The need for increased protection of Antarctica’s inland waters

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**An Information Paper submitted by New Zealand, Spain and the United Kingdom**

Summary

In many parts of Antarctica inland waters are focal points of biodiversity, but they are poorly represented within the current system of Antarctic Specially Protected Areas (ASPAs). Only two ASPA Management Plans cite inland waters as primary values for protection. Protection of inland water and their related biodiversity would be enhanced through (i) increased efforts to document aquatic biodiversity and (ii) the implementation of a new approach for selection of representative lakes, and their catchments, for enhanced protection.

Background information

Inland aquatic ecosystems such as streams, ponds and lakes occur on ice-free land as well as on ice surfaces across Antarctica. They have been recorded as far south as ice-free ground occurs, including in the Pensacola Mountains at 83-84° S (Hodgson *et al.* 2010) and inland nunataks of the Transantarctic Mountains at 86.5° S (Broady and Weinstein, 1998).

The availability of liquid water is the single most important physical driver of Antarctic terrestrial biodiversity, particularly at higher continental latitudes (Convey *et al.* 2014). For this reason, inland aquatic habitats have been recognised since the earliest expeditions of Scott and Shackleton as centres for biodiversity and biological productivity (Murray, 1910). While a comprehensive understanding of the biogeography of Antarctic inland waters is currently lacking, it is clear that there is a high level of continental and regional endemism in the Antarctic freshwater biota (Gibson and Bayly 2007, Hodgson *et al.* 2013*,* Davies *et al*. 2017). The adequate protection of Antarctic inland waters is therefore critical for the preservation of environmental, scientific and intrinsic values, as set out in the Protocol.

The CEP has previously considered the penetration of sub-glacial lakes (ATCM XLI IP12; ATCM XXXIV WP16; ATCM XXXV WP34; ATCM XL WP17), the remediation of scientific sites subject to lake level rise (ATCM XXXVIII IP41) and the clean-up of pollution within lake catchment areas (ATCM XXXV BP12). Details of a classification system of Antarctic inland aquatic ecosystems was presented to the Committee in 2022 (ATCM XLIV IP77) and there have been recent proposals for three new ASPAs to protect inland waters (ATCM XLIV WP12; ATCM XLIV WP 15; ATCM XLV WP60), although these have yet to formally be agreed by the ATCM.

The protection of inland aquatic environments is of relevance to several CEP priority issues as set out in the CEP Five-Year Work Plan, including:

* Processing new and revised protected / managed area management plans (Priority 1);
* Climate change implications for the environment (Priority 1);
* Monitoring and state of the environment reporting’ (Priority 2);
* Overview of the protected areas system (Priority 2); and
* Biodiversity knowledge (Priority 2).

This paper provides information to facilitate a more strategic consideration by the Committee of the protection of aquatic environments and is largely based on a recent peer-reviewed paper: Hawes, I., Howard-Williams, C.,Gilbert, N.,Hughes, K.A., Convey, P. & Quesada, A. 2023*.* The need to protect Antarctica’s inland waters. *Antarctic Science.* doi:10.1017/S0954102022000463 (Available at: <https://www.cambridge.org/core/journals/antarctic-science/article/need-for-increased-protection-of-antarcticas-inland-waters/1B89EF1A158F623E6112A35EE609FCEF>).

Threats to inland water bodies

Human activities have resulted in significant impacts on Antarctic inland waters both directly, such as through activities from station operations, scientific activities, tourism, etc., and indirectly through anthropogenic climate change and long-distance atmospheric contamination. Impacts can include contamination of lake catchment areas leading to increased nutrient and suspended matter inflow from nearby roads and research stations, changes to drainage patterns caused by for example, road construction, pollution from rock dust, hydrocarbons, wastewater and station litter waste. The presence of non-native species in inland water ecosystems has received little attention, with few examples documented.

Status of protection for inland water bodies

The Management Plans for all 75 of the currently designated ASPAs were examined to determine whether each makes any acknowledgement of the presence of inland water bodies and their values. Currently only two of the 75 ASPAs have been designated explicitly to protect inland water systems (ASPA 119 Davis Valley and Forlidas Pond, Dufek Massif, and ASPA 126 Byers Peninsula, Livingston Island) (Table 1). Fourteen additional ASPAs make some reference to aquatic systems within their ‘*Description of values to be protected*’.

Table 1. Representation of inland waters within existing ASPA management plans

|  |  |  |
| --- | --- | --- |
| **ASPA management plan category** | **Number of ASPAs** | **% of all ASPAs** |
| Inland water bodies explicitly identified as the *primary value* to be protected | 2 | 2.67 |
| Inland water bodies are identified as *a* value for protection but not *the* *primary* selection criterion | 14 | 18.67 |

Protection of inland aquatic system values is most effective where entire catchments are set aside. Four ASPAs currently meet this need:

* ASPA 119Davis Valley and Forlidas Ponds, Dufek Massif, Pensacola Mountains;
* ASPA 123 Barwick and Balham Valleys, Southern Victoria Land;
* ASPA 126 Byers Peninsula, Livingston Island, South Shetland Islands; and
* ASPA 147 Ablation Valley and Ganymede Heights, Alexander Island.

These four locations are widespread across the continent, and potentially are the first steps in a systematic approach to protection of representative catchments.

A way forward

A systematic approach to enable appropriate protection of representative inland waters in Antarctica has been developed. Strategic protection of these scarce environments could be further enhanced through consideration of the following points:

1. In the absence of comprehensive, high quality, biodiversity and biogeography data, a conservative approach might be to use Antarctic Conservation Biogeographic Regions (ACBRs; Resolution 3 (2017)) to ensure representative coverage.
2. Very High Resolution (VHR) remote sensing products could be used to identify likely areas in poorly documented ACBRs for potential inclusion for inland water protection.
3. Goals could be set to protect representative classes of inland water bodies from each ACBR that (i) are pristine, or close to it, (ii) include the catchment, or at least the major inflows (iii) are sufficiently distant from stations and other facilities to avoid casual visitation. Sites should also include areas known to host rare aquatic organisms or those with limited distributions. Existing ASPAs should be reviewed to determine whether they contain representative inland water bodies.
4. Consideration could be given to the designation of new ASPAs that specifically meet requirements under the Protocol to protect 'representative examples of major terrestrial, including glacial and aquatic, ecosystems and marine ecosystems'. These could include areas where access is restricted for significant periods of time to act as strategic investments in habitat and biological diversity for future generations.
5. Designation of such representative inland water bodies and their catchments may be best accomplished by a collaborative approach such as multi-party ASPAs (Hughes & Grant 2017), which may also assist a move away from the reliance on small numbers of researchers to champion designation of new ASPAs. Both SCAR and the CEP can also propose such and may offer suitable mechanisms.
6. A set of steps modified from the framework developed by Margules & Pressey (2000) (Table 2), could be used to assist the development of an approach for protection of representative inland water bodies and their catchments.

**Table 2.** Six-step guide (partly after Margules & Pressey 2000) to developing a systematic prioritisation for ASPAs for application to inland waters in Antarctica under the framework for protected area designation in Annex V to the Protocol on Environmental Protection to the Antarctic Treaty. ACBR = Antarctic Conservation Biogeographic Regions

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| --- | --- | --- | --- |
| Step | **Task** | **Sub-tasks: Antarctic Inland waters:** | **Commentary and requirements for Antarctic Inland waters** |
| 1 | Compile data on inland water environmental and biological diversity | * Review existing data and identify datasets to serve as surrogates for the diversity of inland water ecosystems and their associated biodiversity. * Overlay any information about rare and/or threatened species | * Surrogates for representativeness are ACBRs and habitat class * Develop remote-sensing based approaches to classify and map inland water bodies in ice-free areas across the continent, including unrepresented ACBR * Incorporate known rare/threatened species distributions. |
| 2 | Define the requirements of the protected catchment areas | * Set quantitative targets and define criteria underpinning protected area selection. * Consider classification systems for prioritisation of inland aquatic environments for protection. Consider likely vulnerabilities. | * Most or all of the catchment, particularly the major water sources. * More than one inland water body class, representing those most common in that region. * Minimum prior disturbance, preferably distant from stations and facilities. |
| 3 | Review existing protected areas | * Measure how well quantitative targets and criteria are met by existing protected areas. Update existing management plans to explicitly recognise values linked with inland waters. * Identify threats to vulnerable ecosystems, habitats, communities and species in existing protected areas. * Review representativeness of inland water bodies in existing ASPAs | * Of 75 existing ASPAs, ASPAs 119 and 123 provide specific protection for representative inland waters and their catchments and meet the criteria in step 2. * Threats include physical disturbance, pollution and non-native taxa, human activities, anthropogenic climate change. * Assess whether water bodies included within ASPAs but not as a reason for its designation are truly representative. |
| 4 | Select additional areas to propose for protection | * Identify and prioritise new areas for protection from Steps 1 to 3, and facilitate stakeholder review | * Develop mechanisms for catchment-based ASPA selection that involve expert input under CEP and SCAR auspices. |
| 5 | Designation of new protected areas | * Develop ASPA plans for presentation to CEP and ATCM. * Loop back to step 3 to determine whether further areas are needed | * Led by Treaty Parties, the CEP has already developed a process to ensure the proposal is acceptable before a Party goes to the effort of developing a Management Plan for the protected area, but evidence shows long periods of little or no action within the CEP (CEP, 2000). * Case for SCAR intervention to facilitate Parties to propose ASPA designation. |
| 6 | Maintain required values: management and monitoring | * Evaluate performance of existing and new management plans and modify as required. * Loop back to step 3 if values are not being maintained. | * Variable quantity and quality across the 75 existing ASPAs. * The requirement for 5-yearly review of ASPA Management Plans and ongoing monitoring should be retained. |

***Supporting documentation***

ATCM XXXIV WP16. Draft Comprehensive Environmental Evaluation (CEE) for the Proposed Exploration of Subglacial Lake Ellsworth, Antarctica

ATCM XXXV WP34. Technology for investigating the water layer of subglacial Lake Vostok through the ice borehole 5G at the Russian Antarctic Vostok station

ATCM XXXV BP12. Clean-up of a fuel spill near Lake Dingle, Vestfold Hills

ATCM XXXVIII IP41. Remediation and closure of Dry Valley Drilling Project boreholes in response to rising lake levels

ATCM XL WP17. SCAR’s Code of Conduct for the Exploration and Research of Subglacial Aquatic Environments

ATCM XLI IP12. Preliminary Survey for the International Exploration Programme of Subglacial Lakes in Southern Vitoria Land, Antarctica

ATCM XLIV WP12. Prior assessment of a proposed Antarctic Specially Protected Area at Otto-von-Gruber-Gebirge (Dronning Maud Land, East Antarctica)

ATCM XLIV WP15.Proposal for a new Antarctic Specially Protected Area in parts of the Western Sør Rondane Mountains, Dronning Maud Land, East Antarctic

ATCM XLV WP60.Draft Antarctic Specially Protected Area Management Plan for Farrier Col, Horseshoe Island, Marguerite Bay

ATCM XLIV IP77. A classification system of Antarctic inland aquatic ecosystems

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