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PERSPECTIVE

The RACE for freshwater biodiversity: Essential actions to create the social context for meaningful conservation

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Abstract

Freshwater habitats are experiencing two to three times the rate of biodiversity loss of terrestrial and marine habitats. As *status quo* actions within the conservation community are not reversing the downward trajectory for freshwater biodiversity, we propose four actions to shift the narrative such that freshwater biodiversity is no longer invisible and overlooked, but rather explicitly recognized, valued, and protected: (1) *Reshape* our relationship with freshwater habitats and biodiversity, (2) *Appreciate* indigenous knowledge systems relating to freshwater habitats, (3) *Connect* science more directly to action, and (4) *Elevate* freshwater habitats as a unique "domain" that requires explicit recognition in conservation planning (RACE). We highlight roles that both freshwater scientists and the wider conservation community can play in implementing the four actions such that the "RACE" can be won.

KEYWORDS

conservation planning, environmental education, indigenous knowledge, policy, public outreach

1 | CONTEXT

> "The health of freshwater biodiversity has been particularly neglected because freshwater is widely understood and managed more as a physical resource vital to survival rather than as the special and delicate habitat that it provides for an extraordinary array of organisms." Lovejoy (2019)

1.1 | Fresh water is essential for both biodiversity and humans

Freshwater habitats cover less than 1% of the planet's surface, yet they are home to almost 30% of vertebrate species, including 51% of known fish species (Balian et al., 2007; Strayer & Dudgeon, 2010; WWF, 2020). Beyond the intrinsic environmental value of freshwater flora and fauna, freshwater habitats are essential for human life, livelihoods, cultures, and economies (Arthington et al., 2018; Harmsworth et al., 2016; Vörösmarty et al., 2010). When freshwater habitats deteriorate to an extent where they can no longer support healthy freshwater biodiversity, humans will be impacted (Albert et al., 2021). In fact, rivers and lakes, as well as inland and coastal wetlands provide significantly more ecosystem services than open oceans, woodlands, grasslands and temperate forests (Russi et al., 2013 and references therein). Loth (2004) demonstrated that the benefits of restoring freshwater habitats can be higher than the costs of losing them and the services they provide.

1.2 | The challenge

Optimizing freshwater ecosystem services is a challenge given diverse and often competing users. One consequence is the ongoing and rapid collapse of freshwater biodiversity (see reviews by Deinet et al., 2020; Dudgeon et al., 2006; He et al., 2019; Reid et al., 2019; Su et al., 2021). To maximize freshwater ecosystem functioning and provisioning of ecosystem services such that people benefit and water security is ensured, conservation of freshwater biodiversity is crucial (Tickner et al., 2020). It could be argued that freshwater biodiversity is among the biggest challenges for conservation at large, given the rapid and substantial declines in freshwater biodiversity and the increasing need for human water and food security (Lynch et al., 2017, 2020; Phang et al., 2019; WWF, 2020).

1.3 | Conservation is failing freshwater habitats

Experts recognize that the mainstream conservation community has largely failed to acknowledge and to explicitly address this challenge (i.e., inadequate conservation efforts) in the same way that it has embraced challenges facing habitats such as forests and oceans (Albert et al., 2021; Harrison et al., 2018). Meanwhile, freshwater biodiversity and the communities that depend on

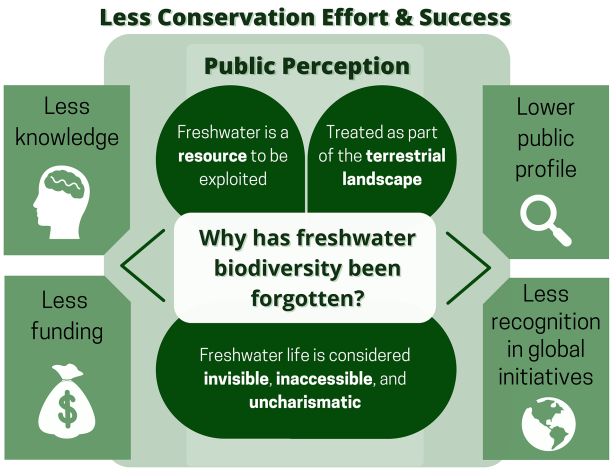


FIGURE 1 Conceptual framework describing the current perspective of freshwater biodiversity and the consequences it has on freshwater protection, ultimately leading to less conservation effort and success.

freshwater habitats continue to lose-lose in favor of short-term or narrowly focused development activities (such as those that rely on or result in poorly planned water infrastructure, excessive water abstraction and massive pollution loads) and environmental and social mitigation strategies (Dudgeon, 2019; Intralawan et al., 2018). There has never been more awareness of the pressing environmental crisis, but freshwater biodiversity continues to be overlooked and undervalued (WWF, 2021). Despite being biodiversity hotspots, fresh waters are an outlier compared to terrestrial and marine systems for their absence or relative lack of headline coverage within key global biodiversity conservation initiatives (see, e.g., the "First draft of the post-2020 global biodiversity framework, Document #5: CBD/WG2020/3/3").

1.4 | The task ahead

The purpose of this forum paper is to provide insights on: (i) how freshwater biodiversity been overlooked, (ii) the consequences and impacts of this neglect, and (iii) how to change perceptions about freshwater biodiversity to provide the social license for necessary political and institutional change towards conservation (Figure 1). At a time when a new global biodiversity conservation framework has just been agreed (Post-2020 Global Biodiversity Framework), and when experts affirm that freshwater biodiversity is in crisis (Harrison et al., 2019; Tickner et al., 2020), we consider why the issue remains at the periphery of these conversations and what can be done to change the status quo and reverse the loss of freshwater

BOX 1 The Emergency Recovery Plan highlights six priority actions to bend the curve for freshwater biodiversity (Tickner et al., 2020).

1. Accelerate implementation of environmental flows.
2. Improve water quality to sustain aquatic life.
3. Protect and restore critical habitats.
4. Manage exploitation of freshwater species and riverine aggregates.
5. Prevent and control non-native species invasions in freshwater habitats.
6. Safeguard and restore freshwater connectivity.

species. An Emergency Recovery Plan highlighting six priority actions (see Box 1) to bend the curve (sensu Mace et al., 2018) of freshwater biodiversity loss was recently developed, which can help guide conservation efforts and enhance conservation success. There are already examples where these priority actions have been implemented, and freshwater habitats improved (see Tickner et al., 2020). However, these recommendations are fundamentally about actions towards the conservation of freshwaters implemented at the management level. Giving effect to the Freshwater Emergency Recovery Plan requires a social license for managers to act (sensu Dare et al., 2014). Consequently, we focus on recommendations to change the *perception* of freshwater habitats in the public eye so that fresh waters are recognized and valued. Doing so is a prerequisite to generating greater political and institutional commitment to their restoration (Byerly et al., 2018; Reddy et al., 2017; Schultz, 2011).

2 | THE PERCEPTION OF FRESHWATER TODAY: HOW HAS FRESHWATER BIODIVERSITY BEEN OVERLOOKED?

2.1 | Fresh water is viewed as a resource to be exploited

The prevailing water management paradigm is centred on human benefit and economic gain (Pahl-Wostl et al., 2011). Freshwater habitats have often been managed to maximize benefits from a narrow range of provisioning services (e.g., water supply, energy generation, sand/aggregates, fish), or to dispose of, dilute, and convey waste products from urban, industrial, and agricultural activities (Carpenter et al., 2011; Dodds et al., 2013). As such, the aim has been to "control" natural processes through engineering (e.g., culverts, weirs, dams, levees, pipes) to accommodate our need for drinking water, food production, energy supply and protection of economic assets and human life (Grill et al., 2019; Hurford et al., 2020).

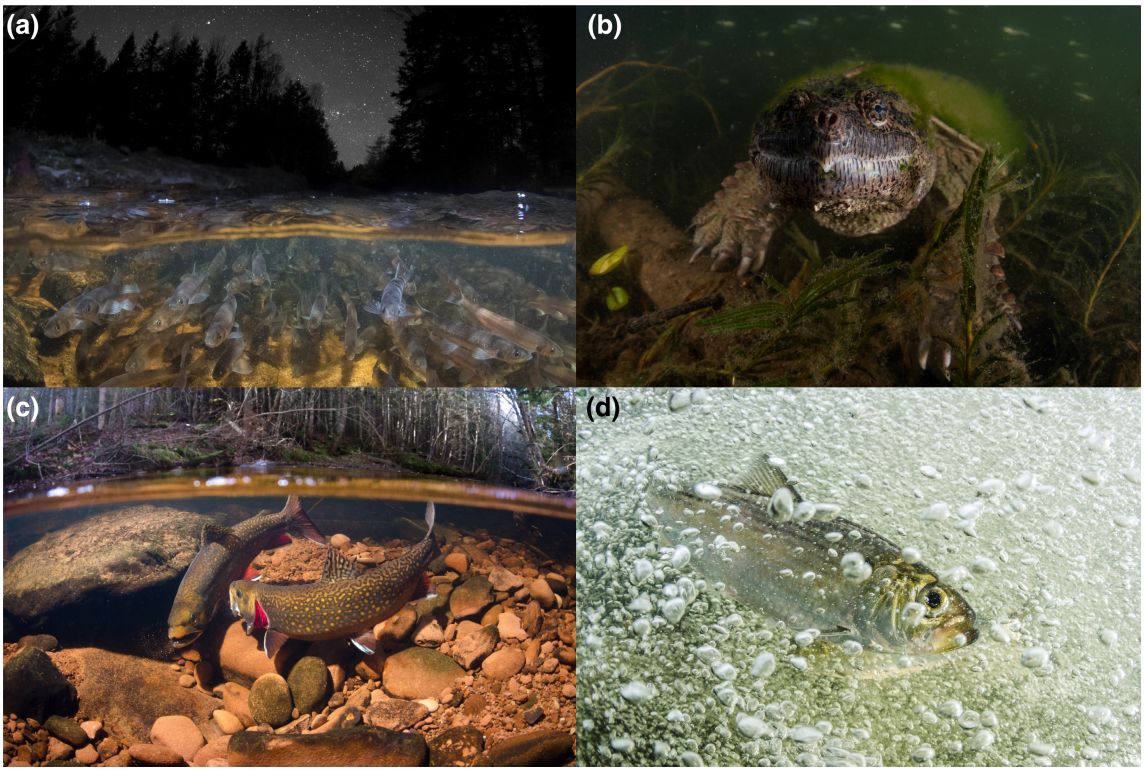
However, this approach neglects a wide range of important roles that freshwater habitats and species often play in our societies. For instance, inland fisheries are an essential food source for hundreds of millions of people worldwide (Lynch et al., 2016, in press; McIntyre et al., 2016; Youn et al., 2014), providing essential protein and nutrients. Recreational fisheries also support economic growth and individual well-being (Arlinghaus & Cooke, 2009). Indigenous identities and livelihoods are often intimately linked to these relationships with water and aquatic species (Anderson et al., 2013; Jackson, 2005; Langton, 2002). However, contemporary mainstream management of fresh waters has often benefited the more powerful or privileged at the expense of everyone else who depends on or lives interdependently with the system (e.g., Langstaff, 2010; Moggridge & Thompson, 2021; Taylor et al., 2020).

2.2 | Freshwater life is considered invisible, inaccessible and uncharismatic

Many people are not aware of the diversity of life in freshwater habitats, so much so that the freshwater biodiversity crisis has previously been referred to as a "quiet crisis" (Richter et al., 1997) and an "invisible tragedy" (Reid et al., 2019). What is beneath the surface of the water is invisible to most; in many instances, freshwater is turbid, and so the species and events under fresh water cannot be seen in the way that marine life can be showcased (Monroe et al., 2009). *So, is it a problem of out of sight, out of mind?*

Freshwater flora and fauna receive relatively little attention compared to their terrestrial and marine counterparts. For instance, He et al. (2021) found that across 18 conservation journals between 1997 and 2016, terrestrial animals were used as their cover images 74.4% of the time, while freshwater taxa were used only 10.6% of the time. Moreover, the 15 most featured species were all terrestrial or marine. The authors also found that cover-featured studies had higher citation rate and Altmetric scores, suggesting that those studies received more attention. Cover features may provide opportunities to better inform the broader public about the continued threats facing freshwater habitats (He et al., 2021). Many

BOX 2 Media in freshwater.



(a) Rainbow smelt (*Osmerus mordax*). (b) Snapping turtle (*Chelydra serpentina*). (c) Brook trout (*Salvelinus fontinalis*). (d) Alewife (*Alosa pseudoharengus*). Images by Sean J. Landsman (used with permission).

freshwater species could capture public attention, including freshwater species that live in the water (e.g., river dolphins, salmon, Glyphis sharks, rays, crocodiles, freshwater turtles) and those that live near and depend on freshwater habitats (e.g., beavers, otters, hippos, kingfishers, cranes).

Relative to terrestrial and ocean habitats, there seem (in our extensive collective experience) to be few filmmakers and photographers dedicated to producing such imagery (Box 2). There might be several reasons for this: the additional expense and knowledge involved in using equipment adapted to aquatic conditions might present barriers; the risks inherent in working on or in fresh water (particularly in rivers)—including risks linked to anthropogenic pollution—may be off-putting; and the fact that so many habitats are already degraded and depauperate of species might also discourage filmmakers and photographers who feel the pressure to produce attractive shots of charismatic wildlife. One consequence is that images of rivers, lakes, and wetlands used in the public domain have normally been taken from the air or the shore, while the astonishing—and often aesthetically appealing—array of flora and fauna that live within freshwater habitats remains largely unseen and unappreciated. Isolated exceptions—such as one episode of the Netflix "Our Planet" series that focused on freshwater wildlife, the "World's Forgotten Fish" report (WWF, 2021), or the work of the relatively few freshwater specialists that exist (e.g., freshwaters illustrated; freshwatersillustrated.org)—have demonstrated that this notion of freshwater habitats as difficult, empty, or home only to uncharismatic species is outdated and that freshwater biodiversity incorporates remarkably diverse flora and fauna, including charismatic animals with life histories that can readily engender public fascination. Despite this, messages to the public do not always demonstrate that losing freshwater biodiversity

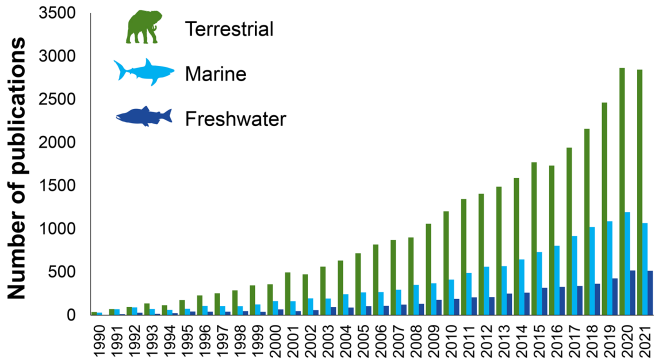


FIGURE 2 Number of peer-reviewed publications within the Biodiversity & Conservation category of the Web of Science Core Collection for freshwater, marine and terrestrial ecosystems. Search performed on January 23, 2022.

is about more than losing what is often perceived as unglamorous or uncharismatic.

2.3 | Freshwater biodiversity needs are perceived as being addressed by terrestrial conservation actions

Conservation initiatives have often portrayed freshwater habitats in the form of water resources for human use, or simply as a socially resonant output from forest conservation initiatives (Monroe et al., 2009). In fact, it is often argued that protection measures identified for terrestrial ecosystems are sufficient to address the needs for freshwater biodiversity, giving the perspective to the conservation community that if terrestrial landscapes are protected, then so are fresh waters (Darwall et al., 2011; Dinerstein et al., 2019). The argument that the needs of freshwater habitats are addressed by conserving forests is at the forefront of many conservation initiatives (e.g., see WWF, 2003) yet has been shown to be fundamentally incorrect (Abell et al., 2007). While management of freshwater habitats cannot be isolated from the terrestrial landscape (Hynes, 1975), the hegemony of terrestrial priorities in conservation planning fails to explicitly recognize the unique needs of freshwater species (Darwall et al., 2011; Hermoso et al., 2016; Reis et al., 2019; Wiens, 2002). Failure to recognize these distinctive needs has led to the ongoing underrepresentation of freshwater aquatic habitats in reserve networks and frequent failures to protect freshwater biodiversity (Acreman et al., 2019; Grantham et al., 2017; Leal et al., 2020). Recent evidence showed that prioritizations based solely on terrestrial needs yielded just 22% of the freshwater biodiversity benefits yielded by freshwater conservation actions (Leal et al., 2020).

The language and framing used by the global conservation community is also a compounding barrier. For example, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem (IPBES) has used the "land and seas" framing which omits freshwater habitats as separate entities, and instead implies that fresh waters are covered by land conservation (IPBES, 2019). Similarly, the UN Sustainable Development Goals (SDGs) include a "Life Below Water" goal (SDG 14) that omits fresh water entirely (Lynch et al., 2020). Instead, freshwater habitats merit only passing mentions under the "Life on Land" (SDG 15) and "Clean Water and Sanitation" (SDG6) goals with little in the way of targeted indicators (Dickens et al., 2020). This failure to recognize the distinctive biodiversity values of freshwater habitats and their unique needs, which are not addressed by terrestrial conservation measures, contributes to their further decline.

3 | ULTIMATELY, FRESHWATER BIODIVERSITY RECEIVES LESS CONSERVATION EFFORT THAN MARINE AND TERRESTRIAL BIODIVERSITY

3.1 | Lower public profile of freshwater biodiversity

Experts contend that fresh waters are underrepresented in conservation initiatives because freshwater habitats and biodiversity are overlooked entirely, viewed as a resource to be exploited, or simply seen as a component of the terrestrial landscape (Figure 1; Cooke et al., 2016; WWF, 2021). Freshwater biodiversity is rarely in the public spotlight despite the fact that more than 30% of vertebrates depend on freshwater. "Planet Earth" (BBC) offers one episode on freshwater out of a combined 17 episodes. This is a substantial missed opportunity as Fernández-Bellon and Kane (2020) found that despite lacking explicit conservation themes, Planet Earth 2 generated species awareness and stimulated engagement comparable to those achieved by specific conservation campaigns. Furthermore, even where there is good intent with respect to raising awareness, shows focused on freshwater tend to be "fishing" shows (e.g., "River Monsters" [Discovery Channel]) rather than "natural history" or 'conservation' shows (e.g., "Monster Fish" [National Geographic]), thus narrowing the audience and potentially diminishing the conservation message. While it is difficult to provide a specific number for what satisfactory attention for fresh waters could be, it seems appropriate that the attention to the different ecosystems could be

somewhat proportional to their biodiversity or the services they provide, which is clearly not the case.

3.2 | Less funding for freshwater biodiversity

Recent analysis from the European Foundation Centre indicates that freshwater research receives 3.2% of the environmental funding from European foundations (Cracknell et al., 2016). The trend is similar elsewhere; 8% of environmental funding was granted to fresh water by North American Foundations with the majority (>80%) of that funding being focused on initiatives in North America (Synchronicity Earth Freshwater, 2018). We recognize that funding for research is rarely plentiful and that many aspects of conservation are under-funded. However, given the importance of fresh water on our planet and the need to keep freshwater systems healthy and functioning, we submit that there are serious deficiencies in funding that impede science-based management and conservation of freshwater biodiversity and ecosystems.

3.3 | Less research on freshwater biodiversity

Within conservation literature, there is a persistent bias towards terrestrial ecosystems and organisms (Darwall et al., 2011), with less than 20% of publications being concerned with aquatic species (Di Marco et al., 2017). A review of the Web of Science Core Collection (January 23, 2022), within the biodiversity and conservation category returned 5217 total publications for "freshwater* OR inland*" published between 1990 and 2021. This is less than half of the publications returned for "marine* OR ocean*" (12,853 hits) and just over a sixth of publications returned for "terrestrial* OR land*" (31,446 hits) (Figure 2). Though this comparison is not a rigorous scientific inquiry and the numbers cannot be overinterpreted, it highlights the disparity in the literature, and is supported by previous findings by Di Marco et al. (2017).

3.4 | Less recognition in global initiatives

There are many missed opportunities to raise awareness on the biodiversity crisis that freshwaters are facing, particularly by promoting existing concepts (Lynch et al., 2017). This is highly problematic given that according to the 2022 Living Planet Index, current overall

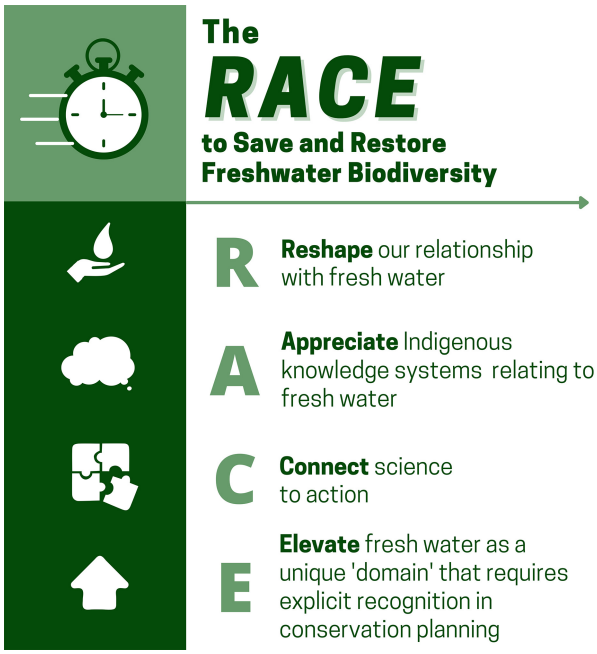


FIGURE 3 The RACE to save and restore freshwater biodiversity.

biodiversity declines are being disproportionately driven by losses in freshwater ecosystems (relative to terrestrial and marine systems; https://www.worldwildlife.org/pages/living-planet-report-2022). The neglect of freshwater biodiversity and ecosystems has been to their detriment (Albert et al., 2021). Again, even within the SDGs, fresh water is either considered as part of the terrestrial landscape (Goal 15 Life on Land) or viewed from the perspective of water services (Goal 6 Clean Water and Sanitation). It is not mentioned once in Goal 14 (Life Below Water) which is instead designed to "conserve and sustainably use the oceans, seas and marine resources." Despite a clear mandate to integrate social, economic, and environmental objectives in the SDGs, freshwater ecosystem health remains underrepresented (Lynch et al., 2020).

4 | MOVING FORWARD: CHANGING THE PERCEPTION OF FRESHWATER BIODIVERSITY FOR TOMORROW

There is an urgent need for conservation practitioners to address freshwater biodiversity before more habitats and species are irreversibly lost (Arthington, 2021; Bunn, 2016; Cooke & Birnie-Gauvin, 2022; Harper et al., 2021). For that reason, we use the analogy of running a race, to frame four actions that we believe are needed now to change the current perceptions of

TABLE 1 Examples of success stories, along with specific actions for freshwater specialists and the broader conservation movement in the "RACE" (Reshape, Appreciate, Connect and Elevate) to save freshwater biodiversity.

	Example of success	Freshwater conservation researchers and practitioners	Wider conservation movement
Reshape	Following the release of the Forgotten Fishes Report (WWF, 2021), 400 popular press articles in more than 45 countries with a reach of more than 2 billion people were published. The #ForgottenFishes hashtag reached over 6 million people, with public figures like Leonardo Di Caprio even tweeting about it.	Distil state-of-the-art science and lessons from practice into communicable formats that resonate with, and respond to the priorities of, key audiences including water managers, the wider conservation community, and policy makers in governments. Engage community members in community science initiatives related to freshwater conservation such as the white sucker monitoring led by the Shedd Aquarium (see https://news.wttw.com/2018/05/04/shedd-scientists-volunteers-track-migrations-great-lakes-fish, Murchie et al., 2018).	Include explicit freshwater biodiversity content among communication and engagement priorities. Organize outreach events (e.g., World Fish Migration Day, www.worldfishmigrationday.com) that engage and educate community members (Twardek et al., 2020). Use brilliant imagery and compelling stories to teach and connect people to fresh waters; ultimately, this relies on social media circles using and sharing these stories, including front page covers (Legagneux et al., 2018, van Rees et al., 2020).
Appreciate	Indigenous-managed areas in Australia, Brazil, and Canada are equally or more biodiverse than other protected areas set aside by federal and other governments (Schuster et al., 2019). The role of Indigenous knowledge systems in these conservation outcomes is increasingly appreciated, and we are witnessing the creation of new Indigenous protected areas (e.g., Thaidene Nëné, "Land of the Ancestors" in Canada's Northwest Territories) where Indigenous rights to manage lands and waters are enshrined in their management plans and recognized as essential to meeting local and global conservation goals (Garnett et al., 2018).	Treat Indigenous knowledge systems as legitimate sources of freshwater knowledge and management insight. Respectfully work with Indigenous partners to co-produce (sensu Cooke, Nguyen, et al., 2021) research strategies that address conservation priorities as well as concerns of communities, with benefits of research or conservation practices shared equitably with Indigenous partners. Embrace and nurture relationships with local knowledge holders.	Collaborate with Indigenous Peoples and actively welcome Indigenous ways of knowing about freshwater habitats and biodiversity to be equitably included in freshwater conservation decision making and action planning. Make way for Indigenous leadership (Latulippe & Klenk, 2020).
Connect	The Emergency Recovery Plan for freshwater biodiversity, based on inputs from the freshwater science community, has been influential in shaping inputs from UN Water and the Convention on Biological Diversity (through the Global Biodiversity Outlook report 2020) into the post-2020 global biodiversity framework.	Make science readily available for decision-makers keeping in mind that robust syntheses and meta-analyses that reduce bias often bear more weight in this process (Walsh et al., 2015). Devote greater time and energy to engaging beyond the freshwater biodiversity specialist community such as through active engagement in influential water management and environmental conservation forums whose purpose is to translate science into policy-friendly information [e.g., Intergovernmental	Collaborate with natural resource managers, policy makers, and the public to frame the science of freshwater conservation in a way that is compelling and solutions-focused (Twardek et al., 2021).

(Continues)

TABLE 1 (Continued)

	Example of success	Freshwater conservation researchers and practitioners	Wider conservation movement
		Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES, 2019), or World Water Week (www.worldwaterweek.org)].	
Elevate	New standards for fish passage were elevated into national policy in New Zealand following the promotion and endorsement of new evidence-based fish passage guidelines (Franklin et al., 2018) and a fish passage assessment tool by the New Zealand Fish Passage Advisory Group. This recognizes the crucial role that connectivity plays in sustaining freshwater fish communities.	Critique terrestrial conservation science to improve the way it takes account of unique properties of freshwater systems (publishing such critiques in non-freshwater journals as much as possible). Ensure water management and environmental conservation policy makers and practitioners are provided with pithy evidence syntheses focused on freshwater biodiversity to guide their activities (Cooke et al., 2017).	Acknowledge fresh waters as a discrete environment, with distinct needs from that of forests (i.e., do not group freshwater ecosystems with terrestrial ecosystems; Leal et al., 2020). Actively pursue more integrated approaches to conservation science and strategy in partnership with freshwater researchers and practitioners, to remedy the gaps in knowledge of terrestrial-freshwater interface (e.g., Leal et al., 2020). Align funding mechanisms to incorporate greater support for research that directly contributes to bending the curve for freshwater biodiversity (Harper et al., 2021).

freshwater biodiversity and set the societal context for implementing the actions to restore freshwater biodiversity laid out in the Freshwater Emergency Recovery Plan (Tickner et al., 2020). The RACE framework was developed through deliberate discourse informed by the authors' collective experiences and the available literature on critical steps towards meaningful actions. We relied heavily upon reflection on Tickner et al. (2020) in an effort to identify what was missing from that Emergency Recovery Plan to create the enabling conditions for change. In that sense, the RACE framework is a direct complement and extension of Tickner et al. (2020). We acknowledge that most races are not run alone and our RACE initiative requires more than freshwater conservation practitioners—it also requires the support of a wide range of agencies, public and private investors, communities, as well as dedicated and consistent political will (e.g., Twardek et al., 2021). We also recognize that, in isolation, changing the social context is insufficient for effectively reversing the declines in freshwater biodiversity. However, the evidence increasingly suggests that influencing human perceptions, values, and behaviors is an important pre-condition for advancing conservation actions (e.g., Byerly et al., 2018; Maynard et al., 2020; Wee et al., 2021), providing the impetus for and acceptance of the broader suite of actions required to elicit biodiversity recovery (e.g., Arthington, 2021; Tickner et al., 2020; van Rees et al., 2020). Here, we outline what these diverse groups can do to run a good race together in a way that leads to a win for freshwater biodiversity, and a win for humanity (Figure 3, Table 1).

4.1 | RESHAPE our relationship with fresh water

To date, efforts to promote freshwater biodiversity to the general public have been largely insufficient to galvanize positive actions (Cooke et al., 2016). Society's relationship with fresh water is embedded in a "control and exploit" paradigm where water is viewed primarily as a resource to be utilized and managed for human benefit (Barlow, 2001; Gebel, 2010). There is a need to *reshape* this relationship by shifting the narrative to demonstrate the value of freshwater biodiversity and emphasize the important roles freshwater ecosystems play beyond providing potable water, food, or energy (Lynch et al., 2021; Monroe et al., 2009; Postel & Carpenter, 1997).

Increasing public awareness and understanding of freshwater biodiversity and its plight is an important first step towards reshaping society's relationship with fresh waters (Cooke et al., 2013); both freshwater scientists and conservation practitioners have a key role to play

here. However, experience from the climate science community has shown that amassing overwhelming evidence and relentless repetition has been insufficient alone to motivate effective action on climate change (Moser, 2016). The freshwater science community would benefit by learning from this experience and drawing on new insights from behavioral science to develop a more diverse toolbox of behavior change interventions targeted towards reaching and mobilizing diverse audiences (Balmford et al., 2021; Byerly & Fisher, 2017; Maynard et al., 2020).

Smart communication strategies are required to *reshape* our relationship with fresh water. Evidence shows that the mass media can help elevate support for and awareness of conservation efforts (e.g., Mariani et al., 2014; Wu et al., 2018; Ostravski et al., 2021), yet biodiversity remains underrepresented in the media relative to the scientific literature (Legagneux et al., 2018). Freshwater scientists and conservation practitioners can proactively foster media interest in their work. Resources for scientists interested in improving their communication with media personnel, including journalists, are available including via books (e.g., Baron, 2010) and dedicated workshops offered in multiple countries by several organizations (e.g., COMPASS in the United States, the Science Media Centre in the UK, EurekAlert!/American Association for the Advancement of Science and the Chinese Academy of Sciences in China). Using locally relevant examples and building compelling narratives, particularly when combined with brilliant images and memorable storytellers, is one way that could be effective at lodging environmental issues in people's consciousness and stimulating behavioral changes (e.g., Hanisch et al., 2019; Husain et al., 2017).

One example of a recent exemplary success story is "The World's Forgotten Fishes" report (WWF, 2021). In its first week of publication, it was picked up by more than 400 popular press articles in more than 45 countries with a reach of more than 2 billion people; it was highlighted on more than 15 broadcast media pieces; the #ForgottenFishes hashtag reached over 6 million users and the Instagram content received more than 250,000 likes (pers. commun. Richard Lee, WWF-International). A well-coordinated media campaign by WWF (World Wide Fund for Nature, formerly World Wildlife Fund) included strategic messaging which highlighted the "dazzling diversity" of freshwater fish species; the importance of healthy rivers, lakes, and wetlands; the value of freshwater ecosystems for food fisheries, and for recreational fishing and aquarium industries; and humanity's freshwater heritage. These key points targeted multiple segments of society to create a personal connection before flagging significant concerns and concluding with opportunities for engagement. Establishing an intimate association with freshwater habitats across diverse audiences and pairing that with a hopeful message to address the freshwater biodiversity crisis were key attributes to the successful campaign. Of course, this does not mean that 2 billion people now feel fully connected to freshwater biodiversity, but psychology and "marketing" are essential tools for conservationists since they cannot rely solely on people's good intentions. The field of conservation psychology aims to address this intention-behavior gap by enabling conservation through the realization of our dependence on nature (Clayton & Myers, 2009; Simaika & Samways, 2018). For example, conservation psychology has been used to link people to the pollination crisis through its direct impact on food security (Simaika & Samways, 2018). Freshwater conservationists thus need to use similar messaging to *reshape* personal relationships to fresh waters, and recognize our dependence on these ecosystems.

4.2 | APPRECIATE indigenous knowledge systems relating to fresh water

Freshwater conservation can be vastly enriched by the inclusion of more than strictly Western scientific ways of understanding and improving the state of fresh water. For instance, much work has shown the value of the knowledge held by anglers and conservation hobbyists—including successful conservation stories—when it comes to managing local rivers, wetlands, and lakes (Granek et al., 2008). Local knowledge holders across the globe are, of course, crucial to our greater understanding of fresh waters and their inhabitants in more ways than simply in the context of angling. However, comparatively little attention has been given to the transformative potential of Indigenous knowledge systems for redefining how society relates to and protects freshwater habitats. Indigenous Peoples span the globe, with 370–500 million people (~5% of the human population) across 90 countries and 5000+ cultures who identify as Indigenous to their lands and waters (i.e., people who have historical continuity with pre-colonial/settler societies; maintain strong links to territories; carry distinct social, economic, or political systems; maintain distinct languages, cultures, and beliefs; UNESCO, 2019). Indigenous understandings of and relationships with fresh water are, therefore, highly diverse and complex (Wilson & Inkster, 2018). The evidence is overwhelming that colonization has aggressively disrupted long-standing systems of knowing and being that has fundamentally upended the ability of many nations, tribes, and peoples to remain connected to and be active caretakers of waterways in

many parts of the world (Whyte & Cuomo, 2016). There is, however, growing evidence that biodiversity in Indigenous territories rivals that found in formal protected areas (Table 1; Schuster et al., 2019) and that Indigenous Peoples have a crucial role to play in the realm of conservation science (Sengupta et al., 2021). What is more, the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP; United Nations General Assembly, 2007) clearly mandates a right for Indigenous Peoples to continue to be keepers of and maintain relationships with their traditional territories, lands, and waters (Article 25) and that activities and developments in these areas require free, prior, and informed consent (Article 32) before they may proceed. Yet, despite the clear importance of Indigenous stewardship for biodiversity maintenance and the protections of rights endorsed by UNDRIP member states ($N = 144$), Indigenous ways of knowing and being are regularly belittled, overlooked, or purposefully suppressed in the interest of economic gain and industrial development opportunities (Whyte, 2015). This is not a new state of affairs, but it is only in recent years that these realities are beginning to be confronted in conservation literature and practice, and that Indigenous knowledge systems are starting to be *appreciated* in these spaces (e.g., Anderson et al., 2019; Moola & Roth, 2019).

Indigenous relationships with water often center on the concept of the rights of personhood—that nature is animate and has inherent rights to which humans have responsibilities. Western perspectives can *appreciate* Indigenous relationships with water which are often fundamentally relational, where humans benefit from water, and where water systems also benefit from human presence. Water management in Aotearoa/New Zealand (New Zealand Government, 2020) is at the forefront of these emerging dimensions where the latest National Policy Statement on Freshwater Management implements the concept of Te Mana O Te Wai (referring to the vital importance and power of water), whereby fresh water has to be managed in a way that gives effect to indigenous principles of mana whakahaere (governance/authority), kaitiakitanga (guardianship), and manaakitanga (respect and care for others), and according to a hierarchy of obligations—firstly to ecosystem health, secondly to drinking water supply, and thirdly to water use for economic benefit (Ministry for the Environment, 2020). *Appreciating* Indigenous knowledge systems in such ways (see specific actions delineated in Table 1) could provide for more sustainable freshwater management now and into the future that recognizes and celebrates the inherent connections between human life and freshwater life. Others, including the Food and Agriculture Organization of the United Nations (FAO, 2009) and Intergovernmental Platform on Biodiversity and Ecosystem Services (McElwee et al., 2020), are starting to take note as well. Of course, past and current attempts to include Indigenous Peoples in decision-making about water use, access, and/or management have not always been just, equitable, or successful, but efforts that truly create space for non-Western ways of knowing (e.g., *Etuaptmumk*/Two-Eyed Seeing; Reid et al., 2021), that do not tokenize individuals or communities in the process, and that respect Indigenous legal traditions and intellectual property rights (UNDRIP Articles 27 & 31) are becoming more frequent (Hessami et al., 2021).

4.3 | CONNECT science more directly to action

The notion that science needs to be connected to action cannot be transformational in a realm like biodiversity conservation. Yet, it is well known that there continues to be a gap between knowledge and action, and the translation of science between those who generate it and those who need to use it for decision making (Cook et al., 2013; Rogers, 2008; Rose et al., 2019). There has been a clarion call made by others for freshwater scientists to *connect* with all water users, including natural resource managers, infrastructure developers and financers, policy makers, and the public, to frame the science of freshwater conservation in a way that is solutions-focused (Albert et al., 2021; Craig et al., 2017; Doubleday & Connell, 2020; Rose et al., 2019).

Connecting science to action requires that it is credible, relevant, and legitimate (Cash et al., 2003). Credibility refers to the accuracy of scientific information provided; relevance refers to how suited the information is to the needs of managers and decision-makers, including timeliness; and legitimacy refers to the alignment of information with respect to stakeholders' values and opinions (Cash et al., 2003). It is about ensuring that existing science and evidence make their way to decision makers in usable forms (e.g., Collins et al., 2019), but also about ensuring that knowledge gaps that make it challenging for practitioners to bend the curve for freshwater biodiversity are addressed by the scientific community in a way that reflects and respects stakeholder interests.

Co-production (i.e., scientist–stakeholder collaborations) is increasingly recognized as an effective way to ensure that knowledge generated is relevant and legitimate (Cooke, Nguyen, et al., 2021; Miller & Wyborn, 2020; Wyborn et al., 2019; Young et al., 2014). Although it is not without challenges (Lemos et al., 2018; Norström et al., 2020), progress in *connecting* science to action requires that freshwater scientists and conservation practitioners embrace the joint framing of research

and policy to increase the likelihood that it will gain traction with decision makers and stakeholders when completed (Beier et al., 2017; Cooke, Lynch, et al., 2021; Nel et al., 2016; Zarei et al., 2020). This also requires better scientific monitoring of the impacts (or lack thereof) of conservation efforts in order to build the evidence base. Evidence suggests that river restoration initiatives consistently fail to put in place robust monitoring and evaluation, leaving conservationists with little knowledge of whether their efforts are delivering benefits for biodiversity or people (Speed et al., 2016).

4.4 | ELEVATE fresh water as a unique "domain" that requires explicit recognition in conservation policy and planning

Relevant conservation policy and planning frameworks, and consequent financial investments and instruments, must *elevate* the biodiversity of rivers, lakes, and freshwater wetlands to the same priority as, say, forests or oceans (we note that engagement with wider policy sectors—especially water, agriculture, and energy—will be essential, too, but that topic falls beyond the scope of this article). The current international conservation discourse, including frequent use of the phrase "land and sea" in assessments and frameworks produced by entities such as IPBES, and in early drafts of the Post-2020 Global Biodiversity Framework under the aegis of the UN Convention on Biological Diversity (CBD), omits explicit consideration of the distinct character and status of freshwater habitats. This effectively relegates them to a mere subset of terrestrial ecosystems, inadvertently contributing to the dramatic losses of freshwater biodiversity (Tickner et al., 2020). Reframing such language—for instance, "land, freshwaters, and sea" or simply "land and waters"—would represent a straightforward but important initial step to elevation of rivers, lakes, and freshwater wetlands to a status equal to terrestrial and marine domains. Indeed, at the Convention of the Parties (COP-15) in Montreal, Canada, in December 2022 for the first time ever the CBD explicitly included "inland waters" in the framing of some targets under the Post-2020 Global Biodiversity Framework (e.g., "Target 2: Ensure that by 2030 at least 30 per cent of areas of degraded terrestrial, inland water, and coastal and marine ecosystems are under effective restoration" and "Target 3: Ensure and enable that by 2030 at least 30 per cent of terrestrial, inland water, and of coastal and marine areas, especially areas of particular important for biodiversity and ecosystem functions and services, are effective conserved and managed"), which is a promising first step (CBD, 2022).

Introducing appropriate targets and indicators may also be beneficial. Analysis has shown ample scope for strengthening the indicator frameworks for the CBD and the UN Sustainable Development Goals such that they are fit for purpose in guiding and monitoring freshwater biodiversity conservation and restoration efforts worldwide (Dickens et al., 2020; Tickner et al., 2020). For this to happen, freshwater scientists and practitioners can proactively engage with policy-making processes and platforms such as IPBES (e.g., by volunteering for IPBES assessments). Recent emergence of initiatives, such as the Alliance for Freshwater Life (Darwall et al., 2018) and Inland Fisheries Alliance (www.inlandfisheriesalliance.org), suggest that the freshwater science and NGO community is gearing itself up for this challenge, although examples of such coordinated efforts providing targeted inputs to international policy processes remain scarce (but see FAO, 2020; GEO, BON, & FWBON, 2022; UN Water, 2019 as exceptions). At the national level, freshwater specialists and NGOs can focus on influencing key instruments such as National Biodiversity Strategic Action Plans (which detail priorities for implementing CBD targets) as well as national laws and policies. Further opportunities for influence lie ahead as attention turns, following the 26th United Nations Climate Change conference (COP-26), to management of nature and ecosystems as a means of meeting United Nations Framework Convention on Climate Change (UNFCCC) targets, and also as Nature-based Solutions initiatives and investments become more prominent.

Beyond the high principles and goals of international agreements, landscape and watershed-scale conservation plans and programmes can also give equal consideration to the strategies necessary for safeguarding life in rivers, lakes, and freshwater wetlands as they do to terrestrial biodiversity. Leal et al. (2020) demonstrated that explicit consideration of freshwater habitats and species in targets, interventions, and indicators can lead to better biodiversity results from conservation programmes. Such alignment of terrestrial and freshwater (and, where appropriate, marine) priorities within conservation planning requires sufficient understanding of the characteristics and processes that are distinct to freshwater systems. This might mean that terrestrial conservationists prepare to have some foundational approaches and philosophies challenged. For instance, conservation plans that are framed in terms of area-based targets and indicators might be inappropriate for riverine habitats that are essentially linear in character, that intersect and connect multiple terrestrial habitats or landscapes, and that are often subject to influences from much further afield (i.e., upstream or downstream) in the watershed, beyond

the boundary of a single terrestrial conservation area or even single political jurisdiction (Tickner, 2017). In fact, it is currently widespread practice to use rivers to demarcate terrestrial protected areas which pays little regard to the role of floodplain and wider watershed processes in influencing the condition of instream and riparian biodiversity (Grantham et al., 2017). Consequently, many protected areas are ineffective at delivering freshwater biodiversity benefits (Acreman et al., 2019). Recent research points to possible ways forward through, for instance, cross-domain systematic conservation planning (Hermoso et al., 2021).

5 | CONCLUSIONS

Freshwater ecosystems and their constituent biodiversity generate many benefits to humans and nature, but their status is increasingly uncertain (Lynch et al., in press). We argue that achieving meaningful progress requires creating the right social context for change. The RACE framework that is proposed here has potential to enable that change, although there will certainly be challenges and learning along the way. What we know is that to date we have largely failed to bend the curve for freshwater biodiversity at the global scale so the ideas here should complement the Emergency Recovery Plan (Tickner et al., 2020) and provide the enabling conditions for protection and restoration of freshwater biodiversity and ecosystems. Not doing so would be tantamount to dropping out of a race before leaving the starting blocks. The RACE for freshwater biodiversity requires freshwater specialists and conservation practitioners to *reshape* society's relationship with fresh water by better communicating that, while some trade-offs with short-term human needs are inevitable, investments in protection of freshwater ecosystems and biodiversity have manifold benefits (short- and long-term) for society (e.g., Febria et al., 2015; Postel & Carpenter, 1997; Russi et al., 2013). Crucial to this is moving beyond conceptualizing the competition between freshwater conservation and water resource use as a zero-sum game (Phang et al., 2019). Progress towards this can be made by *appreciating* and embracing other knowledge and value systems that center on recognizing the intimate and intertwined relationships between nature and human life, where humans benefit from water and water systems can also benefit from human presence (Reid et al., 2021). However, it also requires that freshwater conservation scientists actively recognize and embrace the social-political landscape within which sustainable water management occurs (Cooke, Nguyen, et al., 2021; Evans, 2021). Collaborating with natural resource managers, policy makers, and the public in a co-production process, freshwater specialists can *connect* users with the resource and frame the science of freshwater conservation in a way that is credible, relevant, legitimate, and solutions-focused (Albert et al., 2021; Doubleday & Connell, 2020). *Elevating* fresh waters as a unique domain in conservation, restoration, and policy planning is an essential component to achieve this.

To truly bend the curve for freshwater biodiversity, to bring freshwater biodiversity back from the brink of precipitous declines, and to protect freshwater ecosystems, there is an urgent need to find a more equitable balance between how fresh water is used and how to protect the diverse and unique species that inhabit our freshwater environments. To meet this challenge, freshwater scientists and conservation practitioners can use evidence that demonstrates this rebalancing does not always have to be a zero-sum trade-off. The conservation movement can take up freshwater biodiversity more explicitly as a focus for activities, advocacy, and fundraising approaches. Equally, a concomitant focus on freshwater systems is essential for water resource management activities and in evolving approaches to protect rather than simply "use" fresh waters. Nature-based solutions (Cohen-Shacham et al., 2019) and approaches that offer synergistic development for people and nature (see Hurford et al., 2020) offer the opportunity to simultaneously provide human well-being and biodiversity benefits. Here, we outline four key actions for freshwater specialists and the wider conservation movement that are necessary to achieve the social momentum and capital necessary to garner the support required in the RACE to achieve this rebalancing. Implementation will involve a variety of efforts by individuals and institutions. Some of these efforts will be very local actions (e.g., literally in the backyards of community members) while others need to occur on the global stage to inform broadscale initiatives and policy instruments (e.g., global biodiversity and sustainable development agreements). But at the core, these actions are about humanity—not fish, nor turtles, nor crayfish—and they are urgent. Every day, as freshwater biodiversity continues to decline, we are in a RACE. It is time to shift the narrative such that freshwater biodiversity is no longer invisible and overlooked but, rather, valued, protected, and conserved.

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