So What? Using Scientific Knowledge to Inform Antarctic Decision-making

By Julia Jabour[1]

I. Introduction

Scientific research is both a priority[2] and the 'currency of credibility' in the Antarctic. It is a legitimate peaceful activity that is part of the object and purpose of the Antarctic Treaty – peace and science.[3] Scientific endeavour elevates ordinary contracting states to consultative (decision-making) states.[4] States use the existence of their scientific research programs as the pathway into Antarctica and for some, also as a hedge against being excluded from future resource development. Nevertheless, many scientific results are becoming increasingly important and useful in understanding today's changing environmental conditions. The value of Antarctic-derived research should not be underestimated.

Early Antarctic scientific research was largely curiosity-driven, with scientists exploring an unknown continent and its surrounding water for new knowledge. They anticipated novelty because of the unusual natural regimes such as ice, light, temperature, salinity and prolonged isolation.

The author of one history of Antarctic science, Gordon Fogg,[5] chose to use the word 'science' in the singular rather than the plural as a way of highlighting the holistic nature of research in and about the Antarctic. This holism, he speculated, was partly a product of the necessity for scientists from many different disciplines to share logistics and resources in pursuit of their own scientific knowledge about the remote, inhospitable south. The closeness this requires is not only physical, but intellectual as well. The contemporary melding of scientific disciplines, e.g. biological oceanography, attests to the importance of deeper and broader understanding of the connectedness of our world, in this case how oceanographic processes influence living things in ecosystems. The holistic outlook, Fogg suggested, was one of the defining features of Antarctic research and not only is this rare within the competitive, discipline-based scientific community, but it is also 'of great value to present day science'.[6]

Today, greater knowledge about Antarctica has led to the employment of more technologically sophisticated equipment and procedures in the search for new information. This has given researchers access to high quality, high value data, and resources of high commercial interest, e.g. for pharmaceutical and nutraceutical companies' potential downstream development of products of high commercial value.

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2 Protocol on Environmental Protection to the Antarctic Treaty, 30 ILM 1461 (Madrid Protocol) Article 3.3.

3 Antarctic Treaty, 402 UNTS 71, Articles II and I.

4 Ibid, Article IX.2.

5 Gordon Fogg, *A history of Antarctic science* (CUP, 1992).

6 Ibid, pp 1–2.

Today's research is providing evidence of the dramatic, sometimes irreversible changes that are occurring in the Antarctic, e.g. record high atmospheric temperatures[7] and melting ice contributing to sea level rise,[8] along with historical evidence of CO_2 in the atmosphere and what this means for ocean pH and living organisms.[9] This knowledge is both intrinsically scientifically valuable and of great utility in explaining or predicting global events.[10]

There are two principal opportunities to feed scientific research results into decision-making bodies within the Antarctic legal regime. First, national Antarctic science programs, in part informed by the needs and directions of the Scientific Committee on Antarctic Research (SCAR), feed their research results into their country's delegations to Committee for Environmental Protection (CEP) meetings. Each year the CEP meets and discusses the implementation of the Madrid Protocol.[11] The meeting's discussions and any recommendations the Parties agree to make are reflected in a report presented to the annual decision-making body, the Antarctic Treaty Consultative Meeting (ATCM). The CEP itself cannot make measures of a legally binding nature; it can only advise. Sometimes that advice is not heeded as contentious issues, such as providing a definition of 'biological prospecting', are put on the back burner for continuing discussion.[12]

Secondly, the national programs conduct research of relevance and present its results to the Scientific Committee on the Conservation of Antarctic Marine Living Resources (SC-CAMLR). As with the CEP, SC-CAMLR meets and discusses the operation of its parent instrument – the CAMLR Convention[13] – and provides advice and recommendations in its report to the decision-making body, the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR). CCAMLR can, and does, make legally binding decisions annually on both environmental protection and resource harvesting. It also defers decisions on contentious issues, as the slow adoption of marine protected areas illustrates.[14]

The ATCM and CCAMLR are the only two Antarctic forums where recommendations from their scientific and technical organisations are discussed and where measures – i.e. new laws – can be made. Previously, very little attention was paid to the 'quality' of scientific research, but this is changing, with new guidance issued for the attainment of Consultative Party status. There is also increasing speculation about the politicisation of scientific research. This is hardly surprising since most Antarctic scientific research is government-funded and governments sometimes want/need

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7 National Aeronautical and Space Administration (NASA) 'Antarctica melts under its hottest days on record' https://earthobservatory.nasa.gov/images/146322/antarctica-melts-under-its-hottest-days-on-record (accessed 02 March 2020).

8 Chris Turney et al, 'Early Last Interglacial ocean warming drove substantial ice mass loss from Antarctica', *PNAS*, 2020, DOI: 10.1073/pnas.1902469117.

9 Y Yan et al, 'Two-million-year-old snapshots of atmospheric gases from Antarctic ice, *Nature* 574, 663–666 (2019) https://doi.org/10.1038/s41586-019-1692-3; J Gardner et al, 'Southern Ocean pteropods at risk from ocean warming and acidification', *Marine Biology* 165, 8 2018, https://doi.org/10.1007/s00227-017-3261-3.

10 E.g. Eleanor Frajka-Williams et al, 'Atlantic Meridional Overturning Circulation: Observed Transport and Variability', *Frontiers in Marine Science*, 07 June 2019 https://doi.org/10.3389/fmars.2019.00260.

11 Madrid Protocol, Articles 11 and 12.

12 Julia Jabour, 'Biological Prospecting: The ethics of exclusive reward from Antarctic activities', 10 *Ethics in Science and Environmental Politics* (2010) 19.

13 Convention on the Conservation of Antarctic Marine Living Resources (CAMLR Convention) 19 ILM 837.

14 Danielle Smith and Julia Jabour, 'MPAs in ABNJ: Lessons from two high seas regimes', *ICES Journal of Marine Science* (2017) https://doi.org/10.1093/icesjms/fsx189.

research results that support, rather than inform, their policies. This paper briefly examines these issues in an attempt to evaluate how science is used to inform decision-making in the Antarctic.

II. The Origin and Validity of Science Priority

There are a number of specific references to science in the Antarctic Treaty and its Madrid Protocol that support scientific research as a high-status activity. First, in the Treaty's Preamble, the following words appear:

> Acknowledging the substantial contributions to scientific knowledge resulting from international cooperation in scientific investigation in Antarctica
>
> Convinced that the establishment of a firm foundation for the continuation and development of such cooperation on the basis of freedom of scientific investigation in Antarctica as applied during the International Geophysical Year accords with the interests of science and the progress of all mankind …

There are differing opinions about the legal status of statements in a treaty's preamble.[15] Irrespective of whether you consider preambular paragraphs as merely 'ceremonial' or 'substantive' in law,[16] let us conclude, as Hulme does, that preamble text does matter in a search for context, and in the determination of a treaty's object and purpose.

In this case it is clear that the 1957–58 IGY played an important role in the creation of the *conditions for*, if not the wording itself, of the Antarctic Treaty. The travaux préparatoires[17] provide useful insights into the origin and intention of the scientific obligations contained both here and in the first three articles of the Antarctic Treaty, where the most substantive evidence is found:

> ARTICLE I
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> 2. The present Treaty shall not prevent the use of military personnel or equipment for scientific research or for any other peaceful purpose.
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> ARTICLE II
>
> Freedom of scientific investigation in Antarctica and cooperation toward that end, as applied during the International Geophysical Year, shall continue, subject to the provisions of the present Treaty.
>
> ARTICLE III
>
> 1. In order to promote international cooperation in scientific investigation in Antarctica, as provided for in Article II of the present Treaty, the Contracting Parties agree that, to the greatest extent feasible and practicable:
>
> (a) information regarding plans for scientific programs in Antarctica shall be exchanged to permit maximum economy and efficiency of operations;
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> (b) scientific personnel shall be exchanged in Antarctica between expeditions and stations;
>
> (c) scientific observations and results from Antarctica shall be exchanged and made freely available.

15 M Hulme, 'Preambles in Treaty Interpretation', 164 *University of Pennsylvania Law Review* (2016) 5: 1281–1343s.

16 Ibid, p 1289.

17 Many of these documents are available from the new searchable Antarctic Documents Database, hosted by the Library of the University of Tasmania, https://www.utas.edu.au/library/atadd (accessed 20 March 2020).

> 2. In implementing this Article, every encouragement shall be given to the establishment of cooperative working relations with those Specialized Agencies of the United Nations and other international organizations having a scientific or technical interest in Antarctica.

Scientific research is clearly a significant component of a Party's legitimate presence in the Antarctic, and thus also provides a platform for States wishing to have access to current or future resources. This is amplified by the fact that the *bona fides* for being elevated from a contracting to a consultative party in the Antarctic Treaty Consultative Meeting is thus:

> ARTICLE IX
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> 2. Each Contracting Party which has become a party to the present Treaty by accession under Article XIII shall be entitled to appoint representatives to participate in the meetings referred to in paragraph 1 of the present Article, during such time as that Contracting Party demonstrates its interest in Antarctica by conducting substantial scientific research activity there, such as the establishment of a scientific station or the despatch of a scientific expedition.

The Madrid Protocol, which is the environmental instrument through which the possible impact of all authorised human activity – including scientific research – in the Antarctic is appraised, has further mandated this strong scientific imperative, first, in its Preamble:

> Acknowledging further the unique opportunities Antarctica offers for scientific monitoring of and research on processes of global as well as regional importance …

Then in its second Article on objective and designation:

> The Parties commit themselves to the comprehensive protection of the Antarctic environment and dependent and associated ecosystems and hereby designate Antarctica as a natural reserve, devoted to peace and science.

To emphasise the point, this is carried over to its third Article on environmental principles:

> 1.1 The protection of the Antarctic environment and dependent and associated ecosystems and the intrinsic value of Antarctica, including its wilderness and aesthetic values and its value as an area for the conduct of scientific research
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> …
>
> 3.2. …
>
> (b) …
>
> (vi) degradation of, or substantial risk to, areas of biological, scientific, historic, aesthetic or wilderness significance;
>
> (c) activities in the Antarctic Treaty area shall be planned and conducted on the basis of information sufficient to allow prior assessments of, and informed judgments about, their possible impacts on the Antarctic environment and dependent and associated ecosystems and on the value of Antarctica for the conduct of scientific research
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> …
>
> 3.3. Activities shall be planned and conducted in the Antarctic Treaty area so as to accord priority to scientific research and to preserve the value of Antarctica as an area for the conduct of such research, including research essential to understanding the global environment.

However, there is a major limitation on this priority given to scientific research:

> 3.4. Activities undertaken in the Antarctic Treaty area pursuant to scientific research programmes, tourism and all other governmental and non-governmental activities in the Antarctic Treaty area for which advance notice is required in accordance with Article VII (5) of the Antarctic Treaty, including associated logistic support activities, shall:
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> (a) take place in a manner consistent with the principles in this Article; and
>
> (b) be modified, suspended or cancelled if they result in or threaten to result in impacts upon the Antarctic environment or dependent or associated ecosystems inconsistent with those principles.

These extensive references quoted in full add substance to the argument that while the law gives considerable weight to scientific endeavour, scientific research should not be a priority at any cost – particularly environmental. To complicate matters further, there is no definition of 'scientific research' in international law; essentially any activity that fits within a category of a pursuit of knowledge would be acceptable. As Gogarty pointed out, by failing to define what scientific research was, or was not, in the Australia v. Japan Whaling Case, the International Court of Justice also 'failed to take the opportunity to offer a clear determination to states on their legal–scientific obligations within international law'.[18]

In the Antarctic context, not only is research not defined, but also there has been very little attention paid to the quality of scientific research, providing it is carried out in a manner consistent with the laws of peace, collaboration and environmental evaluation. However, recent discussions in the ATCM have begun to address this shortcoming.

III. Identification and Organisation of Scientific Requirements

The identification and organisation of many of the Antarctic scientific research requirements are conducted by two key Antarctic bodies – the Scientific Committee on Antarctic Research (SCAR) and the Council of Managers of National Antarctic Programmes (COMNAP). While very different bodies, together they play crucial yet understated roles in protecting Antarctica.

A. SCAR

The Scientific Committee on Antarctic Research (SCAR), established in 1958, is an international non-governmental organisation (NGO) outside the Antarctic Treaty System, that is a member of the International Council for Science. It is the body with carriage of the organisation of Antarctic scientific research.[19]

SCAR's mandate is 'the initiation, promotion and co-ordination of scientific research in Antarctica'.[20] SCAR also provides international, independent scientific advice to the Antarctic Treaty System and other bodies. SCAR members are usually but not always Antarctic Treaty Contracting Parties, e.g. the Islamic Republic of Iran is an Associate Member of SCAR, though not a Party to the Antarctic Treaty.

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18 Brendan Gogarty, 'Conceptions and (Mis)conceptions of Science in International Treaties; the ICJ Whaling Case in Context', *The Yearbook of Polar Law VII* (2015) 607–622, 607.

19 Scientific Committee on Antarctic Research, https://www.scar.org/ (accessed 18 March 2020).

20 Ibid, What is SCAR?, https://www.scar.org/about-us/scar-overview/ (accessed 18 March 2020).

According to SCAR's Strategic Plan 2017–22, its vision is to be an 'engaged, active, forward-looking organization that promotes, facilitates, and delivers scientific excellence and evidence-based policy advice on globally significant issues that are relevant to Antarctica'.[21] The task of the delivery of 'policy advice' is interesting, since it would seem that advising on policy would be outside the remit of scientists. However, the relatively new inclusion of policy research, with the convening of an Expert Group on Social Sciences and Humanities in 2014, is likely to give this task more standing.

SCAR's objectives, therefore, are to amplify its leadership in Antarctic research by further strengthening and expanding high-quality collaborative and visionary Antarctic research and to offer independent scientific advice to ATCMs and other bodies dealing with Antarctic and Southern Ocean matters. SCAR is able to enhance and grow research capacity in its member countries and enhance public awareness and understanding of Antarctic issues through communication of research results. An important job is to facilitate unrestricted and free access to Antarctic research data. It routinely submits Working, Information and Background Papers to the ATCM and the CEP; in 2019, SCAR submitted a total of 23 papers to these Antarctic meetings.

B. COMNAP

The Council of Managers of National Antarctic Programs (COMNAP) is the body charged with the practical day-to-day management of the logistics of operating in the Antarctic.[22] Established in 1988, COMNAP is an intergovernmental organisation within the Antarctic Treaty System. Its membership comprises the national officials responsible for planning, conducting and managing support for science on behalf of their respective governments – all Consultative Parties to the Antarctic Treaty.

COMNAP's role is to 'develop and promote best practice in managing the support of scientific research in Antarctica'.[23] To achieve this it serves as a forum for developing best practices; facilitates and promotes international partnerships (e.g., between states with Southern Ocean search and rescue responsibility); provides opportunities and systems for information exchange (primarily via its website); and provides the Antarctic Treaty System with objective and practical, technical and non-political advice drawn from the National Antarctic Programs' pool of expertise. Unlike SCAR, COMNAP does not suggest that it provides 'policy advice'.

But like SCAR, COMNAP does have expert groups. Theirs are air operations, environmental protection, safety, marine platforms, advancing critical technologies, joint expert group on human biology and medicine, science facilitation, and education, outreach and training. Some of its strategic programs include the Antarctic Flight Information Manual, and the new Asset Tracking System (for recording the positions of vessels). Only some of the information from these expert groups is publicly available.

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21 Ibid, Strategic Plan 2017–2022, https://www.scar.org/strategic-plans/774-2017-strategic-plan/ (accessed 18 March 2020).

22 Council of Managers of National Antarctic Programs, About COMNAP, https://www.comnap.aq/ (accessed 19 March 2020).

23 Ibid.

COMNAP also maintains a Station Catalogue, which has information critical for response to emergencies because it describes the facilities that are available at each station, and the characteristics of that place that give good situational awareness in such times.[24]

COMNAP has been able to influence the ATCM in a number of ways, including indicating best practice (e.g. fuel handling, flight information), establishing international partnerships (all the managers of national Antarctic programs routinely meet to discuss common issues and to provide advice to ATCMs), exchanging information (COMNAP submitted a total of seven papers to the ATCM in 2019), and providing non-political advice (especially regarding practical matters such as safety, mapping and the like).

The kinds of information and advice that both SCAR and COMNAP feed into the ATCM and CCAMLR is expert, but whether or not this is heeded is influenced by the decision-makers themselves, who are also those that conduct the majority of scientific research projects in and about the Antarctic.

IV. Questions of Quality

Science is the currency of credibility in Antarctica, and some scientific research is clearly of high value, as the earlier examples illustrate. But some is mildly specious, or even of no value at all. The latter does not go unnoticed. For example, a 2014–15 Antarctic Peninsula inspection by a joint team from the UK and Czech Republic reported to the 38th ATCM that it found some base occupants were only conducting routine, or no, scientific research, evidenced by lack of scientific laboratories and equipment.[25] In the most diplomatic terms, the inspectors recommended that, inter alia:

> National Antarctic Programmes should ensure they use an appropriate system of expert peer review to ensure the science undertaken in Antarctica is of the highest quality and importance, and that its impact can be established.[26]

At the 39th ATCM in 2016, Venezuela – a Contracting Party – was unsuccessful in its bid to become a Consultative Party.[27] This lead to the convening of an Intersessional Contact Group (ICG) by the ATCM to review the criteria for Consultative Party status.[28] It is unusual for an application for Consultative Party status to be rejected. If an application had been received that was unlikely to be successful, the *in camera* Heads of Delegation meeting that occurs just prior to the official opening of the ATCM would decide to reject the matter even being put on the agenda. However, tracking this through publicly available official final reports is impossible because there is no record of the meeting.

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24 COMNAP, Antarctic Station Catalogue, https://www.comnap.aq/wp-content/uploads/2019/11/COMNAP_Antarctic_Station_Catalogue.pdf (accessed 30 March 2020).

25 Governments of United Kingdom and Czech Republic, 'General Recommendations from the Joint Inspections undertaken by the United Kingdom and the Czech Republic under Article VII of the Antarctic Treaty and Article 14 of the Environmental Protocol', Working Paper WP019 rev.3 to ATCM XXXVIII, Bulgaria, 2015.

26 Ibid, p5.

27 Antarctic Treaty Secretariat, Final Report of ATCM XXXIX, Santiago, Chile, 2016, paras 92–98.

28 Ibid.

In a similar vein, in the second performance review of CCAMLR in 2017, the following was noted:

> A working mechanism is needed to better coordinate the research activities among Members in terms of both the focus of research and the temporal–spatial scales to maximise the delivery of such collaborative efforts to support the work of the Commission.[29]

These comments and decisions point to suspicion that a low level of unease was brewing within the Antarctic regime regarding the conduct and coordination of scientific research and the corresponding imperative to have undertaken 'substantial scientific research activity' in order to be granted ATCM decision-making status.

The 2016 ICG was coordinated by Chile, New Zealand and Uruguay and a report was prepared for and presented to ATCM XL in Beijing in 2017.

A. Consultative Party Status Review

At that 2017 ATCM, the report of the ICG on Criteria for Consultative Status was discussed.[30] It is important to note that while the ICG drew up a set of recommended guidelines to assist prospective states in preparing an application, as well as those Consultative Parties assessing applications, the Parties noted that 'the proposed guidelines did not attempt to generate new requirements for Treaty Party [sic] requesting Consultative Status'.[31] This is interesting because it begs the question: Why review the criteria if the recommendations do not generate a new interpretation of Article IX?

Nevertheless, the ATCM did adopt the guidelines recommended by the ICG. They include requirements to demonstrate quality and collaboration:

- list publications related to Antarctica, including both articles in peer-reviewed scientific journals as well as papers to international bodies;
- list publications with co-authors from different countries;
- detail citations of relevant papers that scored well in a science citation index;
- detail data you contributed with emphasis on data cited in publications that score well in a science citation index and on data contributed to Antarctic scientific programmes and databases;
- create data sets that are accessible to the scientific community; and/or
- give examples of research prizes or formal recognition of accomplishments.[32]

Because the adoption was effected through a Decision, none of these recommended guidelines are legally binding.

For the first time in the 60-year history of the Antarctic Treaty, benchmarks of 'quality' have been applied to Antarctic scientific research. The application is limited to Contracting Parties wishing to

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29 CCAMLR, 2nd Performance Review 2017, https://www.ccamlr.org/en/organisation/second-ccamlr-performance-review, para 37.v (accessed 27 March 2020).

30 Governments of Uruguay, Chile and New Zealand, 'Report of the Intersessional Contact Group (ICG) on Criteria for Consultative Status', Working Paper WP 3 to ATCM XL, Beijing, China; see also Final Report at paras 91–93.

31 Final Report, ATCM XL, para 92.

32 Antarctic Treaty Secretariat, 'Guidelines on the procedure to be followed with respect to Consultative Party status', ATCM XL, Decision 2/2017, https://ats.aq/devAS/Meetings/Measure/653 (accessed 29 March 2020).

elevate themselves to decision-makers, but still, asking 'so what is your science contributing?' is a major policy deviation for the actors in the Antarctic Treaty system.

V. Is Antarctic Scientific Research Politicised?

Politicisation of scientific research is more common that we would like to imagine. The clearest indication of this is the way in which climate science is pitted against government policies, ironically whilst also acknowledging that climate problems ultimately require political solutions. Contentious ATCM issues that might be politicised in the decision-making forum, despite the best scientific evidence available, concern, e.g. human impact. The Madrid Protocol compels ATCPs to heed 'the best scientific and technical advice available' in implementing their environmental principles.[33] Further, the ATCM is required to 'review the work of the Committee [CEP] and shall draw fully upon its advice and recommendations'.[34] But the CEP is only advisory and ATCM can, and does, defer discussion on contentious topics raised by the CEP. Some of these topics have included the definition of 'biological prospecting', strict regulation of tourist and non-governmental activities, and the inability of the CEP to recommend the rejection of environmental impact assessments of projects that could potentially cause serious environmental harm.

The CAMLR Convention can be interpreted to have dual objectives: those of conservation and rational use. But while some Commission Members see these as needing to be equally balanced, others do not. The case of the negotiation and adoption of marine protected areas highlights the problems this dichotomy raised at the time, and will continue to blight CCAMLR's future.[35] Therefore, even though CCAMLR has specifically adopted into practice the legal requirement to accept the best scientific evidence available,[36] this has been politicised in instances where conservation is unequally opposed to rational use.

VI. Environmental Impact of Scientific Research and Logistics

A similar analogy to CCAMLR's MPAs exists with the application of the Madrid Protocol. The Protocol urges sharing of facilities, cooperation in the planning and conduct of activities, with plans to be best environmental practice, and the like.[37] Yet there weaknesses, such as a seeming lack of commitment by national operators to these ideals, a lack of legal obligation/remedy, and perhaps the main shortcoming – no veto over state activity that is more or less compliant, because of the ambiguous and subjective nature of the language used in the environmental evaluation requirements, and the lack of a legal mechanism to effect a veto.

Parties that submit environmental evaluations clearly indicating environmental risk can be asked by the ATCM to consider modifications, alternatives, or even suspension. It can be a lengthy process to deal with these kinds of considerations.[38] Sometimes, environmental evaluations will

33 Madrid Protocol, Article 10.1.

34 Ibid, Article 10.2.

35 Smith and Jabour, note 13.

36 CAMLR Convention, Article IX.1 (f).

37 Madrid Protocol, Article 3.

38 For example, the joint Russian/US/French sub-glacial Lake Vostok drilling program and the entire attendant environmental reporting that went with it, took more than a decade to complete.

conclude that while an activity might very well cause a major impact, the value of the activity (either scientific research itself, as in the Lake Vostok drilling project, or one in support thereof, such as the Mario Zucchelli runway) will outweigh the risks to the environment.[39] Because no veto exists, these activities can proceed.

This was recognised by the CEP in a Working Paper submitted by the United Kingdom, Australia, Belgium, New Zealand and Norway in 2017 relating to policy issues that arose in an intersessional examination of EIA guidelines.[40] Some matters were thought to require considerably more thought and discussion, and this veto potential was one of them.

In 2017 the CEP, which cannot make legally binding measures itself, asked the ATCM for advice on, inter alia:

> the extent to which the CEP should begin work on…creating an appropriate and effective method within the Antarctic Treaty System of preventing an environmentally-damaging project proceeding.[41]

When this was raised in the ATCM, responses from the parties included:

> some caution may need to be applied to consideration of a mechanism for preventing activities
>
> …
>
> reviews of CEEs by external organisations may not be desirable.[42]

Unsurprisingly, consensus was not achieved on how (or even if) to allow the CEP to proceed because of the difficulties and sensitivities of creating a legally binding EIA veto. Discussion was concluded with the following statement '… *look forward to further discussions on the matter.*'[43] However, no further discussions have been recorded at subsequent ATCMs. This can partially be explained by the short extraordinary meeting held in Argentina the following year (2018) when Ecuador was unable to host, and in the Czech Republic in 2019, when the ATCM/CEP dealt with the backlog of work from the previous year. Rather, the matter of CEP policy considerations generally, including this particularly sensitive topic of veto, has been placed as an item on the ATCM Multi-year Strategic Work Plan.[44] This work plan has no definite timeframe attached to that task.

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39 For example, the conclusion of the Italian Antarctic Program's CEE was that 'The result of CEE suggests that the benefits that will be obtained from the permanent runway will grossly outweigh the "more than a minor or transitory" impacts of the runway on the environmental and on the ecosystem.' Government of Italy, Final Comprehensive Environmental Evaluation Proposed construction and operation of a gravel runway in the area of Mario Zucchelli Station, Terra Nova Bay, Victoria Land, Antarctica, Information Paper IP070 to ATCM XL, Beijing, China, 2017, https://ats.aq/devAS/Meetings/DocDatabase?lang=e, (accessed 26 March 2020) p 5.

40 United Kingdom, Australia, Belgium, New Zealand and Norway, 'Environmental Impact Assessments – Update on broader policy discussions', Working Paper WP 41 to ATCM XL, Beijing, China, 2017, https://ats.aq/devAS/Meetings/DocDatabase?lang=e, (accessed 26 March 2020).

41 Antarctic Treaty Secretariat, ATCM XL Final Report 2017, https://documents.ats.aq/ATCM40/fr/ATCM40_fr001_e.pdf (accessed 26 March 2020), para 52.

42 Ibid, para 54.

43 Ibid, para 55.

44 Antarctic Treaty Secretariat, ATCM XLI Final Report 2018, 'ATCM Multi-Year Strategic Work Plan', Decision 3 (2018) Annex, Item 8, https://documents.ats.aq/ATCM41/fr/ATCM41_fr001_e.pdf (accessed 26 March 2020).

VII. So What?

The funding bodies, governments and informed public will increasingly require Antarctic research to be useful to the decision-makers in Antarctic fora, as well as to the agencies back home. That is primarily because there is great competition for not only science funding, but other kinds of support that communities require from a federal budget in a competitive arena. The following short case studies illustrate typical examples of how utility can be introduced into hard sciences and value added by asking, so what?

A. Marine Telemetry

Marine telemetry is a rapidly developing technology that provides a range of data on species at sea: their movements, behavior, habitat use, prey consumption rates and ocean properties. It is extremely valuable as a research tool because it is able to collect data that cannot be obtained in any other way.[45]

An Australian conservation biology project initially used a mixture of acoustic and satellite (archival) tags to gather biological data on cryptic species such as Southern Elephant seals and Patagonian toothfish in the Southern Ocean. The researchers subsequently and coincidentally found that the baseline data they sought also had other very important uses including imaging water temperature profiles, light levels (that can indicate chlorophyll), the continental shelf profile and hotspots of foraging activity.[46] Through their scientific networks the researchers became aware of other projects that were using the same technology to conduct tracking research on other marine species at risk.

This new insight enabled the establishment of a network of linked projects that culminated in a paper published in *Nature* in 2020 that was authored by 81 scientists from around the world. In it they describe how their joint research/sharing of data has enabled them to identify so-called 'areas of ecological significance' in the Southern Ocean, which will be useful in Antarctic law making. Specifically, designating these special areas where a range of birds and mammals forage as no-go areas will help to mitigate against the pressures the Southern Ocean ecosystems are experiencing from resource exploitation, which is directly within CCAMLR's ambit, and climate change, which is not.[47]

The *Nature* paper is unashamedly conservation-centric, although the authors are from both conservation-oriented CCAMLR Parties such as Australia and the US, and fishing countries such as Norway and New Zealand.

This paper is a synthesis of projects conducted between 1991–2016 on 17 different marine species from across the Southern Ocean. The paper is based on the premise that 'using the at-sea distributions of an ecologically diverse suite of predators…can identify areas of ecological importance'.[48] The data from 2,823 tracks of individual foraging trips to 2.3 million locations

45 Julia Jabour, et al, 'Marine Telemetry and the Conservation and Management of Risk to Seal Species in Canada and Australia', *Ocean Development and International Law Special Edition* 47:3 (2016) 255–271 DOI 10.1080/00908320.2016.1194094.

46 Ibid.

47 Mark Hindell et al, Tracking of marine predators to protect Southern Ocean ecosystems, *Nature*, 18 March 2020, https://doi.org/10.1038/s41586-020-2126-y.

48 Hindell et al, note 44, Methods p1.

revealed the importance of habitat selection in the various life history stages of the species tracked. This ultimately resulted in the identification of high biodiversity and biomass hotspots, leading to the conclusion that these were areas of ecological significance that were crucial information for CCAMLR as it makes rules about harvesting and MPAs.

However, the scientists identified that 'authorities face the considerable challenge of implementing conservation goals within existing management frameworks' – the dichotomy alluded to earlier.[49] Nevertheless, their paper offered the comment that their results 'highlight where future science-informed policy efforts might best be directed, including both adaptive spatial protection and improved robust management of fisheries'.[50]

B. Autonomous Underwater Vehicles (AUVs), Drones and Satellites

New technology is being used by scientists to undertake a number of tasks that were also previously too difficult or too intrusive to carry out in and around Antarctica. These include mapping the extent, thickness and other characteristics of sea ice, population counts, footprint measurements and the like using unmanned aircraft (drones) and submarine craft (AUVs), and satellite remote sensing.

Polar regions are a strategic priority of the World Meteorological Organization (WMO) and its various task groups. They collect and disseminate data relevant for, *inter alia*, the CEP's Climate Change Response Work Programme and Subsidiary Group on Climate Change Response. The WMO also provides weather and climate information (including the state of sea ice and the ocean) on time scales from hours to decades to assist in situational awareness during maritime activities. Today, drones are also being flown from ice-bound ships to visualise free water leads and ridges, which is a navigation aid as required under the International Code for Ships Operating in polar Waters (Polar Code) and very much within the interest areas of COMNAP – the people who operate those ships.[51]

The ATCM showed its flexibility by handing over carriage of the development of the Polar Code to the International Maritime Organization after initially rejecting their expertise in favour of keeping custody of Antarctic affairs in-house.[52]

While there are some concerns about the impact of drone noise on animal colonies, low surveillance flights are employed in place of human presence to reduce the intrusive aspects of conservation biology tasks such as population counts. This works even better with remote sensing from satellites.[53]

The Integrated Marine Observing System collects observational data from a range of facilities including Argo floats, ships of opportunity, ocean gliders, AUVs and acoustic tags on animals. One project, for example, calibrates satellite altimeters that measure global mean sea level and

49 Ibid, Article p1.

50 Ibid, p5.

51 Guy Williams, 'Drones in science: Rising beyond pretty pictures', ABC News: Science, Australia, 18 August 2016.

52 Julia Jabour, 'Maritime security: Investing in safe shipping operations to help prevent marine pollution' In Hemmings AD, Rothwell DR and Scott KN (eds) Antarctic Security in the 21st Century: Legal and policy perspectives (Abingdon: Routledge, 2012) 238–256.

53 Mathew R Schwaller et al, 'A continent-wide search for Antarctic petrel breeding sites with satellite remote sensing', *Remote Sensing of Environment* 210, 1 June 2018, 444–451.

this supplies information that is used by the CEP to help inform decisions about vulnerable coastal Antarctic infrastructure.[54]

The extent of sea ice is relatively easy to measure but measuring thickness is still problematic. Now there has been some success using AUVs, measuring draft as the first part of calculation of thickness.[55] This also provides crucial information for biological scientists studying krill feeding on ice algae over winter because there is a strong causal relationship between sea ice and the mortality of juvenile krill. When CCAMLR is setting krill harvesting catch limits, this is vital information.[56]

Finally, drone photographs, combined with high-resolution continent-wide satellite data, have been used to map human footprint in Antarctica.[57] Mapping revealed that 10% of Antarctica's ice-free areas show signs of human disturbance, with a building footprint of 390,000 m^2 and a disturbance footprint of 5.2 million m^2. This is the first time such a comprehensive mapping project has been undertaken and researchers judge that their estimates are conservative. This project outcome has been described as 'the most comprehensive inventory of infrastructure across Antarctica to date, and could contribute to a baseline for the regular and effective monitoring of environmental impacts by Antarctic Treaty Parties'.[58]

The problem with uptake is that the ATCM and CCAMLR both operate on the consensus rule (the absence of formal objection) for decision-making. This means that despite the value of the scientific research in purely academic terms, taking up the research and making substantive decisions is not a simple task. Decisions also factor in political sensitivities that are often played down because the objective of these forums is to maintain harmony and to make decisions that meet the benchmark of the lowest common denominator. Were it otherwise, consensus would not be possible.

VIII. Conclusion

Antarctic scientific research is a legitimate peaceful activity prescribed throughout various articles in the Antarctic Treaty, its Madrid Protocol, and the CAMLR Convention. Scientific research provides credibility to a state's interest and presence in the region, and for some, acts as a hedge against exclusion from future resource development. Quality of scientific research was formerly not questioned – overtly, at least – but increasingly parties are being made aware of some shortcomings in relation to the kinds of scientific research undertaken. These parties will be held to account, especially in applications for Consultative Party status to the ATCM. New technologies are providing opportunities for cross-disciplinary appreciation and use of data once thought inaccessible. However, there are limited opportunities to feed scientific information into decision-making bodies in the Antarctic Treaty System, even though the rhetoric suggests that

54 IMOS, What is the Integrated Marine Observing System, http://imos.org.au/about/.

55 Hanumant Singh et al 'Inexpensive, small AUVs for studying ice-covered polar environments, *Science Robotics* 2, eaan4809 (2017).

56 CS Reiss et al, '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, (2017) https://doi.org/10.3354/meps12099.

57 Shaun Brooks et al, 'Our footprint on Antarctica competes with nature for rare ice-free land', *Nature Sustainability* Vol 2, March 2019, 185–190.

58 Government of Australia, 'Footprint in Antarctica' Information Paper IP41 to ATCMXLII, Prague, Czech Republic, 2019, https://ats.aq/devAS/Meetings/DocDatabase?lang=e (accessed 03 April 2020).

decisions will be evidence-based. Politicisation is an ever-present possibility. While some research results contribute positively to activities such as those under the ambit of COMNAP (e.g. maritime transport and safety), other results are applicable to more sensitive areas such as those under the ambit of the CEP, ATCM and CCAMLR, (e.g. environmental impact, marine protected areas). Understanding the scale and scope of the human footprint in Antarctica, or identifying areas of ecological significance, are all very well academically, but responding to those results in a substantive way is difficult under the consensus rule of decision-making.

Science is given priority but irrespective of their rhetoric, it cannot be assumed that the decision-makers always want to make decisions based on the best scientific evidence currently available to them. For example, the environmental impact of scientific programs, there projects (e.g. Lake Vostok drilling) and their support infrastructure (e.g. bases, airstrips, shipping operations) attract critical attention from some parties, but also from the academic and media commentariat and environmental NGOs. Strong conservation arguments often trump rational use arguments in CCAMLR. Awareness that some equipment (e.g. drones) can have dual civilian/military application, and concern that both are occurring in the Antarctic, also attracts attention. However, there is virtually nothing that a party cannot do in the Antarctic in the name of science, providing all legal obligations are complied with.[59] It is the party's own interpretation of those obligations that is the prevailing force. For example, there is no veto power over environmental evaluations that potentially, inappropriately balance the value of science against the risk to the environment.

It would be fair to conclude that the Antarctic decision-makers are more political than egalitarian by nature, especially those with claimed territory and the reserved claimants, and national agendas play a significant role in determining the uptake of some important but contentious scientific research results.

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59 Julia Jabour, 'What countries can and can't do in Antarctica in the name of science', *The Conversation*, 10 November 2018, https://theconversation.com/explainer-what-any-country-can-and-cant-do-in-antarctica-in-the-name-of-science-105858.