportunities, including fishing vessels, as well as lab facilities for experimental krill work, and serves as a platform for the development of future international collaborative research proposals and programs. Since 2020, SKAG has cemented its position as a voice of Antarctic krill researchers. Through publications, reports, website and well-attended annual workshops, SKAG has developed into the central node for transferring relevant krill science to CCAMLR and other organisations, such as the newly established Science-Industry Forum (SIF) and Non-Governmental Organisations (NGOs) like the World Wide Fund For Nature (WWF) and the Pew Charitable Trust (PEW). In addition, SKAG is well integrated with the existing SCAR group "Integrating Climate and Ecosystem Dynamics in the Southern Ocean" (ICED). SKAG's joint workshops and papers have greatly enhanced the opportunities for ECRs to connect with peers and experts internationally and to nurture collaboration. We are currently at a crucial juncture in the management of the krill fishery. As the climate warms and the krill fishery continues to develop, CCAMLR is developing a new krill management approach that relies heavily on new survey and life history information. The role of SKAG in providing policy-relevant information on krill and in serving as a conduit for collaboration is a key legacy that we wish to continue. We, therefore, propose that SKAG becomes a SCAR Krill Expert Group (SKEG) in 2023 for an initial period of 6 years. An application is submitted to the heads of the Life Science Group.

Proposal for the Creation of a Krill Expert Group

1. Introduction and Background

The CCAMLR Scientific Committee recognised in 2017 the need for increased access to the most up-to-date information on krill biology and ecology to improve CCAMLR's management of the Antarctic krill fishery.

One proposed solution was to establish a working group outside of CCAMLR that could synthesise developments in Antarctic krill biology. This group would report its activities and findings to the CCAMLR working group on Ecosystem Monitoring and Management (WG-EMM). WG-EMM would in turn indicate topics of high priority that could be addressed by researchers in the broader community of krill researchers. Such two-way information flow was recognised as a way forward for broadening and accelerating the CCAMLR community's knowledge on krill and for stimulating policy-relevant academic collaboration on krill more widely. Such a krill working group would most logically be formed under the auspices of SCAR, providing it with the appropriate level of independence and legitimacy, while at the same time enhancing the relevance of SCAR to CCAMLR. This led to the submission of a proposal to SCAR to initiate a SCAR krill action group (SKAG), which was approved by SCAR in 2018. The SCAR Standing Committee on the Antarctic Treaty System (ATS), which has responsibility for the provision of SCAR advice to the ATS, including CCAMLR, contributed to these proposals. Since its inception, SKAG has led on coordination of the krill research community and the transfer of krill science to CCAMLR and beyond (e.g. Science Industry Forum: SIF and NGOs: e.g. WWF, PEW).

Many key questions identified in the SCAR Horizon Scan require knowledge on krill biology and ecology. Fishing may exacerbate the threats associated with warming, ocean acidification and changes in sea-ice distribution. However, the cumulative effects of fishing and climate change in Southern Ocean ecosystems have received little attention. SCAR currently has groups that address regional warming and changes in sea-ice distribution. We suggest that a group is also needed to address the science needed to manage the largest Southern Ocean fishery.

Recent publications on the long-term and seasonal population dynamics of krill (Atkinson et al. 2019, 2022, Steinberg et al. 2015, Loeb & Santora 2015, Reiss et al. 2017, Ryabov et al. 2017), their ecological links to sea ice (Meyer et al. 2017), as well as their depth distribution, and threats from environmental changes (Fuentes et al. 2016) have demonstrated that even after almost 100 years of krill research, there are critical gaps in our knowledge of this species. These concern some basic aspects such as life history, responses to climate change, spatial dynamics, and the environmental mechanisms that drive population variability. Currently, no single group within either SCAR or CCAMLR has responsibility for developing a comprehensive understanding of variability in krill life history and spatial dynamics, and the likely response of the species to climate change. This information is urgently needed to effectively manage Antarctic krill fishery. There is also a need to synthesize emerging information into a digestible form targeted at developing management advice.

In 2022 the CCAMLR Scientific Committee held a symposium to identify the scientific information requirements necessary to progress management and conservation of Southern Ocean marine resources. This symposium identified the following opportunities for SKAG (and any successor group) to contribute to the Scientific Committee's krill work program:

- Estimating krill biomass based on acoustic surveys: Advice on design, technology and sources of bias for surveys, including using fishing vessels as research platforms.
- Assesment of the relative ecological risk of potential spatial catch distributions: Contribution or refinement of spatial data of krill life stages outside of Area 48.1.
- Characterizing the functional relationships between krill, their predators and the fishery in space and time.

Here we propose that, due to the ongoing nature and relevance of a SCAR Krill Group to transfer krill research to CCAMLR, SKAG should evolve into a SCAR Krill **Expert** Group with a duration of 6 years. If this proposal is not approved by SCAR Life Science Delegates, our contingency proposal is that SKAG should be extended.

References

Atkinson A, Hill SL, Pakhomov EA, Siegel V, Reiss CS, Loebe VJ, Steinberg DK, Schmidt K, Tarling GA, Gerrish L, Sailley SF (2019) Krill (*Euphausia superba*) distribution contracts southward during rapid regional warming. Nature Climate Change, https://doi.org/10.1038/s41558-018-0370-z

Atkinson et al. (2022) Stepping stones towards Antarctica: Switch to southern spawning grounds explains an abrupt range shift in krill. Global Change Biology. 28(4), 1359-1375. DOI: 10.1111/gcb.16009

Fuentes V, Alurralde G, Meyer B, Gastón EA, Canepa A , Wölfl A-C , Hass HC , Williams GN, Schloss IR (2016) Glacial melting: an overlooked threat to Antarctic krill. Scientific Reports 6, 27234, doi: 10.1038/srep27234

Flores H, Atkinson A, Rebolledo E, Cirelli V, Cuzin-Roudy J, Fielding S, van Franeker JA, Groeneveld JJ, Haraldsson M, Kawaguchi S, Krafft BA, Lombana A, Marschoff E, Meyer B, Milinevsky G, Nicol S, Pakhomov EA, Vande Pute AP, Reiss C, Rombolá E, Schmidt K, Siegel V, Tarling GA, Teschke M, Tonkes H, Toullec J-Y, Trathan PN, Tremblay N, Werner R, Werner T. (2012) Krill and Climate Change. Marine Ecology Progress Series. 458: 1-19

Loeb VJ, Santora JA (2015) Climate variability and spatiotemporal dynamics of five Southern Ocean krill species. Progress in Oceanography, 134: 93-122

Meyer B, Freier U, Grimm V, Groeneveld J, Hunt BPV, Kerwath S, King R, Klaas C, Pakhomov E, Meiners KM, Melbourne-Thomas J, Murphy EJ, Thorpe SE, Stammerjohn S, Wolf-Gladrow D, Auerswald L, Götz A, Halbach L, Jarman S, Kawaguchi S, Krumpen T, Nehrke G, Ricker R, Sumner M, Teschke M, Trebilco R, Yilmaz IN. (2017) The winter pack-ice zone provides a sheltered but food-poor habitat for larval Antarctic krill. Nature Ecology & Evolution, doi.org/10.1038/s41559-017-0368-3

Reiss CS, Cossio A, Santora JA, Dietrich KS, Murray A, Mitchell BG, Walsh J, Weiss EL, Gimpel C, Jones CD, Watters GM (2017) Overwinter habitat selection by Antarctic krill under varying sea-ice conditions: implications for top predators and fishery management. Marine Ecology Progress Series, 568: 1-16, https://doi.org/10.3354/meps12099

Ryabov AB, de Roos AM, Meyer B, Kawaguchi S, Blasius B (2017) Competition-induced starvation drives large-scale population cycles in Antarctic krill, Nature Ecology & Evolution, DOI: 10.1038/s41559-017-0177

Steinberg D, Ruck KE, Gleiber MR, Garzio LM, Cope JS, Bernard KS, Stammerjohn SE, Schofield OME, Quetin LB, Ross RM (2015) Long-term (1993–2013) changes in macrozooplankton off the Western Antarctic Peninsula. Deep-Sea Research I, 101: 54–70

2. Aims, Goals and Objectives

The proposed SCAR Krill Expert Group (SKEG) has five broad aims. **The first** is to be the prime forum for discussing Antarctic krill biology and ecology, where research directions are “guided” and collaborations and early career opportunities are promoted. **The second** is, through close collaboration with the SCAR Standing

Committee on the Antarctic Treaty System, to be the major conduit of information and collaboration among CCAMLR, the fishing industry and the wider krill science community on providing policy-relevant information and knowledge about krill. **The third** is to strengthen connections between the krill modelling community within ICED and the broader krill research community to identify priority research needs for the development of models of krill. **The fourth** aim is to establish links between SKEG and SCAR's Antarctic Biodiversity Informatics Expert Group (EG-ABI), to promote the development of an overarching data repository. The former would provide links to already established databases such as KRILLBASE, and expand to consider how krill data other than abundance (e.g. physiological, genetic and behavioural data) can be combined in a repository, available and visible through SCAR under the FAIR principles (Findability, Accessibility, Interoperability and Reusability). **The fith** aim is to implement a vision paper on Krill stock hypothesis for Southwest Atlantic Sector of the Southern Ocean, by looking to this topic from different angles, environmental parameters such as sea ice, currents, climatology but also krill distribution, physiology, and behaviour. The 2020 policy paper generated by the SCAR Krill Action group identified knowledge gap in krill biology and how we can close it. As following up on this paper, in the last couple of years it became obvious that we do not have a common stock hypothesis for krill in southwest Atlantic sector. However, this is quite important since this will form the basis for coming up with a sensible approach in krill fishery management in the area as well as provide a framework for designing future surveys. How many sources areas does CCAMLR Area 48 krill population have? If so where and what is the dependencies. What is the relation with Bellingshausen sea and Weddell Sea population, e.g. in terms of krill flux and recruitment?

Advancing our current knowledge on krill will require research in the field and the lab, on ships, at Antarctic field stations, and in-home institutions. Ship time is becoming increasingly difficult to obtain, and space at field stations is limited and often prohibitively costly for funding agencies. It is therefore essential that we foster and coordinate international research efforts and resources. SKEG will provide an ongoing forum for information exchange on upcoming cruises, including onboard fishing vessels through the Science-Industry Forum (SIF), and opportunities to encourage international collaboration and cooperation in the broader krill science community. The SCAR Krill Action Group has already provided the basis to realize these plans.

3. Capacity Building, Education and Outreach Plans

There is a need to enhance capacity in the krill research community. SKEG will function as an excellent forum for the advertisement of research opportunities and for scientists to collaborate to develop new initiatives that could grow the krill research community, especially on critical topics. One such opportunity is to support ECR and industry participation in the science underpinning the data collection needs from the krill fishery through participation in upcoming CCAMLR workshops in 2023 and 2024 (in development at WG-EMM-2022). There is also a need for a coordinated outreach program on krill. There is an enormous amount of information on krill available to the general public, including a considerable volume of material produced by bodies such as the krill fishing industry and environmental NGOs with their viewpoints. SKEG would be a trusted independent source of scientific information on krill that could be accessed by journalists and the general public. SKEG will build on the excellent

achievements on this front made by the SCAR Krill Action Group (SKAG) to realize these plans.

4. Proposed Milestone Activities with Timeline

4.1. What have we achieved so far in the SCAR Krill Action Group (SKAG)

Outcomes/Achievements Summary

	Outcome/Achievement
SKAG	Policy paper Meyer et al. 2020, Communications Earth & Environment:https://doi.org/10.1038/s43247-020-00026-1 22 Web of Science citations and 6290 article accesses in the 20 months since publication.
SKAG	SKAG online workshop in cooperation with the WWF 26-30 April 2021: Evaluating change within the krill-based food web and developing solutions for the future sampling of krill: https https://doi.org/10.5281/zenodo.4776335 Workshop attended by 127 participants from 19 countries, of whom 46 were ECR's.
SKAG and ICED	Joint ERC modeling workshop with the SCAR Group Integrating Climate and Ecosystem Dynamics of the Southern Ocean (ICED), 17-20 May 2021: Using models to improve our understanding of Antarctic krill and their ecological role in the Southern Ocean, https://doi.org/10.5281/zenodo.6780069 Joint ICED-SKAG online Session in AGU Open Sciences Meeting, 2-4 March 2022. 'The role of Southern Ocean ecology in the Earth system: Integrating across scales, disciplines, and methods'.
SKAG	SKAG online workshop in March 2022, https://doi.org/10.5281/zenodo.6780075
SKAG	Comment CCAMLR Scientific Committee Chair, Dr. Dirk Welsford: While many of the world's krill experts participate in CCAMLR, it is also a fact that significant expertise and knowledge exists outside of the regular attendees to CCAMLR meetings. SKAG performs an important bridge between CCAMLR and this broader scientific community to ensure CCAMLR bases its decisions on the best available science.

4.2. Proposed Milestone Activities with Timeline

We propose that our SKEG will work for an initial period of six years, from the start of 2022/23 to the end of 2028.

Year	Milestone Activities
2023	• Annual workshop

	• Writing the semi-annual Newsletter, papers related to the annual workshop and the krill research in SKEG that are related to CCAMLR issues • Reporting to SCAR, ATCM and CCAMLR working groups • Development of the SKEG vision paper on Krill stock hypothesis for Southwest Atlantic Sector of the Southern Ocean, to be implemented during the SKEG phase • Development of an ECR education program. • Support early career scientist and industry participation in CCAMLR krill data collection workshop • Developing of a specific SKEG webpage as known from other Expert Groups (Identification of key topics requiring information for the public and the media, and development of information materials to be hosted on the SKEG web page) • Active participation in the Science-Industry Forum annual board meeting
2024	• Annual workshop • Writing the semi-annual Newsletter, papers related to the annual workshop, the krill research in SKEG that are related to CCAMLR issues. • Reporting to SCAR, ATCM and CCAMLR working groups • Development of an ECR education program. • Refinement maintenance of SKEG webpage • Active participation in the Science-Industry Forum annual board meeting and collaboration on *ad-hoc* program(s) • Establish a link between SKEG and SCAR's EG-ABI
2025	• Annual workshop • Writing the semi-annual Newsletter, papers related to the annual workshop and the krill research in SKEG that are related to CCAMLR issues • Reporting to SCAR, ATCM and CCAMLR working groups • Maintenance of SKEG webpage • Organisation of the 4th International Krill Symposium for 2026 • Active participation in the Science-Industry Forum annual board meeting and collaboration on *ad-hoc* program(s)
2026	• Annual workshop • Writing the semi-annual Newsletter, papers related to the annual workshop and the krill research in SKEG that are related to CCAMLR issues • Reporting to SCAR, ATCM and CCAMLR working groups • Maintenance of SKEG webpage • The 4th International Krill Symposium • Active participation in the Science-Industry Forum annual board meeting and collaboration on *ad-hoc* program(s)
2027	• Annual workshop • Evaluation of SKEG and potential Application writing to continue as Expert Group • Writing the semi-annual Newsletter, papers related to the annual workshop, krill symposium and krill research in SKEG that are related to CCAMLR issues • Finalising the vision paper on krill stock hypothesis for Southwest Atlantic Sector of the Southern Ocean, identified by the SKEG group at the beginning of the SKEG period • Reporting to SCAR, ATCM and CCAMLR working groups

	• Maintenance of SKEG webpage • Active participation in the Science-Industry Forum annual board meeting and collaboration on *ad-hoc* program(s)
2028	• Annual workshop • Writing the semi-annual Newsletter, paper related to the annual workshop • Reporting to SCAR, ATCM and CCAMLR working groups • Maintenance of SKEG webpage • Active participation in the Science-Industry Forum annual board meeting and collaboration on *ad-hoc* program(s)

5. Data Management Plans

The results generated from our tasks will be made public on our webpage.

Where SKEG plays a major role in developing a coordinated international research activity, the planning phase of that activity will include the development of a data management plan to follow best practices (i.e, FAIR principles), using established institutional data repositories such as KRILLBASE at the Britsih Antarctic Survey, PANGAEA at the Alfred Wegener Institute Helmholz Centre for Polar and Marine Research, SOOS-DueSouth, among others. In this context, we also plan to establish a link between SKEG and SCAR's Antarctic Biodiversity Informatics Expert Group (EG-ABI) to promote the development of an overarching data repository, providing links to already established databases such as KRILLBASE, but also to consider how krill data other than abundance (e.g. physiological, genetic and behavioural data) can be combined in a data repository so that these data are available and visible through SCAR.

6. Terms of Reference

The SCAR Krill Expert Group will:

1) Inform CCAMLR of the latest scientific knowledge on krill biology and ecology to further develop its krill management approach and to improve krill fishery management decisions.

2) Identify fundamental knowledge gaps and critical new topics for krill research.

3) Facilitate and guide the development of research initiatives aiming to reduce these knowledge gaps and address these new topics.

4) Organise workshops involving members of the CCAMLR scientific community, the wider krill research community, and representatives from the krill fishing companies, with the specific aim of reducing gaps in scientific knowledge about Antrarctic krill relevant to current and future fishery management.

5) Function as a conduit for the wider krill community outside of CCAMLR to facilitate opportunities for research and collaboration, including with commercial krill fishing companies.

6) Develop an education program to encourage more ECRs from a broader representation of countries with Antarctic programs to study Antarctic krill.

7) Interact with, and provide input to, existing SCAR groups such as ICED to improve our understanding of Southern Ocean ecosystems and the impacts of climate change.

8) Identify key topics related to Antarctic krill of interest to the public and the media. Facilitate the preparation of information on these topics in plain language by suitably qualified researchers and make this information available via the SKEG website.

7. Budget and Justification

We apply for a budget of p.a. 5000$ which we plan to spend on the following activities:
In 2023 and 2024

- Developing an education program for students and young scientists on krill research for the SKEG webpage, in close cooperation with ECRs
- Refinement and maintenance of SKEG webpage
- Travel expenses for ECRs and some board members to attend SCAR meetings and workshops
- Travel expenses for ECRs to participate in CCAMLR krill data collection workshops (2023, 2024)

In 2025 and 2026

- Organisation of the 4th International Krill Symposium
- Travel expenses for ECRs and some board members to attend the 4th International Krill Symposium
- Maintenance and update of SKEG webpage

In 2027 and 2028

- Travel expenses for ECRs and some board members to attend SCAR meetings and workshops
- Maintenance and update of SKEG webpage

8. Current SKAG Members

In total 78 members and 40 of them are ECRs, marked with *

Leadership

Role	First Name	Last Name	Country	Email
Chair	Bettina	Meyer	DE	bettina.meyer@awi.de
Chair	So	Kawaguchi	AU	So.kawaguchi@aad.gov.au
Krill research and related management	Angus	Atkinson	UK	aat@pml.ac.uk
Krill research and related management	Simeon	Hill	UK	sih@bas.ac.uk
Communication and outreach	Kim	Bernard	US	kim.bernard@oregonstate.edu
Communication and outreach	Ryan*	Driscoll	DE	ryan.driscol@awi.de

Communication and outreach	Zephyr *	Sylvester	US	zesy2348@colorado.edu
Fishing Industry coordinator	Javier	Arata Soto	CA	javier.arata@ark-krill.org
CCAMLR Science representative	Steve	Parker	AU	Steve.parker@ccamlr.org

Other members

First Name	Last Name	Country	Email
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Haiting*	Zhang	CN	zh_ting@163.com
Guoping	Zhu	CN	gpzhu@shou.edu.cn

9. Webpages and Communication Plans

We would like to improve our webpage with more information for early career researchers (ECR) and work closely with these members to meet their requirements. We will also develop material providing the media and general public with relevant and up-to-date information on krill.

10. Other notes and comments

Through collaboration and consultation with the ECR members in our Executive Member group, SKEG will develop an education program to encourage ECRs from a broad representation of countries with Antarctic programs to study Antarctic krill.
SCAR Krill Action Group are currently involved in the Science-Industry Forum (SIF) board. This parallel organization aims to bring scientists onboard fishing vessels, develop protocols for fishing vessels to follow, and collect valuable information required to improve the management of the kill fishery. Their participation will continue through SKEG.

Polar South % **50+**

	2013		2013 Total	2014		2014 Total	2015		2015 Total	2016		2016 Total	2017		2017 Total	2018		2018 Total	2019		2019 Total	2020		2020 Total	2021		2021 Total	2022		2022 Total	Grand Total
	N	Y		N	Y		N	Y		N	Y		N	Y		N	Y		N	Y		N	Y		N	Y		N	Y		
Fellowship	**1**	**2**	**3**	**5**		**5**	**7**		**7**	**2**	**2**	**4**	**3**		**3**	**4**	**1**	**5**	**7**	**1**	**8**	**6**	**1**	**7**	**7**		**7**				**49**
Atmospheric				1		1	2		2				2		2				1		1	1		1	1		1				8
Earth																			1		1	3		3	2		2				6
Marine	1	2	3	4		4	4		4	1	2	3	1		1	3	1	4	5		5	1	1	2	3		3				29
Terrestrial							1		1	1		1				1		1		1	1	1		1	1		1				6
Large		**3**	**3**				**9**		**9**	**5**		**5**								**7**	**7**		**1**	**1**							**25**
Atmospheric							3		3																						3
Marine		3	3				1		1	5		5								7	7		1	1							17
Terrestrial							5		5																						5
Research Programmes	**2**	**4**	**6**	**1**	**3**	**4**	**1**	**1**	**2**	**8**	**17**	**25**	**2**	**5**	**7**	**5**	**13**	**18**	**8**	**17**	**25**	**18**	**5**	**23**	**3**	**9**	**12**	**9**		**9**	**131**
Atmospheric	2		2	1		1					3	3				1		1		5	5				1		1	2		2	15
Earth		2	2		2	2					2	2		1	1	1	9	10	1	3	4	3		3	1	1	2				26
Freshwater											1	1										12		12				1		1	14
Marine		2	2				1	1	2	8	10	18	1	4	5		2	2	7	8	15	2	5	7	1	8	9	6		6	66
Terrestrial					1	1					1	1	1		1	3	2	5		1	1	1		1							10
Standard RM	**27**	**9**	**36**	**68**	**5**	**73**	**35**	**5**	**40**	**22**	**1**	**23**	**11**	**4**	**15**	**15**	**2**	**17**	**19**	**4**	**23**	**25**	**4**	**29**	**9**	**2**	**11**	**5**	**1**	**6**	**273**
Atmospheric	8		8	10		10	6	2	8	3		3	4	1	5	5		5	2		2	1	2	3		1	1				45
Earth	9	3	12	17	5	22	3	1	4	3		3	1	1	2	4	1	5	3	1	4	5		5	1		1				58
Freshwater				3		3	2		2	1		1		2	2							1		1							9
Marine	10	6	16	30		30	21	2	23	7	1	8	6		6	6	1	7	13	1	14	16		16	8	1	9	5	1	6	135
Terrestrial				8		8	3		3	8		8							1	2	3	2	2	4							26
Grand Total	**30**	**18**	**48**	**74**	**8**	**82**	**52**	**6**	**58**	**37**	**20**	**57**	**16**	**9**	**25**	**24**	**16**	**40**	**34**	**29**	**63**	**49**	**11**	**60**	**19**	**11**	**30**	**14**	**1**	**15**	**478**

Polar South % **Under 50**

	2013		2013 Total	2014		2014 Total	2015		2015 Total	2016		2016 Total	2017		2017 Total	2018		2018 Total	2019		2019 Total	2020		2020 Total	2021		2021 Total	2022		2022 Total	Grand Total
	N	Y		N	Y		N	Y		N	Y		N	Y		N	Y		N	Y		N	Y		N	Y		N	Y		
Fellowship	**6**		**6**	**6**	**2**	**8**	**2**	**1**	**3**	**5**	**1**	**6**	**3**	**2**	**5**	**4**	**1**	**5**	**3**		**3**	**1**		**1**	**8**		**8**				**45**
Atmospheric	3		3	2	1	3				1	1	2	1		1	2	1	3	2		2				5		5				19
Freshwater													1		1							1		1	1		1				3
Marine	3		3	2	1	3	2	1	3	3		3	1	2	3	2		2	1		1				2		2				20
Terrestrial				2		2				1		1																			3
Large				**10**	**5**	**15**					**10**	**10**	**4**		**4**					**2**	**2**										**31**
Atmospheric				9		9																									9
Marine				1	5	6					10	10	4		4					2	2										22
Research Programmes	**4**	**5**	**9**	**1**	**2**	**3**	**5**	**31**	**36**	**10**	**11**	**21**	**1**	**4**	**5**	**5**	**4**	**9**	**7**	**7**	**14**	**6**	**9**	**15**	**1**	**1**	**2**	**10**		**10**	**124**
Atmospheric	1	4	5	1	1	2	2	29	31	1	7	8		1	1	1	1	2		3	3	2	9	11	1		1	2		2	66
Earth	2		2				1		1	1	2	3		1	1	1	1	2		2	2	1		1				2		2	14
Freshwater										1		1							1		1							2		2	4
Marine	1	1	2		1	1	2	2	4	5	2	7	1	2	3	2	2	4	4	2	6	2		2		1	1	4		4	34
Terrestrial										2		2				1		1	2		2	1		1							6
Standard RM	**7**	**4**	**11**	**18**	**1**	**19**	**13**	**1**	**14**	**10**	**3**	**13**	**7**	**11**	**18**	**6**	**3**	**9**	**9**	**2**	**11**	**6**	**1**	**7**	**4**	**1**	**5**	**6**		**6**	**113**
Atmospheric	2		2	6		6	5		5	7	1	8	2	3	5	4	1	5	6	1	7	2		2	3	1	4	2		2	46
Earth	3		3	6		6	2	1	3	1		1	3	1	4	1	1	2				1		1							20
Freshwater				2		2											1	1										1		1	4
Marine	2	4	6	4	1	5	5		5	2	2	4	2	7	9	1		1	3	1	4	3	1	4	1		1	3		3	42
Terrestrial							1		1																						1
Grand Total	**17**	**9**	**26**	**35**	**10**	**45**	**20**	**33**	**53**	**25**	**25**	**50**	**15**	**17**	**32**	**15**	**8**	**23**	**19**	**11**	**30**	**13**	**10**	**23**	**13**	**2**	**15**	**16**		**16**	**313**

Please note values may differ slightly from 2021 due to use of different parameters when compiling data. Also some of the major classifications for applications may have changed, due to the fact that a grant may have 2 or more equal classification percentages (e.g. 30% marine and 30% earth, and in last years version it may have come up as marine, whereas this year the application has come up as earth)

Polar South % **50+**

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Grand Total
Fellowship	**833,133**			**1,143,808**		**476,986**	**653,781**	**529,044**			**3,636,752**
Marine	833,133			1,143,808		476,986		529,044			2,982,972
Terrestrial							653,781				653,781
Large	**2,845,071**						**2,340,362**	**615,444**			**5,800,877**
Marine	2,845,071						2,340,362	615,444			5,800,877
Research Programmes	**620,987**	**77,536**	**99,111**	**5,460,687**	**1,295,861**	**5,443,378**	**5,241,823**	**1,563,221**	**4,334,384**		**24,136,987**
Atmospheric				662,087			2,840,472				3,502,558
Earth	527,869	64,114		278,338	52,251	3,380,999	171,762		47,073		4,522,407
Freshwater				514,391							514,391
Marine	93,118		99,111	3,616,409	1,243,610	1,210,002	2,204,088	1,563,221	4,287,311		14,316,869
Terrestrial		13,421		389,463		852,376	25,501				1,280,761
Standard RM	**3,077,584**	**1,005,351**	**1,824,799**	**298,337**	**1,866,732**	**1,368,997**	**2,113,167**	**1,366,143**	**1,067,918**	**416,070**	**14,405,098**
Atmospheric			953,227		628,391			701,633	417,727		2,700,978
Earth	1,191,225	1,005,351	291,024		610,108	585,987	625,099				4,308,794
Freshwater					628,233						628,233
Marine	1,886,359		580,548	298,337		783,009	458,884		650,191	416,070	5,073,398
Terrestrial							1,029,184	664,511			1,693,695
Grand Total	**7,376,775**	**1,082,887**	**1,923,910**	**6,902,833**	**3,162,593**	**7,289,360**	**10,349,132**	**4,073,853**	**5,402,302**	**416,070**	**47,979,715**

Poalr South % **Under 50**

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Grand Total
Fellowship		**509,161**	**153,697**	**206,807**	**655,288**	**567,509**					**2,092,462**
Atmospheric		14,864		206,807		567,509					789,179
Marine		494,297	153,697		655,288						1,303,283
Large		**2,651,887**		**5,093,933**			**1,093,291**				**8,839,111**
Marine		2,651,887		5,093,933			1,093,291				8,839,111
Research Programmes	**715,714**	**216,454**	**20,778,620**	**3,800,024**	**329,058**	**923,954**	**1,213,663**	**2,058,398**	**103,762**		**30,139,647**
Atmospheric	599,136	125,347	13,560,867	2,381,555	101,894	403,415	419,809	2,058,398			19,650,422
Earth				561,363	50,382	196,146	616,835				1,424,726
Marine	116,578	91,106	7,217,753	857,107	176,782	324,392	177,018		103,762		9,064,499
Standard RM	**1,294,021**	**318,754**	**411,139**	**1,319,818**	**3,379,077**	**1,896,218**	**211,249**	**501,119**	**818,216**		**10,149,612**
Atmospheric				403,379	1,157,310	632,736	146,307		818,216		3,157,948
Earth			411,139		404,137	650,360					1,465,636
Freshwater						613,122					613,122
Marine	1,294,021	318,754		916,439	1,817,630		64,942	501,119			4,912,905
Grand Total	**2,009,735**	**3,696,255**	**21,343,457**	**10,420,582**	**4,363,424**	**3,387,680**	**2,518,202**	**2,559,518**	**921,978**	**0**	**51,220,831**

Please note amount awarded may differ slightly from the information provided in 2021 as a different method of obtaining the 'Amount Awarded' has been used .