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Examining progress towards achieving the Ten Steps of the Rome Declaration on Responsible Inland Fisheries

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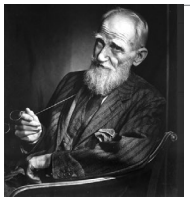
Abstract

Inland capture fisheries provide food for nearly a billion people and are important in the livelihoods of millions of households worldwide. Although there are limitations to evaluating many of the contributions made by inland capture fisheries, there is growing recognition by the international community that these services make critical contributions, most notably to food security and livelihoods in rural populations in those low-income countries with extensive freshwater resources. With the increasing appreciation of the key role of inland fisheries to the health and well-being of human populations globally, the Food and Agriculture Organization of the United Nations and Michigan State University convened the 2015 global conference, *Freshwater, fish, and the future – cross-sectoral approaches to sustain livelihoods, food security, and aquatic ecosystems*. What emerged from the interactions between inland fisheries' scientists, resource managers, policymakers and community representatives from across the world was a forward-looking call to action culminating with the 2015 Rome Declaration "Ten Steps to Responsible Inland Fisheries" (FAO & MSU, *Rome declaration on responsible inland fisheries: 5735E/1/06.16*). Four years after this landmark conference and declaration, we seek to advance discussion on the "Ten Steps," namely what successful implementation looks like, assess current examples of implementation, suggest potential signals of progress and provide some specific, indicative examples of progress for each step. While there are promising signs of progress, we conclude that there remains a strong need to galvanize momentum for sustained action to ensure that inland fish and fisheries are accounted for and incorporated into broader water resource management discussions and frameworks.

KEYWORDS

food–water–energy nexus, freshwater ecosystems, freshwater fisheries, integrated water resources management, sustainability



Ghoti papers

Ghoti aims to serve as a forum for stimulating and pertinent ideas. Ghoti publishes succinct commentary and opinion that addresses important areas in fish and fisheries science. Ghoti contributions will be innovative and have a perspective that may lead to fresh and productive insight of concepts, issues and research agendas. All Ghoti contributions will be selected by the editors and peer reviewed.

Etymology of Ghoti

George Bernard Shaw (1856-1950), polymath, playwright, Nobel prize winner, and the most prolific letter writer in history, was an advocate of English spelling reform. He was reportedly fond of pointing out its absurdities by proving that 'fish' could be spelt 'ghoti'. That is: 'gh' as in 'rough', 'o' as in 'women' and 'ti' as in palatial.

1 | INTRODUCTION

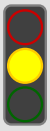
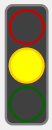
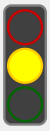
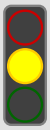
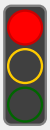
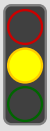
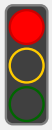
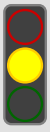
Inland fish and fisheries provide many important services, particularly to rural low-income communities (Cowx & Portocarrero Aya, 2011; Lynch, Cooke, et al., 2016), including support of food and nutritional security, livelihoods and healthy aquatic ecosystems. Inland fisheries provide essential micro- and macronutrients to some of the world's more food-insecure peoples (Youn et al., 2014)—there are simply no replacement opportunities in many locales (e.g. Orr, Pittock, Chapagain, & Dumaresq, 2012). While the magnitude of reported inland catch is <15% of reported marine commercial fisheries (FAO, 2018b), this does not necessarily reflect the disproportionate reliance of certain human communities on inland fisheries, nor capture their intrinsic value in many regions of the world. There have been numerous reviews highlighting the importance of inland fisheries to people (e.g. Cooke, Allison, et al., 2016; Lynch, Cooke, et al., 2016; Nam et al., 2015), and some attempts to estimate a more accurate size of the sector (Deines et al., 2017; Fluet-Chouinard, Funge-Smith, & Mcintyre, 2018; de Graaf, Bartley, Jorgensen, & Marmulla, 2015; Welcomme et al., 2010). Yet, inland fish stocks and the fisheries they support have often been "forgotten" because they often do not have a voice in policy arenas (Cooke, Bartley, et al., 2016) or even in broader fisheries' dialogues where marine fisheries often dominate (Cooke et al., 2013), such that any opportunity (as this article) to raise their profile by including them in broader fisheries, water resource and human rights discussions is valuable. Indicators for the United Nations (UN) 2030 Agenda for Sustainable Development and its Sustainable Development Goals (SDGs) that might cover ecosystem services or food production relevant to inland fisheries fall short of the needs of the sector. SDG 14 (Life below water) focuses on marine systems, SDG 15 (Life on Land) focuses on protection of aquatic ecosystems but fails to recognize the role of inland fish in food production, and SDG 6 (Clean Water and Sanitation) focuses principally on human needs and only tangentially references the role that clean water plays in fish habitat. Yet, inland fisheries directly or indirectly support the achievement of a range of SDGs (e.g. Lynch et al., 2017). The inland fisheries' professional community has, for some time, been trying to get inland fisheries recognized at the policy table for challenging, but important, discussions regarding trade-offs in water resource management (e.g. for how it relates to the water–energy–food nexus, see Biggs et al., 2015; Wichelns, 2017) and food production (e.g. for irrigated agriculture and reservoir fisheries, see Lynch et al., 2019; Renwick, 2001).

In January 2015, the Food and Agriculture Organization of the United Nations (FAO) and Michigan State University (MSU) took a new strategy to address these issues by convening a global conference: *Freshwater, fish, and the future – cross-sectoral approaches to sustain livelihoods, food security, and aquatic ecosystems* (see Taylor, Bartley, Goddard, Leonard, & Welcomme, 2016 for proceedings). This was a landmark event, the first global discussion within a UN agency (FAO) on the state of inland fisheries and the pathways forward, for ensuring that aquatic ecosystems are valued and protected such that inland fisheries can yield the greatest suite of services possible that enhances the health and well-being of humans as well as aquatic ecosystems. The "Rome Declaration—Ten Steps to Responsible Inland Fisheries" (FAO & MSU, 2016) that emerged from the conference was built on the premise that there is an crisis in the ability of inland fisheries to meaningfully engage in broader water resource decisions and, consequently, a need for change in engagement practices (Cooke, Bartley, et al., 2016).

The Rome Declaration's Ten Steps identify key areas for action to sustain freshwater ecosystems and their fishery resources that were derived from contributions and discussions at the global conference. More than 200 scientists, policymakers, resource managers, private industry and representatives from civil society organizations participated in this process. The recommendations are general and not targeted to specific groups or regions; however, numerous entities at various levels of government and society will need to work together to implement them. The steps and recommendations of the Rome Declaration build on, *inter alia*, the principles contained in the Convention on Biological Diversity (CBD, 1992), the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (FAO, 2015) and the Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security (FAO, 2012). Following the conference, the Rome Declaration was disseminated in a diverse array of outlets to the public (e.g. website, social media, popular press), academia (e.g. Taylor & Bartley, 2016) and government entities (e.g. FAO Committee on Fisheries).

Four years later, we qualitatively evaluate the initial progress that has been made in implementing the Ten Steps of the Rome Declaration. While we acknowledge the importance of local initiatives, in this article we focus on high-level (i.e. global) dialogues because we feel strongly that high-level action is essential to provide moral authority for local application. We highlight which steps have made substantial demonstrable (good) progress to achieving their aim, which have made moderate evident (some) progress and which have made very little discernible (limited) progress (Table 1; scored via author consensus). We comment on why progress has been more gradual than intended. Lastly, we make recommendations on how to accelerate actions to achieve the original intent. For this exercise, we define progress through a unanimous consensus approach (among the authors) based on evidence within the international inland fisheries' community, but recognize that quantifiable indicators are more outcome-oriented and, at this point, can only suggest potential signals to galvanize future formal evaluation of the Ten Steps (Table 1). Good progress means quantifiable evidence of implementation of actions towards success; some progress means indication of intent but not necessarily resulting in directed outcomes to date; no progress means limited or no attempt to initiate action. While no step has been incorporated into routine practice or fully institutionalized, we adopt an optimistic perspective in that if these Ten Steps can be incorporated into business-as-usual practice for the use, management and conservation of inland fisheries, there is real potential to overcome the current challenges which they face.

TABLE 1 Potential signs of success and signals of progress implementing the Ten Steps of the Rome Declaration. Through a qualitative consensus scoring process, green steps have made promising (good) progress to achieving their aim; yellow steps have made some progress, and red steps have made limited or no progress and require more tangible action

		Potential signs of success	Potential signals of progress	
	**Improve the assessment of biological production**	*Biological assessment of inland fishes*	• Increase in fisheries where biological assessments have been conducted	
	**Correctly value inland aquatic systems**	*Quantitative economic and social valuation of inland fish, fisheries, and aquatic ecosystems*	• Increase in outputs from inclusion of inland fish in ecosystem services studies • Increase in countries or regions with value estimates for inland fish • Increase in inland fisheries trade-flow studies • Increase in regulated fisheries • Increase in environmental impact assessments that include non-provisioning ecosystem services	
	**Promote the nutritional value of inland fisheries**	*Improved child, maternal, and general food security and nutrition*	• Increase in national or sub-national reports on inland fish consumption • Increase in studies exploring the benefits of fish as food • Increase in consumption surveys with inland fish components • Increase in food consumption guidelines that include inland fish	
	**Improve science-based approaches to fishery management**	*More explicit integration of sciencebased management practices*	• Increase in formal science advice and evidence-based decision making processes used by fisheries and watershed management organizations • Increase in inland fishery management plans using the ecosystem approach to fisheries	
	**Improve communication among freshwater users**	*Public and government acknowledgement of the value of inland fish*	• Increase in “freshwater” stories in the media • Increase in personnel dedicated to information dissemination in local communities • Increase in funding allocations from development and conservation organizations for freshwater programs and themes	
	**Improve governance, especially for shared waterbodies**	*Integration of inland fisheries into water development and management activities*	• Increase in water and lake basin authorities that have inland fisheries instruments and activities • Increase in water management and infrastructure plans that accommodate fisheries • Increase in international instruments that include fisheries along with other users of freshwater	
	**Develop collaborative cross-sectoral integration in development agendas**	*Effective engagement of a broader suite of sectors*	• Increase in water-resource development and management agendas that include inland fisheries • Increase in regulations that provide protection to inland fish within a jurisdiction • Increase in Integrated Water Resources Management (IWRM), basin, or watershed planning processes that include ecosystem approaches to fisheries	
	**Respect equity and rights of stakeholders**	*Greater involvement of under-represented groups in management processes*	• Increase in policy-relevant outcomes from usert-group associations dealing with inland fisheries and water management • Increase in extension services serving key stakeholder groups	
	**Make aquaculture an important ally**	*Inland fisheries and aquaculture sub-sectors working together for responsible use of inland resources*	• Increase in management plans implemented that include the ‘ecosystem approach to fisheries and aquaculture’ • Increase in aquaculture, culture -based fisheries, and stock enhancement licenses, management plans and development plans including conservation of native aquatic species • Increase in activities issued jointly by the aquaculture and fisheries sub-sectors on the value of fish to livelihoods and food security • Increase in sustainable inland fisheries co -occurring with aquaculture operations	
	**Develop an action plan for global inland fisheries**	*Development of an action plan for global inland fisheries*	• Development of an action plan for global inland fisheries	

2 | GETTING THE SHOW ON THE ROAD—REFLECTIONS ON PROGRESS ON THE ROME DECLARATION

The section titles and italicized chapeau below are taken verbatim from the Rome Declaration (FAO & MSU, 2016).

2.1 | Improve the assessment of biological production to enable science-based management

Accurate and complete information about fishery production from inland waters is lacking at local, national and global levels. Governments often lack the resources or capacity to collect such information due to the diverse and dispersed nature of many inland fisheries. There is much scope for developing and refining biological assessment tools to facilitate science-based management.

Though globally reported harvest of inland fish has doubled over the past 30 years (FAO, 2018b), these global catch statistics are widely viewed to be an underestimate of actual harvest and could be up to five times what is currently reported (Bartley, Graaf, Valbo-Jørgensen, & Marmulla, 2015; but see Fluet-Chouinard et al., 2018 for a more conservative over-estimation). Accurate and complete information about fisheries' production from inland waters is lacking at local, national and global levels often due to lack of financial or human capital to collect such information, given the diverse and dispersed nature of many inland fisheries (de Graaf et al., 2015). While we acknowledge that global-scale assessment is exceedingly difficult for inland fisheries because they are so data-poor, opportunities exist to develop and refine biological assessment tools to facilitate science-based management (e.g. population models, emerging data collection methods, spatial tools, decision-support systems; see Lorenzen et al., 2016).

Successful implementation of this step could be the production of a global-scale assessment of inland fisheries akin to that undertaken by FAO for the status of marine fish stocks (see FAO, 2018a). However, we recognize there are specific characteristics (e.g. broad range of drivers affecting status beyond fishing effort; diffuse, multispecies nature of the fisheries; challenges for data collection) that make an identical assessment approach (focusing solely on stock status) untenable for inland fisheries. Likewise, we concede that any global approach does sacrifice some level of precision. Despite this, local assessments of inland fisheries, the majority of which are small scale, can inform up to global processes and we are confident that trend analyses at local, national and even global scales can be produced that will allow tracking of the status of these valuable resources, at stock, species or even fish community levels. In aiming for standard tools that are calibrated to provide robust assessments (e.g. Bonar et al., 2017), a potential signal of progress could include increased fisheries where biological assessments have been conducted, particularly for valuable stocks that are most threatened.

Some progress is being made as a result of recent innovations such as data-poor assessment techniques (Fitzgerald, Delanty, & Shephard, 2018), eDNA (Hänfling et al., 2016), use of fisher reporting tools (e.g. cell phone apps; Venturelli, Hyder, & Skov, 2017), geospatial data on human population densities (Deines et al., 2017), drones (Kopaska, 2014) and traffic counters to estimate effort (van Poorten & Brydle, 2018), all of which show great promise to improve biological assessment. Yet, many of these tools have to be tested beyond the pilot phase such that it is not possible to incorporate them formally into routine biological assessment. Further attempts to apply existing and emerging approaches to biological assessment creatively, and to do so across different types of waterbodies and scales (e.g. regionally, globally), will be essential for making greater progress towards this step. Efforts to convene global technical experts to work collaboratively towards identifying effective standardized biological sampling methods (Bonar et al., 2017) have the potential to revolutionize how inland fisheries are assessed. However, capacity building and resources will still be needed to effectively employ these approaches in many areas where implementation and enforcement of fishery assessment plans are problematic (FAO, 2018a).

2.2 | Correctly value inland aquatic ecosystems

The true economic and social values of healthy, productive inland aquatic ecosystems are often overlooked, underestimated and not taken into account in decision-making related to land and water use. Economic and social assessment is often difficult and valuation often limited. In most cases, especially in the developing world, inland fisheries are part of the informal or local economy, so their economic impact is not accurately measured in official government statistics.

The services provided by healthy inland aquatic ecosystems are often overlooked or underestimated in decisions made relating to land and water use, food security, agricultural development and economic development (e.g. the UN SDGs, Ramsar Convention, FAO international guidelines on land and water tenure). A major challenge has been the accurate measurement of social and economic contributions of inland fish and the services they provide, especially in developing countries (Funge-Smith & Bennett, 2019; Lynch, Beard, et al., 2016). This is often because inland fisheries are part of more informal value chains and unreported trade channels that make most reported statistics underestimates and, consequently, most value unnoticed (Simon Funge-Smith, 2018). While economic valuation is often more straightforward (e.g. economic value of goods or services, willingness to pay) and can be scaled up, social valuation approaches are especially important for fisheries outside of traditional market chains (e.g. nonmonetary valuation, social perception of service benefits) and often have to be conducted at local scales (Chan, Satterfield, & Goldstein, 2012; Farber, Costanza, & Wilson, 2002).

Successful implementation of this step could be a global-scale economic valuation of inland fish, fisheries and aquatic ecosystems or, as a start, a select set of comparative case-studies that include economic and social elements. Potential signals of progress could include increases in: the outputs from inclusion of inland fish in ecosystem services studies; countries or regions with value estimates

for inland fisheries (noting that in many cases there needs to be some disaggregation between wild capture fisheries and aquaculture in freshwaters); inland fisheries' trade-flow studies; regulated fisheries; and environmental impact assessments that include non-provisioning services of freshwater ecosystems.

In recent years, some progress is being made towards improving estimates of production from inland fisheries (e.g. Fluet-Chouinard et al., 2018) and economic value (e.g. Nam et al., 2015), but little towards valuing other ecosystem services (e.g. nutrient cycling, sediment transport, spirituality, aesthetics). An estimate of economic value has been derived for inland capture fishery and recreational fisheries, alongside a first estimate of global employment in inland fisheries (Funge-Smith, 2018). The value chain for inland fish can be extended in some regions and there are ongoing efforts to assess and value these, especially relating to the trade of inland fish in Africa (Kolding, Zwieten, Marttin, Funge-Smith, & Poulain, 2019; Mussa et al., 2017). The improving global estimates have revealed that there are discrepancies in reported information and established understanding regarding catches, participation and values of inland fisheries. The Illuminating Hidden Harvests initiative (http://www.fao.org/voluntary-guidelines-small-scale-fisheries/ihh/en/), a follow-up to the earlier Hidden Harvests study (World Bank, 2012), will attempt to validate estimates at national or subnational level (FAO, 2017).

2.3 | Promote the nutritional value of inland fisheries

The contribution of inland fisheries to food security and nutrition is higher in poor food-insecure regions of the world than in many developed countries that have alternate sources of food. Good nutrition is especially critical in early childhood development (i.e. the first 1,000 days). Loss of inland fishery production will undermine food security, especially in children, in these areas and put further pressure on other food producing sectors.

While overfishing is a predominant concern for marine fisheries, inland fisheries are more impacted by external drivers and highlighting the nutritional value of the resource can, in fact, help protect from productivity declines (Lynch, Cooke, et al., 2016). Inland fishes, particularly in low-income food-deficit regions of the world with limited access to other sources of animal protein, can provide a crucial source of animal protein, minerals, essential oils and vital micronutrients (i.e. required in trace amounts for proper growth and development; e.g. vitamin A, calcium, iron, zinc; Roos, Wahab, Chamnan, & Thilsted, 2007; Youn et al., 2014). Indeed, 43% of inland capture fisheries are produced by low-income food-deficit countries (Simmance & Funge-Smith, 2018). Beyond just the importance to food security, the nutritional contribution can go unrecognized if it is not routinely assessed, which can lead to adverse health outcomes (e.g. increase in rickets among children; Craviari et al., 2008). Of particular, health consequence is public officials and decision-makers discounting the role of inland fish in providing essential components of healthy diets to the most poor and vulnerable populations, or suggesting replacement food sources that are unrealistic (e.g. cost-prohibitive land-based, animal protein sources) for these populations (e.g. Craviari et al., 2008).

Successful implementation of this step could result in increased child, maternal and overall improvement of food security and nutrition, particularly for vulnerable populations in food-insecure regions (i.e. increased fish consumption for improved nutrition). To do so, inland fisheries need to be appropriately valued as a part of the food portfolio for nutritional and food security benefits. Potential signals of progress could include increases in: national or subnational reports that show increased inland fish consumption; studies exploring the benefits of fish as a food source; consumption surveys with targeted inland fish components; and food consumption guidelines that include inland fish.

Good progress is being made to promote the nutritional value of inland fisheries. The nutritional benefits of a "fish" diet (i.e. not restricted to inland fish) are becoming more frequent in publications on food systems (e.g. Willett et al., 2019). Ongoing studies into the nutritional composition of inland fish (e.g. Kolding et al., 2019) will help populate global databases for nutrition (e.g. FAO/INFOODs) and support more accurate estimates of the nutritional contribution of inland fish. Additionally, improving estimates of inland fishery catch derived from surveys on household consumption (e.g. Fluet-Chouinard et al., 2018) demonstrates the direct contribution of inland fisheries to food security. The recent approaches which provide more specificity than just gross fish consumption per capita have the dual facility of providing an insight into the amount of fish available to households and its nutritional value, which challenge previously established assumptions of lower fish consumption based on national statistical accounting (Funge-Smith, 2018). Household studies are becoming more comprehensive, but further investigation is needed as they still lack the necessary detail on fish species composition, seasonality, intrahousehold dynamics and especially the contribution to maternal and childhood nutrition. They do have limitations, in terms of periodicity (infrequent) and are susceptible to their own inherent biases. As with estimates of catch, national and subnational studies are necessary for the effective validation of the role of inland fish in nutrition, particularly to identify inland fishery hotspots where there is an above-average dependence on inland fish for nutrition compared with other regions.

2.4 | Develop and improve science-based approaches to fishery management

Many inland waterbodies do not have fishery or resource management arrangements that can adequately address sustainable use of resources. Where management arrangements exist, compliance and enforcement are often minimal or non-existent. This may result in excessive fishing pressure, decreased catch per unit effort, and conflicts between fishers, as well as changes in the productivity of fishery resources. In some areas, reductions in fishing capacity will

be required. To facilitate fishery management, it will be important to improve access to and promote better sharing of data and information about inland fisheries supporting the assessment–management cycle.

Globally, management of aquatic resources in inland waters, especially fisheries, has largely been driven by out-of-date and marine-oriented regulations that rarely fit the management needs in multiuser, freshwater environments (Kolding & van Zwieten, 2011). Excepting some well-regulated recreational fisheries, top-down management approaches (e.g. closed seasons, closed areas and gear restrictions) often fail due to low compliance, a limited enforcement capacity and open access regimes (FAO, 2018a; Ostrom, 1990). Community-based management is similarly constrained by low capacity and low compliance by outside fishers and few ways to limit fishing effort (e.g. number of fishers or gears used; Kolding, Jacobsen, Andersen, Zwieten, & Giacomini, 2016; Welcomme et al., 2010). The impact of external drivers on inland fisheries (such as land and water management, dams and pollution) is also forces generally beyond the control of fisheries' management agencies. Holistic frameworks to address these impacts are still rare, but exist in some cases, such as national environmental regulations that require maintenance of ecosystem integrity and functioning through integrated river basin management practices (e.g. U.S. River Basin Authorities), but these are mostly linked to pre-existing legislation and limited to industrialized countries.

Successful implementation of this step could be proactive changes to management practices to embrace more explicitly science-based approaches (e.g. catch monitoring and reporting, quantifying social benefits, examining ecosystem services trade-offs and applying ecosystem-based management; see Beard et al., 2011). Advances in technology and data management now allow for application of scientific findings in one situation to now help inform other circumstances. Greater use of decision-support tools can also help streamline the incorporation of specific, often project-driven, scientific and local knowledge (*see Step 8*) into management frameworks. Potential signals of progress for this step could include increases in: occasion data on fisheries' status and trends collected through both fishery-dependent and fishery-independent mechanisms as well as from local knowledge are used by fisheries and watershed management organizations, and inland fishery management plans using the ecosystem-based approach to fisheries (as recommended by Beard et al., 2011).

Some progress has been made to improve access to, and sharing of, inland fisheries' data to support such assessment–management frameworks, including the use of modern technologies (e.g. improved survey methodologies and use of mobile technologies; Venturelli et al., 2017), estimation of catches from household data (Fluet-Chouinard et al., 2018), historic and ongoing fishery-dependent and fishery-independent surveys (Ainsworth, Funge-Smith, & Cowx, 2018) and establishment of research networks (such as the international InFish research network; http://infish.org/). Nonetheless, these approaches are not widespread and evidence of incorporating fisheries as an important ecosystem service into multiuser environments remains limited and largely restricted to major infrastructural developments like hydropower dams in large rivers (e.g. Agostinho, Pelicice, & Gomes, 2008; Alexander, Wilson, & Green, 2012; Orr et al., 2012; Williams, 2008). Greater collaboration between all sectors impacting water quantity, quality and fisheries' productivity is necessary to position inland fisheries in integrated natural resource management frameworks rather than treating and managing fisheries in isolation.

2.5 | Improve communication among freshwater users

Information on the importance of the inland fishery and aquaculture sectors is often not shared with or accessed by policy-makers, stakeholders and the general public, thereby making it difficult to generate political will to protect inland fishery resources and the people that depend on them. Moreover, many misconceptions exist on the needs and desires of fishing communities. Building from the "Small-Scale Fisheries Guidelines" and other relevant instruments, use appropriate and accessible communication channels to disseminate information about inland fish, fishers and fisheries to raise awareness of inland fisheries' values and issues, to alter human behavior, and influence relevant policy and management.

Information on the importance of the inland fishery and aquaculture sectors is often not shared between the sectors or accessed by policymakers, stakeholders or the general public. This lack of communication makes it difficult to generate political action and the public voice to protect and enhance inland fishery resources and the well-being of the people that depend on them. Sustained efforts to increase meaningful engagement with other freshwater users and the broader public are essential to gain support and understanding for the plight of inland fish and their value to society (Cooke et al., 2013).

Successful implementation of this step could, ultimately, help people and governments acknowledge the value of inland fish in a social, economic and ecological context. These efforts could involve "top-down" and "bottom-up" communication approaches among fisheries and other user groups and coproduction of information by multiple stakeholders. Beyond generating the traditional scientific paper, these outputs (e.g. story maps, comics, performance art) may focus on diverse audiences including youth (the leaders of tomorrow) and include opportunities for bidirectional knowledge exchange with other important sectors (e.g. Cowx, Lungu, & Kalonga, 2018). Such efforts could be supported by social science studies to identify preferred communication messages (see Ebner et al., 2016, for freshwater fish example with flagship species), media and pathways that reach the target audience and elicit the intended behavioural change. Potential signals of progress could include increases in: "freshwater" stories in the media, number of personnel dedicated to information dissemination in local communities and funding allocations from development and conservation organizations for freshwater programmes and themes.

Some progress has been made to use appropriate and accessible communication channels to disseminate information about inland fish, fishers and fisheries to raise awareness of inland

fisheries' values and issues, to alter human behaviour and influence relevant policy and management (e.g. InFish.org; activities in public aquaria, see Murchie, Knapp, & McIntyre, 2018). The parallel advocacy efforts of organizations concerned with freshwater conservation (e.g. Conservation International [CI], International Union for Conservation of Nature [IUCN], The Nature Conservancy, World Wildlife Fund [WWF]) also favour convergence of messaging because inland fisheries and freshwater conservation tend to have inextricably linked needs and objectives (Phang et al., 2019). Of particular note are efforts to celebrate the role of inland fish in generating diverse services (Lynch, Cooke, et al., 2016) and in the ways in which inland fish contribute to achieving the United Nations 2030 Agenda for Sustainable Development (Lynch et al., 2017), but more action is needed to engage and appreciate Local Ecological Knowledge (e.g. Mamun, 2010) as there are many examples of where inland fisheries remain underappreciated or even invisible (e.g. hydropower development in the Amazon; Doria et al., 2018).

2.6 | Improve governance, especially for shared waterbodies

Many national, international and transboundary inland waterbodies do not have a governance structure that holistically addresses the use and development of the water and its fishery resources. This often results in decisions made in one area adversely affecting aquatic resources, food security, and livelihoods in another.

Fishery governance broadly relates to the exercise of economic, political and administrative authority of the sector, and to the establishment of its overriding principles and objectives (FAO, 2016a). Because the Ten Steps originated from an international cross-sectoral conference, they have a focus on water issues and especially transboundary issues in addition to more specific aspects of fishery management (*included under Step 4*). Although many transboundary and national water bodies do not have effective governance systems in place for holistic basin management (FAO, 2007), international and national policies on water management have been evolving for decades. Multinational commissions have been established on rivers and lakes (e.g. the European Union Water Framework Directive, Mekong and Danube River Commissions, Lake Victoria Fisheries Organization, Great Lakes Fishery Commission, International Joint Commission for the United States and Canada). Ramsar sites (i.e. wetlands of international importance) now include transboundary or international wetlands that call for international cooperation in their maintenance, and novel approaches to wetland governance are emerging in some locations (e.g. designation of "person" status to the Whanganui River in New Zealand; Gardner & Finlayson, 2018).

Questions remain, however, as to if these policies and approaches are effective and what comprises successful governance. Successful implementation of this step could be inland fisheries fully integrated into water development and management activities at local, national and international levels. Potential signals of progress could include increases in: water and lake basin authorities that have inland fisheries' instruments and activities; water management and infrastructure plans that accommodate fisheries through water quantity, water quality and environmental flow considerations (e.g. timing of release of water from dams, fish pass redesign and incorporation fish into irrigation schemes); and international instruments taken up that include fisheries along with other users of freshwater (e.g. the international guidelines on land and water tenure, FAO, 2012; Ramsar Convention adding fisheries as a criterion for establishment of a wetland of international importance, Ramsar, 2017). Examples of progress towards achieving this step include the Great Lakes Fishery Commission (GLFC) establishing three broad areas of intervention for governance of the Laurentian Great Lakes: (a) healthy ecosystems/sustainable fisheries, (b) sea lamprey (*Petromyzon marinus*, Petromyzontidae) control and (c) alliances/partnerships (GLFC, 2017). In the vast majority of these areas, the GLFC has been successful and has improved fisheries, made progress in the control of invasive species, improved the status of many native species and developed strong partnerships that incorporate environmental concerns into fishery management. The Mekong River Commission (MRC) has embarked on collaborative and participatory process to review the design of the Xayaburi Dam (Lao PDR) and fish pass proposals as to their impact on fisheries (MRC, 2019). Some redesign of the proposed fish pass has been incorporated into the project based on MRC recommendations. However, some concerns remain regarding the potential impacts on fish migration. More broadly, environmental flows are being incorporated into management and policy deliberations, which has resulted in better maintaining ecosystem services and biodiversity in impacted rivers (Granit et al., 2017; Yang et al., 2017).

These examples are encouraging signs, but most pre-date the Rome Declaration, and limited progress has been made with regard to new governance initiatives for many transboundary waterbodies due to a lack of financial support or an effective mechanism for collaborative policymaking between all vested sectors. There are also some examples of governance setbacks, such as the European Union Water Framework Directive, which was seen as a positive step in international legislation, but which is reportedly failing to fulfil its objectives during implementation (Voulvoulis, Arpon, & Giakoumis, 2017). Significant effort in the governance arena at national, international and transboundary scales will be necessary to enhance the capacity of the inland fisheries' sector to engage other sectors to a common good and manage the resources in a holistic, sustainable manner, particularly with regard to future activities.

2.7 | Develop collaborative approaches to cross-sectoral integration in development agendas

Water-resource development and management discussions very often marginalize or overlook inland fisheries. Therefore, trade-offs between economically and socially important water-resource sectors and ecosystem services from inland water systems often ignore inland fisheries and fishers. Development goals based on common

needs, e.g., clean water and flood control, can yield mutually beneficial outcomes across water-resource sectors.

Since the Industrial Revolution, inland fisheries have been largely overlooked and in some cases sacrificed, in the race to develop water resources, especially to meet growing demands for potable, agricultural, municipal and industrial supply as well as power and navigation (Cooke, Bartley, et al., 2016). Consequently, they have been systematically, though perhaps unintentionally, degraded (Dudgeon et al., 2006). While the SDGs are a very positive step overall (UN, 2015), the fact that the SDGs have only tangentially incorporated inland fisheries under "Life on Land" (SDG 15) sends the wrong message on the value of inland waters for fish production, food, and societal health and well-being. However, we are encouraged that the scientific and development communities are realizing that integration is necessary to address the SDGs in a holistic manner that includes all sectors (Blanchard et al., 2017).

Successful implementation of this step would engage a broader suite of sectors. Partnerships, communication and education will be essential, and evidence of these activities evolving where major inland fisheries exist within multi-water resource use scenarios is paramount. For example, the common misconception that farmed fish or land-based agriculture can nutritionally replace wild fisheries must be addressed at a policy level via communication and stakeholder engagement (Beveridge et al., 2013). These approaches need further investment, especially because without sustained effort and promotion at multistakeholder events and policy forums, any momentum will be quickly dissipated without a champion. Potential signals of progress could include increases in: water resource development and management agendas that include inland fisheries; regulations that provide protection to inland fish within a jurisdiction; and Integrated Water Resources Management (IWRM), basin or watershed planning processes that include ecosystem approaches to maintain and enhance local, regional and global fisheries.

To address this issue, some progress has been made to raise the profile of inland fisheries and their vital contribution to meeting the SDGs (Funge-Smith, 2018; Lynch et al., 2017), through adoption of the ecosystem services concept (Pope et al., 2016) and ecosystem approach to fisheries' management (Nguyen et al., 2016). Considerable efforts are also being made by international organizations, nongovernmental organizations and stakeholders (e.g. FAO, WWF, IUCN, U.S. Geological Survey) to promote inland fisheries beyond the current sectoral participants and raise the profile of inland fisheries at international meetings and workshops (e.g. sessions on inland fisheries at the 2016 International Water Association World Water Congress and Exhibition, 2018 and 2019 Stockholm World Water Weeks, 2018 Sustainability and Development Conference and 2019 Water Future Conference). Exasperatingly, the general reaction of stakeholders from other sectors is along the lines of "We did not realize!!" or "We have the same problem!!" Still, as inland fisheries operate in complex, multiuser environments, mechanisms to integrate the contribution and enhance their profile in basin management plans and decision frameworks remain limited, but need direct approaches to engage in meaningful dialogue. Efforts to create a "grand coalition" across the sectors to spearhead this issue are badly needed.

2.8 | Respect equity and rights of stakeholders

Lack of recognition of the cultural values, beliefs, knowledge, social organization, and diverse livelihood practices of indigenous people, inland fishers, fishworkers, and their communities has often resulted in policies that exclude these groups and increase their vulnerability to changes affecting their fisheries. This exclusion deprives these groups of important sources of food as well as cultural and economic connections to inland aquatic ecosystems.

Stakeholders in inland fisheries can vary broadly from local communities to indigenous peoples, inland fishers, fishworkers and all those involved in the value chain. Often, these groups are among the most vulnerable who rely on inland fisheries for livelihoods and nutrition (Smith, Khoa, & Lorenzen, 2005; Youn et al., 2014). Historically, engaging these groups in decision-making processes has been limited, which has often resulted in negative consequences for the people and the fish (e.g. Doria et al., 2018). Given the importance many local and indigenous groups have for inland fisheries as a resource that often goes well beyond more traditional uses such as food or recreation, incorporation of their knowledge into decisions is important to ensure the sustainability of inland fisheries (Ban, Eckert, McGreer, & Frid, 2017; Giles, Fanning, Denny, & Paul, 2016).

Successful implementation of this step could require greater involvement (e.g. membership on management boards) of under-represented groups in management processes. Engagement, itself, is often difficult to quantify, but representation may be the first approach at some form of quantitative accountability. FAO guidelines (e.g. the Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security; FAO, 2012, and Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication; FAO, 2015) can provide some direction on operational, measurable variables that could be assessed. Potential signals of success could include increases in: policy-relevant outcomes from user-group associations dealing with inland fisheries and water management, and extension services serving these communities.

Limited progress has been made to engage holders of local knowledge about inland fisheries more widely and integrate their values into decisions regarding management of local aquatic ecosystems and, by default, the inland fisheries (e.g. Béné et al., 2009; Doria et al., 2018). Even when indigenous or other local uses of inland fisheries hold legal rights, suppression or other denials are common until settled through legal actions (Harris & Millerd, 2010; Nesper, 2002). Significant effort is needed to better appreciate and integrate the value and importance of inland fisheries into these processes using culturally sensitive methods to incorporate indigenous and local knowledge, along with respecting their rights to inland fisheries' resources (e.g. Lumley, FiveCrows, Gephart, Heffernan, & Jordan, 2016).

2.9 | Make aquaculture an important ally

Aquaculture is the fastest-growing food production sector and an important component in many poverty alleviation and food security programmes. It can complement capture fisheries, e.g., through stocking programmes, by providing alternative livelihoods for fishers leaving the capture fisheries sector, and by providing alternative food resources. It can also negatively affect capture fisheries, e.g., introduction of invasive species and diseases, through competition for water resources, pollution, and access restrictions to traditional fishing grounds.

Aquaculture is an undeniable force in the fisheries' sector (FAO, 2018b); however, the interactions between aquaculture and inland capture fisheries range from win–win to lose–lose (e.g. Toufique & Belton, 2014). Both aquaculture and inland fisheries depend on a variety of services provided by healthy aquatic ecosystems (Cowx & Portocarrero Aya, 2011). Particularly in the face of growing populations, increasing income inequity and sustainable development opportunities (Stead, 2019), it is in the best interest of both subsectors to work together to ensure fisheries and aquaculture continue to provide high quality and affordable food at the local, regional and global scale.

Successful implementation of this step could be integrated into inland fisheries and aquaculture systems where both subsectors work together with mutual respect towards responsibly using the world's freshwater ecosystems and their resources. Potential signals of progress could include increases in: number of fisheries and aquaculture management plans implemented that include the "ecosystem approach to fisheries and aquaculture" (Beard et al., 2011); number of aquaculture, culture-based fisheries and stock enhancement licences, management plans and development plans with conservation of native aquatic species explicitly written into them; activities (e.g. initiatives, publications or resolutions) issued jointly by the aquaculture and fisheries' subsectors on the value of fish and fish products for increasing livelihood and food security; and sustainable inland fisheries co-occurring with aquaculture operations.

Examples of progress towards achieving this step include recent analyses by FAO (2018a) based on submission from over 90 countries that have re-enforced the strong linkages between aquaculture and capture fisheries (e.g. aquaculture depends on wild populations for early life history stages or broodstock in 90% of reporting countries and for feed in 50%). Against this, aquaculture is the reason most often cited for the deliberate movement of aquatic species outside of their native range (Bartley, Brugère, Soto, & Gerber, 2007). Some progress has been made in recognizing the important contributions of wild fish to aquaculture, particularly with regard to the recommendations of the FAO Commission on Genetic Resources for Food and Agriculture (FAO, 2018a). However, linking food production sectors and taking an ecosystem approach (Beard et al., 2011) have proven difficult because of siloed research and management between fisheries and aquaculture professionals. In addition to the above, there are promising steps forward with a new understanding by the aquaculture community that working collaboratively with inland fisheries will improve conservation of aquatic resources, as well as economic and food security (Cottrell et al., 2018).

2.10 | Develop an action plan for global inland fisheries

Without immediate action, the food security, livelihoods and societal well-being currently provided by healthy inland aquatic ecosystems will be jeopardized, risking social, economic, and political conflict and injustice. Therefore, it is necessary to develop an action plan based on the above recommendations to ensure the sustainability and responsible use of inland fisheries and aquatic resources for future generations. The action plan should involve the international community, governments, Civil Society Organizations, indigenous peoples groups, and private industry, and include all sectors using freshwater aquatic resources.

To enact this vision of responsible inland fisheries strategically, a global and multisectoral action plan can serve as a guiding framework for achieving impact on the previous nine steps, relevant at regional and local scales. Such global plans, although admittedly difficult and potentially superficial, can provide moral authority and even funding opportunities (e.g. the Global Environment Facility funds biodiversity projects under the Convention on Biological Diversity [CBD]) to implement specific local actions. To be most effective, this plan should foster sustainability and responsible use through engagement of a diverse suite of stakeholders including governments, nongovernmental organizations, local communities and indigenous peoples, as well as the fishing industry and other freshwater resource users, including aquaculture, agriculture, hydropower and municipalities. We call for integration of inland fisheries into existing or upcoming global frameworks to achieve these Ten Steps of the Rome Declaration on Responsible Inland Fisheries by learning from previous efforts, such as the CBD Strategic Plan for Biodiversity 2011–2020 and its Aichi Targets (note that the current Aichi Targets have no explicit mention of inland fisheries). The CBD process defined the Aichi Targets at a biopolitical level (i.e. by signatory governments in consultation with scientific experts), while their indicators were independently identified so that there was very little integration between the two (Maxwell et al., 2015). Not surprisingly, most of the Aichi Targets have failed to make significant progress towards their 2020 goals (Tittensor et al., 2014) and there have been multiple calls for improvements on the process for the post-2020 CBD agenda, which include suggestions for SMART objectives and associated indicators (i.e. specific, measurable, achievable, relevant and time-bound; Doran, 1981) and resolution of issues around "ambiguity, quantifiability, complexity, and redundancy" (Butchart, Marco, & Watson, 2016).

Successful implementation of a Ten Steps action plan will involve a more integrated process than these predecessors had, which includes: defining success, selecting targets to achieve success, identifying indicators to track progress and sequentially monitoring and adjusting

strategies through an inclusive, iterative process (Figure 1). To act on this recommendation, we are holding a workshop-style session at the 2020 World Fisheries Congress (https://wfc2020.com.au/) to continue the conversation started here on how to define success and what tangible targets and tractable indicators may look like. We are also heavily engaged on this topic with the InFish research network (http://infish.org/), an international group of experts in inland fish and fisheries' issues. We understand that this is only the beginning of a much broader approach to building a framework for responsible inland fisheries but want it to build momentum and accountability. The only indicator of success for this step is development of an action plan itself, one that can be applied in a regional and local context.

While informal discussions of an action plan specifically linked to the global conference have been ongoing since 2015, an action plan represents a massive task and has yet to be initiated. Questions remain regarding who will lead such a plan and how it can be constructed such that it would be broadly adopted, and how it will be implemented. Nonetheless, limited progress has been made in a number of other important arenas. An example of progress towards engaging the international community includes an increase in organizations using, or planning to use, the Rome Declaration in their strategic exercises which should increase the recognition of inland fisheries in broader development discussions (e.g. Conservation International [CI]; https://www.conservation.org/what/Pages/fresh-water.aspx).

3 | STILL SITTING AT A RED LIGHT

Our qualitative review suggests that there are focused or individual actions contributing to the various steps, but that this does not have a critical mass or strategic coherence; thus, progress towards global impact is constrained (Table 1). We also recognize that the many dedicated professionals working towards this progress lack the catalytic or strategic processes that could promote engagement beyond the inland fisheries' sector. Inland fisheries have only had limited recognition within existing policy frameworks and even here are spread thin across the domains of conservation, biodiversity, food security and livelihoods. It remains challenging to find a way to get inland fisheries acknowledged in their own right as a relevant subsector among all the other competition for policy attention and action in the natural resources arena. There have been some bright spots of recognition in high-level fora, such as FAO's Committee on Fisheries (COFI), where, at the 32nd session, inland fisheries were specifically discussed for the first time. COFI noted "the difficulties faced in accurately measuring inland fisheries production" and recommended "the development of an effective methodology to monitor and assess the status of inland fisheries, to underpin their valuation, to give them appropriate recognition and to support their management" (FAO, 2016b).

To move implementation into action beyond statements of intent still requires willing advocates and actors. The global conference, the Rome Declaration, and its Ten Steps, highlights the recognition that there are many fronts for action and that it will be a long and arduous process. While progress has been made, much more is needed if we are to have sustainable inland fisheries, locally, regionally and globally. The collective action and change needed are grand, so perhaps we cannot be too suprised that a nonbinding declaration is insufficient to achieve this broad suite of objectives.

4 | ALL ROADS LEAD TO ROME

Freshwater ecosystems and their biodiversity face many long-standing (Dudgeon et al., 2006; Strayer & Dudgeon, 2010; Vörösmarty et al., 2010) and emerging (Reid et al., 2018) threats, which collectively impede the ability to recognize and sustain their full potential. However, coherent—and innovative—action can go a long way to effectively conserve and sustain these important resources. Perhaps a single action plan will not be the most appropriate path to progress and may require multifaceted approaches, targeting development sectors, donors and governments. Recognizing that not all inland fisheries around the world face the same threats, specific action plans may need to be targeted to specific regions. Successful implementation of the Ten Steps may involve tactics that take a global-to-local (or top-down) approach (e.g. high-level policy action implemented on a local scale) and those that take a local-to-global (or bottom-up) approach (e.g. local success strategies scaled up to broader initiatives).

At a global scale, a key strategy is the meaningful integration of inland fisheries into existing international frameworks that must go beyond catch-all statements of protecting or sustaining freshwater ecosystems. It will require the incorporation and adoption of quantitative targets and indicators of progress into existing instruments and processes related to aquatic biodiversity, environmental and water management, agricultural best practice and the energy sectors. Policy action such as within the scope of high-level multilateral environmental agreements (MEAs—e.g. CBD, Ramsar Convention) or at sector levels (e.g. fish-aware water management) can provide moral authority for local implementation. The identification and tracking of agreed indicators to meet defined targets would ensure that inland fish and fisheries are accounted for and incorporated into broader water and landscape management frameworks. A critical action will be to foster

FIGURE 1 Successful implementation of a Ten Steps action plan will involve application of the following steps through an inclusive, iterative process

engagement within the global inland fisheries' community and other sectors that impact water resources to generate awareness of these targets and indicators and then promote the information needed for their monitoring.

At a local scale, we can think even more creatively. Citizen science and crowd-sourcing data are emerging fields in science that have the bonus effect of increasing public awareness in a given issue (Novacek, 2008). Inland fisheries can be incorporated into ecosystem approaches for management of inland waters (Beard et al., 2011). Comanagement offers mechanisms to instil even greater stewardship in local and regional communities through ownership in the process (Cowx & Portocarrero Aya, 2011). And where there are "bright spots" (i.e. successes beyond the norm; Bennett et al., 2016), we can learn what from those particular examples might be applicable in other contexts. To that end, there may be great value in using a case-study approach to consider how the Rome Declaration applies to specific fisheries around the globe in an effort to identify on-the-ground challenges and solutions with respect to implementation. The lessons learned from this process can provide rationale for broader regional and even global initiatives.

While this perspective may not provide a single solution for the myriad of complex issues surrounding inland fisheries, we hold that "all roads lead to Rome"— idiomatically and literally as implementing the Rome Declaration—is our aim. We recognize that there is more than one effective way to achieving these Ten Steps and hope that this piece can encourage that coherent action and momentum for change with an increasing recognition of the importance of inland fisheries within global environmental and development policy. We contend that identifying key elements for a suite of indicators for inland fisheries that relate to the major MEAs and relevant sectors (e.g. agriculture, irrigation, food, power, aquaculture) is of vital importance to promote inland fisheries in multiple arenas. If we can work towards the incorporation of these into cross-sectoral legislation and monitoring at global, regional and local levels, we will have come far down the 'road to Rome' and towards achieving the Ten Steps of the Rome Declaration on Responsible Inland Fisheries.

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No data were used in the production of this Ghoti article.

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