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OPINION

Is it a new day for freshwater biodiversity? Reflections on outcomes of the Kunming-Montreal Global Biodiversity Framework

Steven J. Cooke[1,2]*, Ian Harrison[3], Michele L. Thieme[4], Sean J. Landsman[1,2], Kim Birnie-Gauvin[5], Rajeev Raghavan[6], Irena F. Creed[7], Gary Pritchard[8], Anthony Ricciardi[9], Dalal E. L. Hanna[1]

1 Department of Biology, Carleton University, Carleton University, Ottawa, Ontario, Canada, **2** Institute of Environmental and Interdisciplinary Science, Carleton University, Ottawa, Ontario, Canada, **3** Conservation International, Arlington, Virginia, United States of America, **4** World Wildlife Fund, Washington, District of Columbia, United States of America, **5** Section for Freshwater Fisheries and Ecology, Technical University of Denmark, Silkeborg, Denmark, **6** Department of Fisheries Resource Management, Kerala University of Fisheries and Ocean Studies, Kochi, India, **7** Department of Physical and Environmental Sciences, University of Toronto, Toronto, Ontario, Canada, **8** 4 Directions Conservation Consulting Services, Curve Lake First Nation, Ontario, Canada, **9** Redpath Museum, McGill University, Montreal, Quebec, Canada

* steven.cooke@carleton.ca, StevenCooke@cunet.carleton.ca

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The 2022 United Nations (UN) Biodiversity Conference of the Parties (COP) to the UN Convention on Biological Diversity (CBD) recognized for the first-time 'inland waters' as a distinct realm in terms of setting targets and a process for monitoring and conserving them and their biodiversity. It is common for environmentalists and environmental scholars to bemoan things that they care about, but that have been forgotten, ignored, or excluded when it comes to environmental decisions, or the development of environmental policy. Often those concerns focus on a specific taxonomic group or species, a specific locality, a particular environmental decision, or a particular regional or national policy. However, rarely do they focus on an entire realm that occurs around the globe. By 'realm' we are referring to terrestrial, freshwater, and marine ecosystems. Equally important, some of the key messages of the Kunming-Montreal GBF were picked up at the UN Water Conference in March 2023, the first of such meetings in almost 50 years, which commits to a global water action agenda to restore and protect freshwater ecosystems as a component of sustainable development. Here, we draw attention to the CBD included language that recognizes inland waters on their own merits (i.e., as a distinct realm) within the Kunming-Montreal Global Biodiversity Framework (GBF) [1] that was submitted by the President of CBD COP 15, held in Montreal, on December 18, 2022.

Previously, freshwater ecosystems were inherently–and in our opinion, mistakenly–considered part of the terrestrial realm. Concerns existed about the lack of attention to inland waters in the 2011–2020 Aichi Targets [2]. These concerns were redressed in the Kunming-Montreal GBF by recognizing the need to move beyond reference to simply 'land and sea,' and to place more specific focus on inland waters and their biodiversity. In particular, inland waters are now explicitly recognized for focused attention in two targets of the Kunming-Montreal GBF text submitted from the CBD President (i.e., Target 2 and Target 3).

> ***Target 2:*** *Ensure that by 2030 at least 30 percent of areas of degraded terrestrial, inland water, and coastal and marine ecosystems are under effective restoration, in order to enhance biodiversity and ecosystem functions and services, ecological integrity and connectivity.*

> ***Target 3*:** *Ensure and enable that by 2030 at least 30 percent of terrestrial, inland water, and of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem functions and services, are effectively conserved and managed. . .).*

It is our perspective that this distinct recognition of inlands waters has the potential to benefit freshwater biodiversity. To some, distinct recognition of "inland waters" (which includes inland freshwaters and saline waters) is semantic, given that inland waters are interconnected with terrestrial landscapes. However, evidence shows that terrestrial-focused conservation efforts fall short of meeting the needs of freshwater ecosystems [3], and freshwater-focused conservation efforts likely fall short for terrestrial ecosystems. Freshwater biodiversity is under immense pressure because of both persistent and emerging threats [4,5]. These threats have manifested in dramatic declines in freshwater biodiversity as documented by the World Wildlife Fund (WWF) Living Planet Index [6] and extinction rates that are orders of magnitude higher than background levels [7,8]. Threatened taxa, as currently assessed by the International Union for the Conservation of Nature (IUCN), include: 36% of freshwater mammals; 30% of freshwater species of amphibians, crayfishes, and molluscs; 25% of freshwater species of reptiles; and 21% of freshwater species of fishes [9]. Notably, declines in freshwater biodiversity eclipse those observed in terrestrial or marine ecosystems and are driving the overall state of decline in biodiversity measures [6]. To call this a crisis is not hyperbole given that the compelling evidence that freshwater biodiversity is in a dire state [10,11]. Freshwater biodiversity declines are a clear sign that there is need for action that is specific to protecting and restoring freshwater ecosystems [12].

When freshwater systems are omitted from global policy agreements and instruments, the signal to civic society is that they are sufficiently protected via actions targeting lands and seas or, even worse, that they are unimportant [13]. Neither of those unfounded conclusions will lead to the support needed to address the freshwater biodiversity crisis, and, ultimately, the biodiversity crisis overall. There is need for coordinated and sustained effort from diverse actors to ensure that freshwater biodiversity is adequately valued, protected, and restored. This need has been raised for many years [14].

The Kunming-Montreal GBF is an acknowledgment that freshwater systems are worthy of our collective attention. This GBF targets set for both restoration (Target 2) and protection (Target 3; see above) are bold, which we applaud, but there will undoubtedly be challenges with their implementation that must be overcome.

For Target 2, freshwater restoration efforts are often not underpinned with a strong evidence base and, in general, freshwater systems have been omitted from the current UN Decade for Ecosystem Restoration further emphasizing that freshwater systems are often forgotten [15]. Restoring the structure and function of freshwater systems is challenging but achievable [16,17]. Significant resources need to be allocated to make meaningful progress on Target 2 for inland waters, and these resources must not be wasted–or worse, counter-productive [18]. Restoring terrestrial systems adjacent to or upland of freshwater systems can undoubtedly have positive effects on freshwater systems [19], but given their specific needs and the diversity of threats facing freshwater systems (e.g., invasive species, pollution, fragmentation, climate change), there is need for targeted restoration efforts focused on imperiled populations and, most importantly, essential habitats and the requisite quality of and connectivity between those habitats [20–22].

For Target 3, we have typically assumed that by conserving and protecting terrestrial systems we protect the wetlands, streams, rivers, and lakes that are intertwined with them. We acknowledge the importance of thinking about the interconnectedness of systems [23,24], but we also acknowledge the need for systemic prioritization of freshwater habitats and species in

need of conservation or protection [25]. Terrestrial system protections tend not to be done from the perspective of riparian or catchment-scale protections [26], so although there may be large proportions of a given catchment that are protected from development, that is no guarantee that those protections will protect critical habitats, populations, or entire freshwater systems [27]. Water moves in complex ways which means that we need to think about freshwater biodiversity and its conservation in a hierarchical and interconnected manner [28]–from upstream to downstream [29], uplands to the valleys [30], the groundwater to the surface [31], and across the land-inland water ecotone [32].

Other targets in the Kunming-Montreal GBF aimed at managing threats across realms could benefit freshwater biodiversity [33]. For example, Target 4 is focused on reducing extinction risk for all species, with freshwater species facing some of the highest risks. Targets 5 and 10 are focused on addressing sustainable fisheries and aquaculture that are relevant to inland fisheries [34]. Target 6 calls for rates of species invasion to be reduced by at least 50% by 2030. Freshwater ecosystems in general are acutely sensitive to the impacts of invasive species [e.g., 35–37]; therefore, any substantive reduction in invasion rates can lower the risk of ecosystem disruption and the loss of native species from local to global scales [36]. Similarly, Targets 7 (reducing pollution from excess nutrients, pesticides and plastics) and 8 (reducing impacts of climate change on biodiversity and increasing resilience) are highly relevant to freshwater systems.

The current alignment of several global actions, including the Kunming-Montreal GBF, the Sharm el-Sheikh Implementation Plan (https://unfccc.int/documents/624444) of the UN Framework Convention for Climate Change (UNFCCC) that recognizes the importance of protecting, conserving and restoring water and water-related ecosystems, and the UN Water Conference Water Action Agenda (https://sdgs.un.org/conferences/water2023/action-agenda) and more specifically the Water Conference Freshwater Challenge (see https://www.unep.org/news-and-stories/press-release/largest-river-and-wetland-restoration-initiative-history-launched-un) that is a country-driven initiative aimed at leveraging the support needed to bring 300,000 km of rivers and 350 million hectares of inland waters under restoration by 2030, provide an unprecedented global platform that we have been looking for, for too long. We need to take the message of the role of freshwater ecosystems in sustainable development and climate mitigation and adaptation to the global community of decision makers, developers, and investors [38]. It is crucial that we identify every opportunity to pick on these points now, to ensure their implementation.

Indeed, it is the implementation, with actions on-the-ground, that make the global commitments real [38,39]. To that end, we are excited at the prospects of those words leading to meaningful action that result in wins for freshwater biodiversity and the peoples that depend on freshwater systems for culture, nutrition, livelihoods, and well-being [40]. The actions will require the efforts of many–including local stewardship groups, Indigenous communities and governments, the public and private sector, scientists and conservation professionals, and individuals [39]. Restoring and protecting freshwater systems must be done at a scale that is attuned to the context specific to any watershed [41]. Work is needed to create pathways for the collective to engage and help achieve the ambitious goals set out in current global commitments, especially the Kunming-Montreal GBF.

We need freshwater scientists and practitioners to continue to provide their knowledge of what, where and when to protect and restore, and their links with local networks which can promote the required communication, outreach, education, and action [42]. We need to fully embrace and appreciate Indigenous knowledge systems and ensure that they inform actions to restore and protect freshwater systems. Water is the cultural fabric for many Indigenous communities [e.g., 43, 44]. Although such knowledge systems were celebrated in Montreal, there

was little evidence that they were considered equal to Western scientific knowledge. Inclusion of Indigenous voices in decision making processes is important for many reasons. It is a legal imperative via the UN Declaration for the Rights of Indigenous Peoples [45] but it is also an ethical imperative given the reality that current approaches to freshwater biodiversity conservation are failing whereas there are a growing number of examples where Indigenous-led freshwater conservation initiatives are succeeding [43,46]. We need leaders from the public and private sectors and philanthropic organizations to allocate the resources needed to act at scale. We need to develop targeted communication materials and campaigns about freshwater systems that reach diverse publics in the same way that has occurred for some time in terrestrial and marine realms [see 42].

The freshwater biodiversity crisis has been dubbed an "invisible tragedy" [4], in part because public discourse on this issue is largely absent. The formal recognition of freshwater systems as worthy of protection and conservation in the Kunming-Montreal AGBF represents an opportunity to change the public discourse moving forward. We welcome a new day for freshwater biodiversity and call on our colleagues and allies around the globe to help bend the curve for freshwater biodiversity. Tickner et al. (2020;[12]) published an emergency recovery plan that details what is needed to halt and reverse biodiversity loss in freshwater systems while underscoring the need for broader public education, engagement and support. The Kunming-Montral GBF should help to further the emergency recovery plan while also brining new ideas, energy, resources and political will to the endeavour. We welcome help from anyone and everyone able to join us in this important, if not essential, journey that is not only timely but urgent [10,11,13]. Only time will tell if this is a new day, or more of the same with freshwater biodiversity forgotten.

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Author Contributions

Conceptualization: Steven J. Cooke, Ian Harrison, Michele L. Thieme, Sean J. Landsman, Kim Birnie-Gauvin, Rajeev Raghavan, Irena F. Creed, Gary Pritchard, Anthony Ricciardi, Dalal E. L. Hanna.

Project administration: Steven J. Cooke.

Writing – original draft: Steven J. Cooke, Ian Harrison, Michele L. Thieme, Sean J. Landsman, Kim Birnie-Gauvin, Rajeev Raghavan, Irena F. Creed, Gary Pritchard, Anthony Ricciardi, Dalal E. L. Hanna.

Writing – review & editing: Steven J. Cooke, Ian Harrison, Michele L. Thieme, Sean J. Landsman, Kim Birnie-Gauvin, Rajeev Raghavan, Irena F. Creed, Gary Pritchard, Anthony Ricciardi, Dalal E. L. Hanna.

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