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Making global targets local for freshwater protection

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Freshwaters require targeted policy considerations to achieve biodiversity conservation goals and to support ecosystem services that communities around the globe depend upon. Effective conservation requires creative solutions that build and expand upon conventional protected areas, contextualized for these diverse ecosystems.

Global recognition of the need for protection targeting inland waters has lagged behind protections for marine and terrestrial ecosystems, likely contributing to the greatest biodiversity losses occurring among freshwater species[1]. In December 2022, at the Convention on Biological Diversity's 15th Conference of the Parties, inland waters were specifically included for area-based protection in Target 3 of the Kunming-Montreal Global Biodiversity Framework (GBF), calling for "at least 30 per cent of terrestrial, inland water, and of coastal and marine areas" to be protected by 2030 (commonly referred to as '30x30')[2]. The inclusion of inland waters (defined as fresh, inland brackish and saline systems) in Target 3, and the discussions that led to this outcome, have put more emphasis on the need to protect inland waters in their own right. This heightened attention opens the door to new national-level action, such as explicit and intentional incorporation of inland waters in National Biodiversity Strategy and Action Plans, the main implementation mechanism of the GBF. Nevertheless, how global inland waters protection initiatives are tracked or implemented locally remains unclear.

Despite the fact that simple overlays of protected areas and ecosystem maps have suggested near achievement of the 2020 17% Aichi protection target for rivers[3] and other freshwater types at a global scale, there is broad consensus that the world's freshwaters remain poorly protected from the range of threats affecting them, especially in some regions, and that better ways of defining and measuring freshwater protections are needed[4]. Freshwater ecosystems reflect connections not just within the networked channels through which water flows, but also with the atmosphere, lateral lands and the subsurface, thereby coupling terrestrial and aquatic environments. Furthermore, watersheds drain terrestrial pollution, transporting and accumulating sediments, nutrients and other toxins into freshwaters, thus increasing the exposure of aquatic biota and compromising ecosystem function[5]. The critical importance of natural hydropatterns and connectivity for ecosystem integrity and resilience makes defining, designing and implementing freshwater protections especially challenging. What, then, does protection of freshwater ecosystems and biodiversity entail in practice, and how can we offer practical guidance to inform implementation of global policy?

Effective protections will incorporate freshwater ecosystem dynamics and will likely look different from conventional protected areas[4]. Mosaics of aquatic, riparian and upslope (watershed) conservation interventions will be necessary[6]. Consequently, a static area-based (or percentage) target may be an incomplete way to measure progress towards the protection of these dynamic systems. At the same time, even imperfect targets can help to establish accountability for increased, dedicated investment in the conservation of rivers, lakes and wetlands.

Protection for and against what

The GBF 30x30 target highlights the need to conserve and manage 'areas of particular importance for biodiversity and ecosystem functions and services', suggesting that ecosystems could be protected for their biodiversity, services or both[2]. Freshwater ecosystems

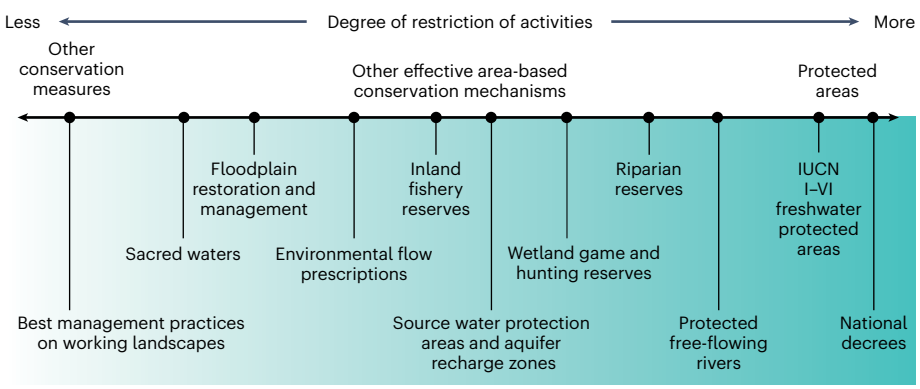

Fig. 1 | Freshwater protections fall along a spectrum of management intensity and restriction. A diverse array of policy mechanisms is available to expand and define protections of places identified as important in the local or global conservation of biodiversity.

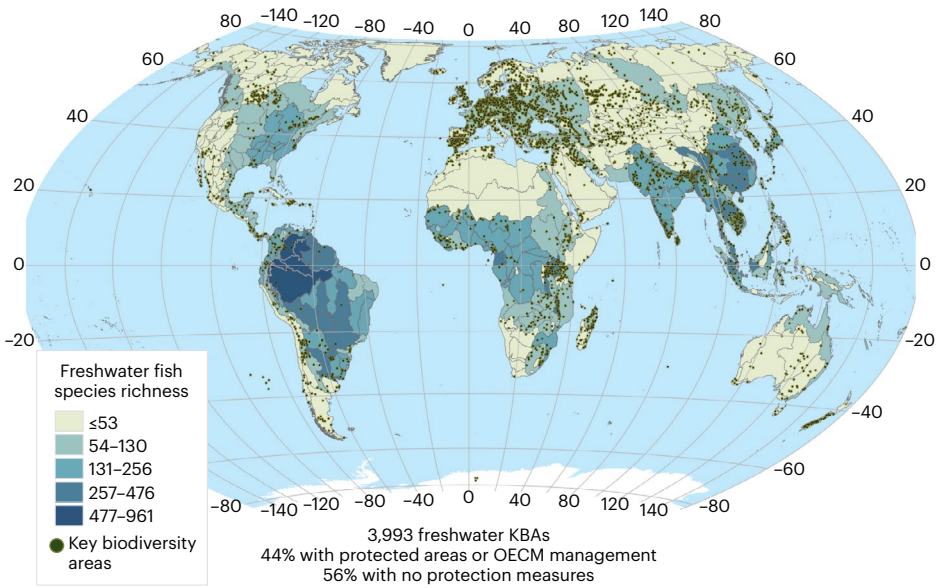

Fig. 2 | Global patterns of fish species richness are mapped with key biodiversity areas (that include freshwater). In current global databases, more than half of the tracked key biodiversity areas that include freshwater do not have documented protections or management plans in place (which suggests the need for more accurate reporting). Furthermore, currently identified areas of key biodiversity were often identified locally and may not be concentrated where the highest global freshwater biodiversity (here represented by fish) occurs. Global fish species richness source: Freshwater Ecoregions of the World. Key biodiversity areas source: BirdLife International World Database of Key Biodiversity Areas 2022 version. Publ. note: Springer Nature is neutral about jurisdictional claims in maps.

support a disproportionately large number of the world's species[5], and at the same time freshwaters and their watersheds provide critical ecosystem services[7]. However, protecting ecosystem services is not always aligned with protecting biodiversity, and protections designed principally for one value may differ from those designed for another. For instance, a free-flowing river might be protected from future dams for the purpose of protecting biodiversity, but the service of water provision could require new reservoirs. Or, fish reserves may be present in a river to protect specific habitats and associated life stages, but high harvest rates outside the reserve could reduce fish populations. Ultimately, clarity about the intended goal of protection measures is critical both to area design and to evaluations of effectiveness.

Many, if not most, protected or conserved areas of freshwater will have multiple objectives and will accommodate multiple uses. Water is fundamental to life, and human civilizations have been located along and beside freshwaters for millennia. Even if certain uses are restricted, many designated protected areas and most other effective area-based conservation mechanisms (OECMs) will allow for multiple uses of water resources and aquatic species. Indigenous peoples and local communities must be given voice in discussions about place-based freshwater protections to build common and coordinated goals and objectives that provide adequate protection, while ensuring equitable outcomes that acknowledge and build on existing sustainable ecosystem stewardship[7]. Importantly, local, bottom-up creation of freshwater protections will need to be rooted in best available knowledge and balanced with basin-wide planning and implementation, lest the objectives of local protections be undermined by pressures and threats originating upstream, downstream or in the larger watershed[8].

Measuring freshwater protection

The conservation community has long acknowledged that the existence of a protected area does not necessarily equate with effective protection. Furthermore, most protected areas have not been designed expressly for freshwater conservation[5]. The construction of dams within protected areas, or the over-extraction of water from protected areas, are illustrations of this disconnect[9]. The effective conservation of freshwaters will often require careful management of the lands draining to them, even though managed watershed lands (for example, for timber harvest) would not normally be considered protected areas unless conservation were a primary management objective. The inclusion of OECMs expands the possibility of counting managed lands towards freshwater protection targets, but the question remains as to whether and when lands should be counted.

Resolution of this question may be aided by articulation of where place-based freshwater protections, broadly defined, sit along a spectrum from best management practices to more restrictive protected areas (Fig. 1). In effect, this spectrum would include the full range of International Union for Conservation of Nature (IUCN) protected-area management categories (I–VI) and extend further to encompass OECMs and a variety of management practices[5]. Measuring elements of freshwater protection conferred broadly by legislation will require other forms of accounting, and the importance of these mechanisms should not be overlooked[4]. Ultimately, measuring near-term progress towards a GBF protection target may require falling back on intersecting maps of freshwater ecosystems with protected areas and OECMs. However, the effectiveness of established place-based protected and conserved areas for freshwaters will likely depend on additional measures, creating a network of coordinated interventions that support eco-hydrogeomorphic processes necessary to maintain biodiversity and resilience.

Identifying where to protect

The conservation of "the composition, structure, function and evolutionary potential of biodiversity" is listed as one of the principal objectives of IUCN-classified protected areas[10]. In practice, however, this principle may not have been applied systematically, and the freshwater realm has certainly not been a key part of that process. For example, there are many existing key biodiversity areas (KBAs) that cover freshwater ecosystems (Fig. 2), but those KBAs may not have been identified because of the suite of freshwater species present (that is, fishes, mussels, crayfishes, reptiles, amphibians, insects and birds), but rather, for example, based on their importance for migratory birds. An ongoing process seeks to identify freshwater KBAs more specifically based on the diversity of freshwater-dependent species. A validation process would then check the proximity of potential new freshwater KBAs to existing protected areas and evaluate their potential for effective management for freshwater biodiversity[11]. Thus, management objectives of existing protected areas can expand and shift to include freshwater conservation needs, but filling gaps in freshwater protection may also require the design of interventions in new places. Prospects for creating new protected areas in many parts of the world may be limited, but the diverse menu of possible interventions (Fig. 1) means that they can be applied in places where conventional protected areas may be less viable.

Protected-area gap assessments may also highlight questions of scale. For instance, many more stream kilometres would be identified using a 1:24,000-scale map than a 1:500,000-scale map, identifying more extensive gaps using the former than the latter[12]. A country with only coarse-resolution maps of protected areas might choose to use lower-resolution maps of freshwater ecosystems, whereas another country might use higher-resolution spatial data. However, it will be important to distinguish between different types and sizes of freshwater ecosystems to ensure adequate representation. For instance, small headwater streams support markedly different aquatic communities to downstream rivers in the same basin.

Assessing protection effectiveness

As important as the initiative to protect 30% of freshwater ecosystems is, determining what types of protection are effective, and in what contexts, will be equally critical. Reviews of the effectiveness of protected areas in conserving freshwaters and their species have been largely inconclusive owing to lack of quality input data at the appropriate scale. Notably, Thieme et al. found that even when the resources and indicators for monitoring conservation outcomes are available, the staff managing protected areas are often too unfamiliar with freshwater ecosystems to effectively apply these tools[13]. Investments in staff training, better data collection (such as remotely sensed data), more comprehensive integration of information from different stakeholder groups (for example, local communities at the protection site) and development of outcome-based indicators for use by local, regional or national policymakers, are critical for channelling investments where they can be most effective.

The way forward

Justifications for enhanced area-based protection initiatives are linked to the ongoing biodiversity crisis; the need to bolster resilience to climate change; and the potential of improved livelihoods, food security and cultural sustenance. With strengthened governance and monitoring, area-based protections can contribute to the conservation of existing biodiversity and ecosystem health as well as deliver accompanying benefits to people.

The push for 30x30 is surfacing important dialogues about who controls biodiversity protection, where funding is directed and how the lines around area-based protections are drawn. Given the central role that freshwater ecosystems and services play in people's lives, efforts to meet freshwater protection targets may heighten concerns around equity, inclusion and authority. Freshwater protections can take many forms. Thus, inclusion of stakeholders in their design and implementation can temper concerns and generate solutions that aim to meet multiple objectives simultaneously.

Combining freshwater and terrestrial conservation objectives in integrated area-based protections may be a relatively simple way to begin to fill freshwater protection gaps and elevate freshwater conservation needs within governance structures. Modelling has demonstrated that considering aquatic and terrestrial needs together in designing protected areas can markedly enhance freshwater benefits without appreciably reducing terrestrial benefits[14]. Exercises of this kind require consideration of how freshwater and terrestrial conservation needs differ, making transparent the goals of local protection actions (for example, see ref. 15). As governments, agencies, non-profit organizations and citizens work together to halt the loss of freshwater biodiversity, exploring and assessing how global calls for protection apply in local settings is crucial to the success of freshwater protection initiatives[2].

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Competing interests

The authors declare no competing interests.

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