



International
Science Council

SCAR Sub-Group

SG / SC

Person
Responsible:

SKAG

LS

Bettina Meyer

XXXVII SCAR Delegates Meeting

India, September 2022

SCAR Krill Action Group (SKAG)

2020-22 Final Report

Summary

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 to 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](https://doi.org/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 Ocean,
- Reporting workshop output to CCAMLR WG EMM and the SC-CCAMLR

In 2022

- SKAG online workshop 7-11 March 2022: Variability in krill recruitment, and its implication for modelling and fishery management.
- Creating a SKAG Newsletter and a SKAG Logo
- Finalising 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

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	None	2000\$ to other Life Science Group	None
	3000€ in 2021			
	3000\$ in 2022			

Notable Papers

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

NONE

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

Within SCAR

1. ICED

Outside SCAR

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

Outreach and Capacity Building

Outreach, communication and capacity building activities

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)

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.driscoll@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 Responsible 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)

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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

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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

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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.)