frontiers in Marine Science

PERSPECTIVE
published: 28 August 2020
doi: 10.3389/fmars.2020.00692

Overcoming the Obstacles Faced by Early Career Researchers in Marine Science: Lessons From the Marine Ecosystem Assessment for the Southern Ocean

Madeleine J. Brasier[1], Stacey McCormack[1], Narissa Bax[2], Jilda A. Caccavo[3,4,5], Emma Cavan[6], Jessica A. Ericson[7], Blanca Figuerola[8], Alyce Hancock[1], Svenja Halfter[1], Nicole Hellessey[9], Juan Höfer[10,11], Peter S. Puskic[1,2], César Soares de Oliveira[12], Roshni C. Subramaniam[1], Jake Wallis[1] and Christine K. Weldrick[13]*

[1] Institute for Marine and Antarctic Studies, University of Tasmania, Hobart, TAS, Australia, [2] Centre for Marine Socioecology, Institute for Marine and Antarctic Studies, University of Tasmania, Hobart, TAS, Australia, [3] Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research, Bremerhaven, Germany, [4] Berlin Center for Genomics in Biodiversity Research, Berlin, Germany, [5] Department of Evolutionary Genetics, Leibniz Institute for Zoo and Wildlife Research, Berlin, Germany, [6] Department of Life Sciences, Imperial College London, Silwood Park, Ascot, United Kingdom, [7] Cawthron Institute, Nelson, New Zealand, [8] Institute of Marine Sciences (ICM-CSIC), Barcelona, Spain, [9] School of Biological Sciences, Georgia Institute of Technology, Atlanta, GA, United States, [10] School of Ocean Sciences, Pontifical Catholic University of Valparaiso, Valparaiso, Chile, [11] Research Center Dynamics of High Latitude Marine Ecosystems (IDEAL), Valdivia, Chile, [12] UEF Law School, University of Eastern Finland, Joensuu, Finland, [13] Australian Antarctic Program Partnership, Institute for Marine and Antarctic Studies, University of Tasmania, Hobart, TAS, Australia

OPEN ACCESS

Edited by:
Jess Melbourne-Thomas, Oceans and Atmosphere (CSIRO), Australia

Reviewed by:
Rebecca Jane Shellock, Australian National University, Australia
Jasmine Lee, Monash University, Australia

***Correspondence:**
Madeleine J. Brasier
madeleine.brasier@utas.edu.au

Specialty section:
This article was submitted to Global Change and the Future Ocean, a section of the journal Frontiers in Marine Science

Received: *21 May 2020*
Accepted: *30 July 2020*
Published: *28 August 2020*

Citation:
Brasier MJ, McCormack S, Bax N, Caccavo JA, Cavan E, Ericson JA, Figuerola B, Hancock A, Halfter S, Hellessey N, Höfer J, Puskic PS, de Oliveira CS, Subramaniam RC, Wallis J and Weldrick CK (2020) Overcoming the Obstacles Faced by Early Career Researchers in Marine Science: Lessons From the Marine Ecosystem Assessment for the Southern Ocean. Front. Mar. Sci. 7:692. doi: 10.3389/fmars.2020.00692

Pressure in academia and science is rapidly increasing and early career researchers (ECRs) have a lot to gain from being involved in research initiatives such as large international projects. But just how inclusive are they? Here we discuss experiences of ECRs directly involved in the Marine Ecosystem Assessment for the Southern Ocean (MEASO), an Australian led international research project to assess the status and trends of Southern Ocean ecosystems. We review the benefits of ECR involvement in large-scale initiatives to the project deliverables, the leadership team and ECRs themselves. Using insights from MEASO, we outline the obstacles that may become barriers to ECRs in scientific research in general but with a focus on large-scale research projects and suggest potential actions to overcome these at the individual, institutional and scientific community level. We consider the potential for ECRs to lead future Antarctic science programmes with a focus on science communication and applied research for policy makers within a global setting.

Keywords: ECR, mentorship, diversity and inclusion, polar science, interdisciplinarity

INTRODUCTION

The successful delivery of high quality and long-term research in most disciplines, including Antarctic and Southern Ocean research, requires both international and inter-generational collaboration. It is therefore imperative that Antarctic research initiatives involve the next generation of polar scientists and prepare them to become effective future leaders of such

initiatives. Historically as with other disciplines, polar research has predominantly focused on the achievements of more established scientists, particularly senior career-staged males (Nash et al., 2019). Although inequities have been reduced in recent history, for example 46% of the projects from the Chilean Antarctic program were led by women in 2019 (INACH, 2019) and the establishment of Pride in Polar Research in 2018[1], Antarctic and Southern Ocean research still lacks diversity across gender, sexuality, cultural background, and experience. The involvement of early career researchers (ECRs), defined as researchers within 5 years of a terminal degree, in large-scale initiatives fosters many benefits. These benefits may include promoting diversity, capacity building and greater transference of Southern Ocean knowledge to the next generation by allowing ECRs to draw upon their scientific expertise, experience, and innovation. However, there are numerous obstacles to ECR involvement in such initiatives (Patterson et al., 2013; Sobey et al., 2013; Jaeger-Erben et al., 2018; Pannell et al., 2019). Examples include a lack of relevant research or support networks (Bridle et al., 2013; Macoun and Miller, 2014; Freeman, 2018), scarcity of long-term contracts (Sobey et al., 2013), failure to include contributing ECRs in papers (Maestre, 2019), a lack of travel support (Bradley et al., 2020) and a competitive academic hierarchy (Pannell et al., 2019). In this manuscript, we explore these obstacles and suggest actions to overcome these barriers using our experiences from the Marine Ecosystem Assessment for the Southern Ocean (MEASO) initiative. We also identify the role ECRs can have in Antarctic and Southern Ocean research moving forward although it is also applicable to research in general.

Marine Ecosystem Assessment for the Southern Ocean is an ongoing international collaborative Antarctic and Southern Ocean research project begun by the Antarctic Climate & Ecosystems Cooperative Research Centre (ACE CRC) in Hobart, Australia, in 2018. The overarching aim of MEASO was to assess the status and trends of Southern Ocean habitats, species, and ecosystems. The outcomes of these assessments are presented in this Research Topic and, in future, in a summary for policymakers.

The participation of ECRs in large-scale initiatives like MEASO not only enriches scientific and political debates with diverse and "fresh" perspectives, but also provides an opportunity for ECRs to develop collaborative skills such as networking, communication, interdisciplinary knowledge, leadership and team-building. In addition to the above, these opportunities boost ECR self-esteem, foster wider collaborations that can lead to job opportunities and encourage ECRs to stay in science. They can also cultivate competencies frequently required by funding agencies, which can be difficult to develop within traditional academic training processes (Hindshaw et al., 2018). Large organizational bodies, such as the Scientific Committee on Antarctic Research (SCAR), recognize that providing opportunities for ECRs to voice their opinions on the development of international research priorities, themes and collaborations is valuable. SCAR and associations organizational bodies, such as the Association of Polar Early Career Scientists (APECS) provide many opportunities for ECR involvement including specific ECR workshops and reviewing opportunities such as the review of the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report[2].

ECRs as a Part of MEASO

From the outset, MEASO has involved community consultation, whereby both stakeholders and academics of all stages, including ECRs, have been encouraged to participate in the assessment process at any level of engagement. The first milestone in the MEASO process was the MEASO2018 international conference held in Hobart, Australia[3]. The conference was an important opportunity for the scientific community to engage with policymakers, the private sector, and civil society toward a common goal of assessing the Southern Ocean. In total, 175 participants from 23 countries attended the conference. ECRs represented approximately one-third of all attendees (see **Figures 1A,B** for additional statistics on ECR contributions to MEASO).

Early career researchers were pivotal in the pre-conference organization, including contacting and inviting potential contributors. Direct contact with the MEASO steering committee allowed for a welcoming environment in which ECRs were encouraged to share ideas, network with other attendees, and participate in breakout groups. In addition, a pre-conference ECR workshop was co-hosted with APECS which focused on ECR involvement in large international initiatives[4]. ECRs were also offered to partake in a mentorship programme whereby they were paired with a more senior attendee, who could be a point of contact and provide guidance during the conference. Mentoring programmes like the one offered at MEASO2018 are not universal but have been a major contributing factor to the success of other research programmes such as the 2007–2009 International Polar Year (Baeseman et al., 2011). A unique component of the MEASO2018 conference was a day-long research-policy forum, which provided an opportunity for ECRs to experience discussions among scientists, policymakers, and industry to identify ways to achieve a sustainable future for the Southern Ocean. These discussions were used to structure the core papers of the MEASO Research Topic in Frontiers in Marine Science.

Following the conference, ECRs participated in a range of essential roles related to the MEASO assessment process. One of the more significant roles included co-authoring, and in some cases, leading articles for this Research Topic as well as previous MEASO publications [e.g., Brasier et al. (2019)]. Another unique role involving ECRs included writing, editing and the reviewing of Wikipedia-style MEASO biota pages for

[1]https://www.scar.org/general-scar-news/celebrating-polar2018/

[2]https://www.apecs.is/news/apecs-news/3571-call-for-reviewers-of-the-second-draft-of-working-group-i-contribution-to-ipcc-sixth-assessment-report-ar6.html

[3]http://www.MEASO2018.aq

[4]http://www.measo2018.aq/apecs

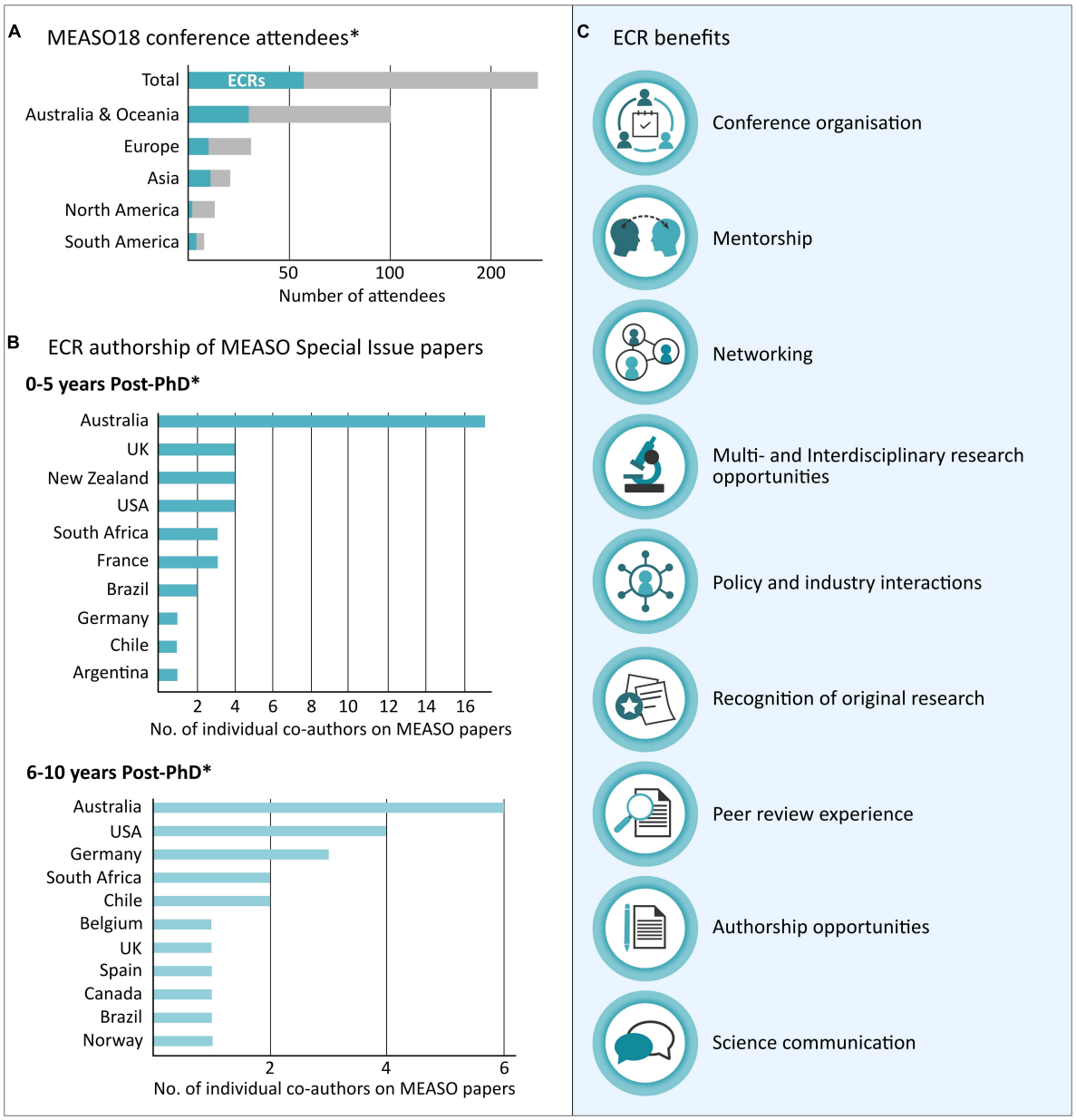

FIGURE 1 | Early career researcher (ECR) participation and resulting benefits from their involvement in the Marine Ecosystem Assessment for the Southern Ocean (MEASO). **(A)** attendance at the MEASO2018 conference by continent **(B)** ECR and mid-career researcher (MCR) authorship of MEASO Research Topic papers by country **(C)** a list of benefits and opportunities created for ECRs during the MEASO project. * Continents/countries represent institutional affiliation not nationality of individuals. ECRs are defined as researchers being within 5 years of finishing a Ph.D. or other terminal degree, which is the definition used by the Scientific Committee on Antarctic Research and MCRs as those within 5–10 years of their Ph.D. Data used in this figure is supplied in the **Supplementary Material**.

the Southern Ocean Knowledge and Information wiki (SOKI)[5]. ECRs also developed and managed the MEASO Twitter page (@MEASO20), producing new infographics targeted at general audiences and sharing research outcomes and projects weekly. **Figure 1C** highlights the aspects of the MEASO process in which ECRs were engaged, and their potential to greatly benefit ECR experience in polar research.

This article presents perspectives of 16 ECRs from 8 different countries directly involved in the MEASO project (e.g., conference attendees, SOKI contributors and/or authors within the MEASO Research Topic). Specifically, the aims of this manuscript are to:

(1) Discuss the benefits of ECR involvement in large research projects such as MEASO, to both ECRs and the project itself.

[5]http://soki.aq/

(2) Identify obstacles to ECRs in science and their involvement in large international research projects, how MEASO faced these obstacles, and how the research community could further overcome these obstacles to support ECRs.
(3) Provide a MEASO ECR perspective on the role of ECRs in the future of Antarctic and Southern Ocean research.

OBSTACLES AND ACTIONS

Overall, MEASO created an inclusive working space for many ECRs engaged in the project. However, long-term obstacles to ECR involvement in similar initiatives do exist in Antarctic and Southern Ocean research and across other scientific disciplines (Chapman et al., 2015; Mallaband et al., 2017; Ayala et al., 2019). We summarize eight key obstacles (**Table 1**) and suggest potential actions from the perspective of the MEASO ECR community that can be implemented at the individual, institutional and research community level to enhance scientific engagement. See the expanded version of **Supplementary Table S1**.

Pressure to Network

The highly competitive nature of modern academia, where there are more applicants than available jobs, places significant pressure on ECRs to network with senior researchers at conferences and meetings. However, as stated in Sobey et al. (2013) "most networking opportunities are found at higher levels." We (the MEASO ECR community) encourage ECRs to engage in mentoring programmes, research groups within their community and seek sponsors who can enhance their confidence, visibility, credibility, and professional networks (Ansmann et al., 2014; Fenton et al., 2016; Gottlieb and Travis, 2018; Bohleber et al., 2020). The academic environment has changed rapidly over the last decades (Pitt and Mewburn, 2016), and the issues ECRs face now are most likely different from those their mentors faced earlier in their careers. For this reason, we encourage institutions and the wider research community to invest in and promote mentoring training programmes.

Early career researcher Mentors (i.e., those officially assigned through a mentoring scheme or an ECR supervisor), across all disciplines could engage in faculty training targeted at providing a space in the academic pipeline for ECR career progression (Sood et al., 2016). Funding for such initiatives could coincide with organizations, universities and institutes investing in training opportunities for ECRs. Training may include workshops on career advice, writing manuscripts, science communication, mental health, ethics and schemes aimed at tackling inappropriate behavior toward ECRs, which may go unreported and lead to career attrition in science (Nash et al., 2019). Institutions should provide advice for mentors not only focused on mentorship, but also on the idea of "sponsorship" to provide collaborative and supportive outcomes that advance an ECR's career. This would help generate positive wellbeing in the workplace (increasingly important in modern academia; Maestre, 2019), improve grant success (Libby et al., 2016) as well as competence and retention of a diverse workforce (Sood et al., 2016). Thus, there are many social and economic reasons for institutes to invest in mentor training, beyond just the benefit to ECRs.

Competition

The imbalance between the number of ECRs and research positions and grants has resulted in immense competition between researchers for funding opportunities. With many grant applications being specific to ECRs they are constantly competing against their peers. Such competition can prevent collaborations and negatively impact working relationships (Anderson et al., 2007). This could inhibit their involvement in large-scale research initiatives. Furthermore, with limited research positions available, ECRs may be competing with mid-career and senior researchers for institutional positions. We encourage ECRs and their institutes to invest in technical and research training opportunities and promote a more humane, collaborative, and healthy work environment that discourages competition (Maestre, 2019). It is important to develop the soft skills and confidence of ECRs to improve their working relationships (Boeren et al., 2015; Hindshaw et al., 2018).

Pressure to Publish

Researchers are evaluated based on publications, especially in high impact journals, and citation numbers (Chapman et al., 2019), resulting in an increasing pressure to publish across research disciplines. Whilst many ECRs publish within their Ph.D., they may not be established enough to be invited to co-author manuscripts (Elmassry, 2020). This may deter them from getting involved in large-scale research initiatives or using other methods of science communication due to being viewed as less valuable or a lower priority. Publishing in high-impact journals frequently depends more on the research team than the ECRs themselves. We suggest increasing the value of alternative research outcomes and activities, such as leadership of small projects, public science articles or policy contributions, and the facilitation of co-authorship of papers within research groups and large research initiatives.

Academic Job Market and Career Uncertainty

The lack of jobs in academia and the highly competitive nature of funding schemes can make relocation an essential part of a research career in most scientific disciplines (Skakni et al., 2019). However, the short-term contracts offered to many ECRs can limit their outputs, create career uncertainty and impact their mental well-being (Nash et al., 2019; Woolston, 2020). We encourage ECRs to join interdisciplinary networks, perhaps by using associations such as APECS and SCAR working groups as a starting point. ECRs can actively follow the APECS job board[6] and SCAR working groups, which circulate job postings on request. ECRs can also seek support from institutions to provide longer term contracts, career development and workshops on how to attract funding with salary support (Sobey et al., 2013).

[6]https://www.apecs.is/career-resources/job-board.html

TABLE 1 | Major obstacles often experienced by early career researchers (ECRs) in science and the possible key actions that can be taken to improve them at the individual (I), institutional (In), and Antarctic and Southern Ocean research community level (RC) that may also apply to other marine and science disciplines.

Obstacles	Key actions	MEASO examples
 (1) Pressure to network	• Provide mentoring and sponsorship programmes at conferences and within institutes and universities (In, RC) • ECR involvement and inclusion in organizations and research networks (I) • Utilize social media platforms to connect with other researchers (I) • International and diverse supervisory teams (In) • Offer remote attendance for those ECRs unable to travel to conferences or workshops (In, RC)	• 2018 Conference had a mentoring program • ECRs were involved in the conference planning, organization and running • Conference registration fee waived for ECR organizers and prize winners • Co-hosted an ECR workshop with APECS • An ECR led Pew funded project resulting in a Nature publication (Cavan et al., 2019) • Remote attendance was offered for the 2019 United Kingdom workshop
 (2) Competition	• Promote a more humane, collaborative, and healthy work environments that discourage competition (In) • Promote skill development including technical and research training (In) • Where possible offer in-house training or ECR discounted attendance fees (In, RC)	• ECRs specifically asked to provide content for the SOKI pages on Antarctic and Southern Ocean biota and ecosystems
 (3) Pressure to publish	• Value and fund alternative research outcomes and activities e.g., science communication, articles, policy reports (RC) • Facilitate the successful publication of ECR research (e.g., funding the publication costs for open access articles) (In) • Create and support co-authorship opportunities (In, RC)	• ECR presentations and posters were awarded at the end of the conference. • ECRs were interviewed by local radio stations during the conference • ECRs participated as lead and co-authors in this special issue as well as in earlier MEASO publications (e.g., Brasier et al., 2019)
 (4) Academic job market and career uncertainty	• Join interdisciplinary networks (I) • Minimum term contracts >1 year in funding for ECR salary in large research projects (In) • Provide workshops on obtaining funding (In, RC)	• Employed several temporary ECR workers from 6 to 18 months
 (5) Work-life balance	• Project councils and committees should lead by example (In, RC) • Prioritize well-being and long-term sustainability of working collaborations (In, RC) • Accessible and freely available counseling support (In) • Dedicated time and funding for student support roles (In)	• Conference provided free on-site childcare facilities and personnel for all attendees • Meeting notes were circulated for those unable to attending online lead author and committee meetings
 (6) Language barriers	• Offer free language training (In) • Free Language support e.g., copy editing and translation (In) • Provide translated or plain language summaries of key research outcomes (In, RC) • Encourage English speakers to learn another language (In) • Non-English events at conferences (RC)	• MEASO will publish a plain English summary highlighting key messages for policymakers and stakeholders with the potential for translation into languages used by the Antarctic Treaty System
 (7) Voicing an opposing opinion	• Respect all scientific opinions (In, RC) • Encourage scientific discussion (In, RC) • Code of conduct to prevent harassment (In, RC)	• The MEASO process aimed to provide an unbiased assessment of the literature which represented diverse scientific perspectives
 (8) Discrimination	• Zero tolerance policy of discrimination of any kind (In, RC) • Promote diversity groups such as Women in Polar Science and Pride in Polar Research (In, RC) • Clear and accessible reporting mechanisms for harassment, abuse and bullying in the workplace and science events (In, RC)	• Conference hosted a Women in Antarctic Science breakout session • MEASO ensured that on-site participation for the United Kingdom workshop in 2019 was diverse across gender, nations, expertise, and experience

We highlight examples of such actions used during the MEASO project. An extended table with more detailed actions is available in the ***Supplementary Material****.*

Lack of Work-Life Balance

Maintaining a work-life balance benefits academic productivity and publication outputs (Bielczyk et al., 2019). Without consideration for personal well-being, researchers, disproportionately PhDs and ECRs (Mitra and McAlpine, 2017; O'Neill and Schroijen, 2018), run the risk of experiencing burnout and mental health issues (e.g., Petersen, 2011). Recognizing this at higher-levels and leading by example to implement flexible working arrangements and well-being support systems across institutions sets a standard of work-life balance. This standard must include those with (or planning) a family, or in caring roles (Calisi and A Working Group of Mothers in Science, 2018). Consequently, institutions and research laboratories incorporating these work ethics show improved productivity and creativity (Hunter, 2019). We also encourage mid-career and senior members of the research community to lead by example to promote working more effectively and efficiently over working more hours (Powell, 2017).

Language Barriers

Research communities are made up of multiple nationalities and languages, however, English remains the primary scientific language. This disadvantages ECRs that come from non-English speaking countries by limiting their potential output, hindering expression of their ideas and restricting their networking abilities and the reach of their research, along with associated racial biases. Additionally, terminology between disciplines can be a barrier for collaboration across science, policy, and the social sciences (Pannell et al., 2019). We encourage free language training, translation, and copy-editing services to non-native English speakers but also the translation and plain language summaries of key publications. Institutes could also provide language training for English speakers to learn another scientific language and conferences could host non-English speaking events.

Voicing an Opposing Opinion

Early career researchers can be hesitant to publish controversial research or object to proposed projects for fear of damaging their future career. By utilizing research networks and institute workshops, ECRs should be able to discuss these perspectives in a safe and supportive environment. Supervisors should also be trained to encourage everyone to contribute, even if they have opposing views.

Discrimination

Early career researchers bring new perspectives and a diverse set of skills to large-scale research initiatives (Fritz et al., 2015; Hindshaw et al., 2018). Valuing the opinions and perspectives of emerging researchers in science facilitates the identification of previously unexplored gaps and diverse ways of thinking. However, despite these benefits, in some cases, the opinions and perspectives of ECRs tend to be dismissed by more established researchers. Discrimination as a result of age, career stage, class, race, sexuality and gender should not be tolerated. To promote diversity in research we encourage researchers to join diversity groups such as Women in Polar Science (@WomeninPolarSci on Twitter), Minorities in Polar Research (@PolarImpact on Twitter) and Pride in Polar Research (@PolarPride on Twitter). Institutes and the wider research community can lead by example, such as ensuring diverse representation on selection panels and committees (Nash et al., 2019).

PERSPECTIVES OF ECRS ON THE FUTURE OF ANTARCTIC AND SOUTHERN OCEAN RESEARCH AND THEIR ROLE IN IT

Across many disciplines there is a shifting research culture from individualistic, competitive practices to models of interdisciplinary collaboration and transparency which may help address many of the challenges faced by ECRs today (**Table 1**). Whilst such a shift requires changes to be made at multiple organizational levels (from individual projects up to large institutional and multinational goals), appreciating diverse views and adopting a broad vision for the application of research findings across fields can help build a more inclusive environment. Doing so may advance our ability to address the ever more complex and *trans*-disciplinary challenges (e.g., Global Change) being faced today (Hossain et al., 2017).

Antarctic and Southern Ocean research needs to be high-quality and evidence-based to contribute to decision making and policy development for ultimate protection of vulnerable Antarctic ecosystems (Kennicutt et al., 2015; Hughes et al., 2018). Protecting and understanding these ecosystems is of global importance as environmental change within Antarctica has implications for global climate, sea level, biodiversity, and society (Kennicutt et al., 2014). ECRs are well-placed to conduct this research with the modern research landscape requiring ECRs to be generalists, working across disciplines with a wide range of collaborators. ECRs able to travel between institutes to establish such collaborations need travel support from their project budget or schemes such as the SCAR/Council of Managers of National Antarctic Programs (COMNAP) fellowships[7]. In addition, ECRs are actively trained in science communication using the most updated technologies and platforms as well as traditional methods. This training will benefit discussions and correspondence between researchers, policymakers and the general public, as well as fostering integrated, cross-disciplinary research teams. These cross-disciplinary and communicative skill sets of ECRs may also assist in the integration of Antarctic and Southern Ocean research into global policies and initiatives such as IPCC reports (for example, IPCC, 2019) and the United Nations Decade of Ocean Science for Sustainable Development (Pendleton et al., 2020), which will facilitate recognition of the impacts and importance of Antarctic and Southern Ocean research.

Evaluating research projects and the scale upon which they are likely to be relevant to policymakers and the broader

[7]https://www.scar.org/awards/fellowships/overview/; https://www.comnap.aq/expert-groups/education-outreach-training-expert-group/comnap-antarctic-fellowship/).

scientific community continues to be an important priority in today's dynamic management and political culture. This may be challenging for ECRs striving to generate impactful and timely research, with many working on projects with short timescales and limited access to long-term observations. In such circumstances, large collaborative initiatives provide the necessary opportunities for ECRs to participate in larger-scale initiatives relevant to policy (Chapman et al., 2015; Evans and Cvitanovic, 2018). For long-term initiatives, such as national research programs, engaging with ECRs in the early stages of planning, may offer significant benefits to their long-term success. For example, a range of new infrastructures and research initiatives are coming to fruition within many national polar research programmes, which, once established, will require engagement from today's ECRs. The predicted lifespan of new research vessels is around 30 years (e.g., the RSV *Nuyina*)[8], during which time today's ECRs are set to be highly involved over their research careers in planning scientific activities on-board the ship, including the management and execution of cruises. We encourage ECRs to engage in longer-term initiatives and action plans within national programmes as this could promote opportunities in the future.

FINAL REMARKS

The opportunity for ECRs to engage directly at a high level in comprehensive projects such as MEASO, while historically rare, is increasingly becoming the standard in marine research. Whilst ECRs need to take a proactive approach, they also need support from supervisors, mentors and research institutes to facilitate these opportunities. Overall, MEASO created positive opportunities and outcomes for a small number of ECRs. We have suggested specific future actions for ECRs and the marine research community to support ECRs in improving their potential longevity in this space and capacity to lead future research programmes. ECR engagement in initiatives such as MEASO provides ECRs with the experience and skills to help acquire funding for their own research projects, which contributes to the development of their own independent research teams (Majaneva et al., 2016; Hindshaw et al., 2018). However, many barriers remain to ECR involvement in such initiatives that must be addressed at the organizational, institutional, and community level, before today's ECRs will be able to lead a second MEASO in the future.

We have provided a general ECR perspective on the future of marine research with a focus on how science is delivered. We feel that the future success of marine research will require the following: (1) effective communication of research outcomes to diverse audiences, and (2) its incorporation into globally relevant and impactful reporting aligned with global research initiatives beyond an Antarctic and Southern Ocean focus. We encourage further discussions and qualitative surveys from an ECR perspective to investigate the priorities, gaps, trajectories and pathways to overcome barriers to ECR engagement in marine research.

[8]http://www.antarctica.gov.au/icebreaker/about-the-ship

DATA AVAILABILITY STATEMENT

All datasets presented in this study are included in the article/ **Supplementary Material**.

AUTHOR CONTRIBUTIONS

MB and SM conceptualized this manuscript and sought co-authors and created an outline of the manuscript. All authors were involved in discussion regarding the aims and content of the manuscript. MB and CW led manuscript production including the designation of sections to co-authors, editing, and streamlining text contributions. MB, CW, and CO wrote the introduction and section "Obstacles and Actions" with JC and JE contributing significantly to the benefits of ECRs in large research projects. Section "Perspectives of ECRs on the Future of Antarctic and Southern Ocean Research and Their Role in It" was designed by MB and EC with text contributions from EC, BF, PP, SH, and RS. SM created **Figure 1** based on ideas from co-authors. Additional text in section "Perspectives of ECRs on the Future of Antarctic and Southern Ocean Research and Their Role in It" was written by JE, SM, EC, NB, and SM. AH, SM, BF, and CW wrote section "Final Remarks" and MB wrote the final remarks incorporating opinions of all co-authors. All co-authors commented on and edited draft versions of the manuscript. MB finalized the manuscript for publication.

FUNDING

MB, CW, and SM were supported by the Antarctic Climate & Ecosystems Cooperative Research Centre and PEW Charitable Trusts. JC acknowledged the support from the Alexander von Humboldt Foundation in the form of a Humboldt Research Fellowship for Postdoctoral Researchers. BF was supported by a postdoctoral contract Juan de la Cierva-Incorporación (IJCI-2017-31478) of Ministerio de Ciencia, Innovación y Universidades. NH was funded by the NSF grant (Award #: 1840927) under a postdoctoral contract at Georgia Institute of Technology, United States. JH was funded through FONDECYT (POSTDOCTORADO 3180152) and CONICYT (FONDAP-IDEAL 15150003). EC was supported by the United Kingdom Natural Environment Research Council research programme grant NE/S000348/1. RS and PP were supported by the IMAS and University of Tasmania (UTAS) Tasmanian Graduate Research Scholarship. SH was supported by the Australian Research Council through a Laureate awarded to Philip Wallace Boyd, IMAS, UTAS, Australia (FL160100131).

ACKNOWLEDGMENTS

We acknowledge that the ideas presented here are of ECRs contributing to the MEASO project and thus may not reflect the

views of all ECRs within the Antarctic science community. We would like to acknowledge the MEASO steering committee for the opportunity to contribute to MEASO and voice our opinions to the scientific community. We would also like to thank the MEASO2018 organizers for arranging a travel grant scheme that supported several ECRs, including some of the authors of this manuscript. We are grateful for support to publish this manuscript from The Pew Charitable Trusts. We dedicate this manuscript to Adrian Dahood-Fritz, an APECS representative at MEASO2018 and MEASO collaborator. Adrian was an inspiring early career researcher, well-loved and an incredible attribute to the polar research community; she will be greatly missed.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fmars.2020.00692/full#supplementary-material

REFERENCES

Anderson, M. S., Ronning, E. A., De Vries, R., and Martinson, B. C. (2007). The perverse effects of competition on scientists' work and relationships. *Sci. Eng. Ethics* 13, 437–461. doi: 10.1007/s11948-007-9042-5

Ansmann, L., Flickinger, T. E., Barello, S., Kunneman, M., Mantwill, S., Quilligan, S., et al. (2014). Career development for early career academics: benefits of networking and the role of professional societies. *Patient Educ. Couns.* 97, 132–134. doi: 10.1016/j.pec.2014.06.013

Ayala, A. P., Sikora, L., Kirtley, S., and Labelle, P. R. (2019). Barriers and facilitators for early career researchers completing systematic or scoping reviews in health sciences: a scoping review. *OSF* 1–34. doi: 10.31219/osf.io/gkzf2

Baeseman, J., Xavier, J., Lantuit, H., and Taylor, A. (2011). "Early career researcher activities during IPY," in *Understanding Earth Polar Challenges: International Polar Year 2007-2008*, eds I. Krupnik, I. Allison, R. Bell, P. Culer, D. Hik, J. Lopez-Martinez et al. (Edmonton, AB: University of the Arctic), 511–522.

Bielczyk, N., Ando, A., Badhwar, A., Gao, M, Haugg, A., Hernandez, L et al. (2019). "Effective self-management for early career researchers in the natural sciences," in *Working paper, & OHBM Student and Postdoc Special Interest Group*, vol. 1, (England: Open Science Framework), pp. 1–22. doi: 10.17605/OSF.IO/W6EMK

Boeren, E., Lokhtina-Antoniou, I., Sakurai, Y., Herman, C., and McAlpine, L. (2015). Mentoring: a review of early career researcher studies. *Front. Learn. Res.* 3, 68–80. doi: 10.14786/flr.v3i3.186

Bohleber, P., Casado, M., Ashworth, K., Baker, C. A., Belcher, A., Caccavo, J. A., et al. (2020). Successful practice in early career networks: insights from the polar sciences. *Adv. Geosci.* 53, 1–14. doi: 10.5194/adgeo-53-1-2020

Bradley, A., Höfer, J., Savaglia, V., and Eayrs, C. (2020). Survey on early career travel support shows geographic, career stage, and indigenous status inequality in access to polar science events. *Adv. Geosci.* 53, 73–85. doi: 10.5194/adgeo-53-73-2020

Brasier, M. J., Constable, A., Melbourne-Thomas, J., Trebilco, R., Griffiths, H., Van de Putte, A., et al. (2019). Observations and models to support the first Marine Ecosystem Assessment for the Southern Ocean (MEASO). *J. Mar. Syst.* 197:103182. doi: 10.1016/j.jmarsys.2019.05.008

Bridle, H., Vrieling, A., Cardillo, M., Araya, Y., and Hinojosa, L. (2013). Preparing for an interdisciplinary future: a perspective from early-career researchers. *Futures* 53, 22–32. doi: 10.1016/j.futures.2012.03.011

Calisi, R. M., and A Working Group of Mothers in Science (2018). Opinion: how to tackle the childcare-conference conundrum. *Proc. Natl. Acad. Sci. U.S.A.* 115, 2845–2849. doi: 10.1073/pnas.1803153115

Cavan, E. L., Belcher, A., Atkinson, A., Hill, S. L., Kawaguchi, S., McCormack, S., et al. (2019). The importance of Antarctic krill in biogeochemical cycles. *Nat. Commun.* 10, 1–13. doi: 10.1038/s41467-019-12668-7

Chapman, C. A., Algera, D., Dick, M., Hawkins, E. E., Lawrence, M. J., Lennox, R. J., et al. (2015). Being relevant: practical guidance for early career researchers interested in solving conservation problems. *Glob. Ecol. Conserv.* 4, 334–348. doi: 10.1016/j.gecco.2015.07.013

Chapman, C. A., Bicca-Marques, J. C., Calvignac-Spencer, S., Fan, P., Fashing, P. J., Gogarten, J., et al. (2019). Games academics play and their consequences: how authorship, h-index and journal impact factors are shaping the future of academia. *Proc. Roy. Soc. B-Biol. Sci.* 286:20192047. doi: 10.1098/rspb.2019.2047

Elmassry, M. M. (2020). Helping others—and myself. *Science* 368, 1282–1282. doi: 10.1126/science.368.6496.1282

Evans, M. C., and Cvitanovic, C. (2018). An introduction to achieving policy impact for early career researchers. *Palgrave Commun.* 4, 1–12. doi: 10.1057/s41599-018-0144-2

Fenton, A., Walsh, K., and MacDonald, A. (2016). "Capacity building of early career researchers through cross-institutional mentoring," in *Global Co-Mentoring Networks in Higher Education*, Ed. B. Johannessen (Cham: Springer).

Freeman, J. (2018). LGBTQ scientists are still left out. *Nature* 559, 27–28. doi: 10.1038/d41586-018-05587-y

Fritz, M., Deshpande, B., Bouchard, F., Högström, E., Lepage, J., Morgenstern, A., et al. (2015). Brief communication: future avenues for permafrost science from the perspective of early career researchers. *Cryosphere Discuss.* 9, 1209–1225. doi: 10.5194/tc-9-1715-2015

Gottlieb, A. S., and Travis, E. L. (2018). Rationale and models for career advancement sponsorship in academic medicine: the time is here; the time is now. *Acad. Med.* 93, 1620–1623. doi: 10.1097/acm.0000000000002342

Hindshaw, R. S., Mariash, H., Vick-Majors, T. J., Thornton, A. E., Pope, A., Zaika, Y., et al. (2018). A decade of shaping the futures of polar early career researchers: a legacy of the International Polar Year. *Polar Rec.* 54, 312–323. doi: 10.1017/S0032247418000591

Hossain, M. S., Pogue, S. J., Trechard, L., Van Oudenhoven, A. P. E., Washbourne, C.-L., Muiruri, E. W., et al. (2017). Identifying future research directions for biodiversity, ecosystem services and sustainability: perspectives from early-career researchers. *Int. J. Sustainable Dev. World Ecol.* 25, 249–261. doi: 10.1080/13504509.2017.1361480

Hughes, K. A., Constable, A., Frenot, Y., López-Martínez, J., McIvor, E., Njåstad, B., et al. (2018). Antarctic environmental protection: strengthening the links between science and governance. *Environ. Sci. Policy* 83, 86–95. doi: 10.1016/j.envsci.208.02.006

Hunter, P. (2019). Remote working in research: an increasing usage of flexible work arrangements can improve productivity and creativity. *Sci. Soc.* 20, 1–4. doi: 10.15252/embr.201847435

INACH (2019). "Chilean antarctic science program 2019-2020," in *Sixty Successful Years of the Antarctic Treaty*, Ed. R. Canales (Chile: Instituto Antártico Chileno), pp. 53–74.

IPCC (2019). *IPCC Special Report on the Ocean and Cryosphere in a Changing Climate*. Geneva: IPCC.

Jaeger-Erben, M., Kramm, J., Sonnberger, M., Völker, C., Albert, C., Graf, A., et al. (2018). Building capacities for transdisciplinary research. Challenges and recommendations for early-career researchers. *Gaia* 27, 379–386. doi: 10.14512/gaia.27.4.10

Kennicutt, M. C., Chown, S. L., Cassano, J. J., Liggett, D., Massom, R., Peck, L. S., et al. (2014). Polar research: six priorities for Antarctic science. *Nat. News* 512, 23–25. doi: 10.1038/512023a

Kennicutt, M. C., Chown, S. L., Cassano, J. J., Liggett, D., Peck, L. S., Massom, R., et al. (2015). A roadmap for Antarctic and Southern Ocean science for the next two decades and beyond. *Antarct. Sci.* 27, 3–18. doi: 10.1017/S0954102014000674

Libby, A. M., Hosokawa, P. W., Fairclough, D. L., Prochazka, A. V., Jones, P. J., and Ginde, A. A. (2016). Grant success for early-career faculty in patient-oriented research: difference-in-differences evaluation of an interdisciplinary mentored research training program. *Acad. Med.* 91, 1666–1675. doi: 10.1097/ACM.0000000000001263

Macoun, A., and Miller, D. (2014). Surviving (thriving) in academia: feminist support networks and women ECRs. *J. Gen. Stud.* 23, 287–301. doi: 10.1080/09589236.2014.909718

Maestre, F. T. (2019). Ten simple rules towards healthier research labs. *PLoS Comput. Biol.* 15:e1006914. doi: 10.1371/journal.pcbi.1006914

Majaneva, S., Hamon, G., Fugmann, G., Lisowska, M., and Baeseman, J. (2016). Where are they now?–A case study of the impact of international travel support for early career Arctic researchers. *Polar Sci.* 10, 382–394. doi: 10.1016/j.polar.2016.06.001

Mallaband, B., Staddon, S., and Wood, G. (2017). Crossing transdisciplinary boundaries within energy research: an 'on the ground' perspective from early career researchers. *Energy Res. Soc. Sci.* 26, 107–111. doi: 10.1016/j.erss.2017.01.021

Mitra, M., and McAlpine, L. (2017). A balancing act: the interaction between the work and broader lives of male and female early career researchers. *Higher Education Rev.* 50, 5–34.

Nash, M., Nielsen, H. E., Shaw, J., King, M., Lea, M. A., and Bax, N. (2019). "Antarctica just has this hero factor…": gendered barriers to Australian Antarctic research and remote fieldwork. *PLoS One* 14:e0209983. doi: 10.1371/journal.pone.0209983

O'Neill, G., and Schroijen, M. (2018). Early-career researchers and mental health. *Impact* 2018, 44–45. doi: 10.21820/23987073.2018.12.44

Pannell, J. L., Dencer-Brown, A. M., Greening, S. S., Hume, E. A., Jarvis, R. M., Mathieu, C., et al. (2019). An early career perspective on encouraging collaborative and interdisciplinary research in ecology. *Ecosphere* 10:e02899. doi: 10.1002/ecs2.2899

Patterson, J. J., Lukasiewicz, A., Wallis, P. J., Rubenstein, N., Coffey, B., Gachenga, E., et al. (2013). Tapping fresh currents: fostering early-career researchers in transdisciplinary water governance research. *Water Altern.* 6, 293–312.

Pendleton, L., Karen, E., and Visbeck, M. (2020). Opinion: we need a global movement to transform ocean science for a better world. *Proc. Natl. Acad. Sci.* 117:202005485. doi: 10.1073/pnas.2005485117

Petersen, E. B. (2011). Staying or going? Australian early career researchers' narratives of academic work, exit options and coping strategies. *Aust. Univ. Rev.* 53, 34–42.

Pitt, R., and Mewburn, I. (2016). Academic superheroes? A critical analysis of academic job descriptions. *J. High. Educ. Policy Manag.* 38, 88–101. doi: 10.1080/1360080X.2015.1126896

Powell, K. (2017). Work–life balance: break or burn out. *Nature* 545, 375–377. doi: 10.1038/nj7654-375a

Skakni, I., Calatrava Moreno, M. D. C., Seuba, M. C., and McAlpine, L. (2019). Hanging tough: post-PhD researchers dealing with career uncertainty. *High. Educ. Res. Dev.* 38, 1489–1503. doi: 10.1080/07294360.2019.1657806

Sobey, A. J., Townsend, N. C., Metcalf, C. D., Bruce, K. D., and Fazi, F. M. (2013). Incorporation of Early Career Researchers within multidisciplinary research at academic institutions. *Res. Eval.* 22, 169–178. doi: 10.1093/reseval/rvt004

Sood, A., Tigges, B., and Helitzer, D. (2016). Mentoring early-career faculty researchers is important-but first "Train the Trainer". *Acad. Med.* 91, 1598–1600. doi: 10.1097/ACM.0000000000001264

Woolston, C. (2020). Australian junior scientists report damaging lack of support at work. *Nature* 579, 457–458. doi: 10.1038/d41586-020-00687-0

Conflict of Interest: JE was currently employed by the Cawthron Institute, a private research institution that also offers a range of commercial services.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.