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Stepping Up: A U.S. perspective on the 10 Steps to Responsible Inland Fisheries

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Abstract

The 10 Steps to Responsible Inland Fisheries are global recommendations to address the subordinate position of inland fisheries in sustainability dialogues. Regional and local perspectives are essential for implementing global initiatives. Hence, we surveyed state fisheries agency administrators and American Fisheries Society Governing Board members about the importance, funding, and achievability of the Steps. Respondents rated Science, Communication, and Assessment as highly important, well-funded, and achievable steps, unlike Aquaculture and a Global Action Plan. Nutrition was rated the most inadequately supported yet achievable step, highlighting an opportunity to promote nutritional contributions of inland fisheries. Opinions were similar between administrators and governing board members across U.S. regions,

suggesting a foundation for incorporating underemphasized Steps into management programs by building multi-organizational partnerships and applying lessons from better integrated steps (e.g., Science, Assessment). Overall, the Steps can advance freshwater science and management in the United States while increasing the visibility of inland fisheries that are rarely prioritized globally.

INTRODUCTION

Inland fisheries are often overlooked in national and global policy discussions (Cooke et al. 2016). This is problematic because inland fisheries—systems of inland fish, habitats, and human users and associated nutritional, economic, cultural, and recreational contributions (Taylor and Bartley 2016)—play a crucial role in human health and livelihoods, particularly in rural, low-income, and food-insecure regions, including many areas with Indigenous populations (Cooke et al. 2016; Islam and Berkes 2016). Inland fisheries represent a large share of global fisheries output, and official statistics likely undercount true catches (Welcomme 2011). Current estimates indicate that 40% of all finfish production originates from inland capture fisheries and aquaculture (FAO 2020). Moreover, inland aquaculture production accounts for more than half of global aquaculture output, growing faster than marine aquaculture production and both marine and inland capture fisheries landings in recent years (Figure 1; FAO 2020). Greater recognition of these contributions is crucial for raising the profile of inland capture fisheries and aquaculture.

More than 200 scientists, policymakers, resource managers, and industry representatives gathered in Rome in January 2015 for a global conference that focused on increasing the visibility of inland fisheries. The resultant Rome Declaration provides international recognition of the importance of inland fisheries for human health and wellbeing, while highlighting unique challenges of inland fisheries management (Taylor and Bartley 2016). More than many marine fisheries, stock health in inland fisheries is influenced by the individual, overlapping, and cumulative impacts of habitat loss and impairment, eutrophication, climate change, species invasion, and other stressors beyond exploitation that disproportionately affect freshwater systems (e.g., water shortages, migration barriers, unsustainable development; Reid et al. 2018; FAO 2020). Furthermore, inland fisheries management and governance are intertwined in the social and cultural constructs of many societies, implying that unfairness and inequity in fisheries have large impacts on peoples that rely on fish for food, nutrition, and livelihoods (Islam and Berkes 2016; Taylor and Bartley 2016). Thus, decision makers are also challenged with recognizing and rectifying complex issues at the nexus of inland fisheries and environmental justice.

The Rome Declaration included 10 Steps to Responsible Inland Fisheries (hereafter, the Steps; Table 1), a set of recommendations to help raise the profile of inland fisheries across sectors and geographies when making decisions that impact their viability and productivity (Taylor and Bartley 2016). The Steps follow a logical progression of generating biological and ecological knowledge about fisheries, assessing their multidimensional value (e.g., economics, ecology, nutrition, livelihoods), developing management and governance programs (using science, communication, and sectoral collaboration), respecting stakeholder equity, working with aquaculture, and creating a global action plan. Whereas inland fisheries can include aquaculture, authors of the 10 Steps treated inland fisheries and aquaculture as separate sectors, with emphasis on identifying linkages and synergies between them (e.g., Step 9: "Make aquaculture an important ally"). To date, global progress toward achieving the Steps has been mixed, and notably limited for Governance, Equity, and Action Plan (Lynch et al. 2020), perhaps because the Steps have generally been viewed through a broad spatial lens that tends to overlook the regional and local considerations that are necessary for implementing global initiatives. In addition, variability in awareness of and opinions about the Steps among fisheries professionals is largely unknown. Therefore, it is valuable to characterize and compare perspectives on the Steps among fisheries professionals from management jurisdictions with differing priorities, objectives, and practices (e.g., individual U.S. states) to lay a foundation for intra- and international implementation of the Steps. Recognizing that global implementation of the Steps has already been reviewed (Lynch et al. 2020), and will require coordinated efforts among many nations, we assessed regional and local perspectives on the Steps within the United States.

We evaluated opinions about the importance, funding, and achievability of the Steps among lead administrators (e.g., directors, chiefs) of U.S. state fisheries agencies (hereafter, administrators) and American Fisheries Society (AFS) Governing Board (GB) members. Authors of this study are partners in a multistate research project (USDA NIFA Project No. MICL04161, Multistate No. NC1189) focused on generating knowledge to support U.S. fisheries management (Carlson et al. 2019). In alignment with this goal, we surveyed administrators and GB members because of their role in steering and informing U.S. fisheries policy and management. Although the U.S. federal government, industry groups (e.g., American Sportfishing Association), and advocacy organizations can play critical roles in fisheries conservation, it is principally state agencies that are tasked with managing U.S. inland fisheries.

Our goal was to shed light on: (1) the importance of the Steps for administrators and GB members at different scales (personal job duties, global advancement of inland fisheries), (2) opinions about how the Steps are funded within U.S. states and across the inland fisheries profession, and (3) opinions about achievability (relative ease/difficulty of accomplishment) of the Steps. Our overarching hypothesis was that rankings of the job–duty and global advancement importance of the Steps would vary within and between respondent groups, but ratings of funding and achievability would be relatively similar. Ultimately, we expected that limitations in fisheries management resources (e.g., time, money, personnel, equipment) would be more comparable across the inland fisheries profession than individual opinions about the importance of the Steps. Survey results could reveal regional and national patterns in U.S. inland fisheries management in relation to the Steps, provide insights for implementing the Steps at different scales, and offer guidance and justification for raising the profile of inland fisheries globally.

METHODS

We emailed Qualtrics questionnaires to administrators (*n* = 50) and AFS GB members (*n* = 29) in fall 2019. Questionnaires were identical except for a question in the GB survey regarding employer type (e.g., state agency, federal agency, university), which was unnecessary for state agency administrators. To ensure that respondents were familiar with the Steps, we described each step in the questionnaires and included web links to further information. Specific expertise on the Steps was not a prerequisite for informative responses. Indeed, we surveyed administrators and GB members because they occupied key positions in U.S. fisheries policy, management, or research. Examining administrator and GB member perspectives provided meaningful information for integrating the Steps into U.S. fisheries policies and management programs.

Questionnaires asked administrators and GB members about the percentage of work hours that they devote to various professional roles (e.g., manager, researcher, biologist) and the importance of the Steps for their job duties and for global advancement of inland fisheries (use of “importance” herein refers specifically to these contexts; Table 2). In addition, administrators and GB members were asked to rate step-specific funding (exceptional, adequate, inadequate, I don't know) at two operational scales (U.S. state where they primarily work, profession-wide), as well as overall achievability (readily achievable, achievable with some difficulty, not achievable, I don't know). Survey participants could also suggest additional Steps and offer general comments (Table 2).

Both questionnaires included a letter explaining that participation was voluntary, confidential, and anonymous. Participants were also informed that they could skip questions that they preferred not to answer, and could withdraw from the survey at any time. We collaborated with survey specialists from several universities affiliated with the authors of this study to develop questionnaires that were concise, yet comprehensive in providing information necessary for evaluating perspectives on the Steps. The 11-question (administrator) and 12-question (GB member) surveys were approved by the Michigan State University Institutional Review Board (IRB STUDY00003043 and STUDY00003205, Exempt 2ii). Survey reminder emails were sent every 20 days between October 2019 and January 2020. A total of 49 people (27 administrators, 54% response rate; 22 GB members, 76%) responded to the survey. None of the authors of this paper were survey respondents.

We analyzed the administrator and GB member surveys separately, but ultimately pooled responses because respondent groups exhibited no major differences. We analyzed categorical questions by calculating the percentage of respondents who selected each category. For the question regarding the amount of time that respondents devote to various professional roles, we calculated the mean percentage and standard error of the mean (SEM) for each role. We analyzed questions involving quantitative rankings (e.g., job–duty and global advancement importance of the Steps) by calculating median rankings on a scale from 1 to 10 (most important) and using Mann–Whitney U tests ($\alpha = 0.05$) to compare job–duty and global advancement rankings for each Step.

Most respondents voluntarily identified the U.S. state in which they primarily work. Using this geographic information while maintaining respondent anonymity, we analyzed survey data by U.S. region as defined by the U.S. Census Bureau (2020). In particular, we compared respondents' job–duty and global advancement rankings of the Steps among northern (northeastern/Midwestern), southern, and western states using Kruskal–Wallis (KW) tests ($\alpha = 0.05$). We analyzed these regions because they encompassed responses from ≥63% of the total number of states in each region, a level deemed sufficiently representative for statistical analysis.

Moreover, we used Mann–Whitney *U* tests to compare step-specific rankings between inland and coastal (marine) states at job–duty and global advancement scales. To facilitate interpretation of our results, we illustrated existing linkages between the Steps and U.S. inland fisheries management using black bass *Micropterus* spp. as a model (Table 1), given the wide distribution, popularity, and socioeconomic importance of these fishes.

RESULTS AND DISCUSSION

Respondents averaged 25 ± 3 years (95% CI) of professional fisheries experience. Whereas administrators worked for state fisheries agencies by definition, GB members worked for state agencies (45%) and universities/colleges (23%), along with federal fisheries agencies, consulting firms, nongovernmental organizations (9% each), and commercial aquaculture companies (5%). Respondents performed a variety of professional roles, including fisheries manager (mean 51% of work hours, SEM 11), director (18%, SEM 7), researcher (11%, SEM 6), biologist (9%, SEM 6), university faculty member (7%, SEM 5), consultant (3%, SEM 3), technician (<1%, SEM 0.4), and aquatic educator (<1%, SEM 0.4).

Importance of the Steps

Science and Communication received high job–duty and global advancement importance rankings, whereas Nutrition, Action Plan, and Aquaculture received low rankings (Table 3; Figures 2A, 2B). Rankings for individual steps were often variable among respondents, with most steps receiving multiple high and low importance rankings (Figures 2A, 2B). Nine Steps did not have statistically different job–duty and global advancement rankings. The only significant difference was a higher global advancement than job–duty ranking for Governance (Mann–Whitney $U = 1425.5$, $P = 0.025$), perhaps because the focus of this step—managing international and transboundary water bodies—was not a job duty for most respondents. Alternatively, perhaps Governance was thought to be effectively addressed by the job duties of U.S. fisheries professionals, making it a more critical Step internationally. It is important to recognize that the theme of Governance—developing policies and regulatory frameworks that integrate social, economic, political, and legal perspectives across individual, sectoral, and societal levels (Taylor and Bartley 2016)—is applicable to fisheries management in the United States and throughout the world. The USA has a robust system of state, federal, and tribal fisheries management, science-based regulation, and industry-financed fisheries conservation, but U.S. fisheries professionals stand to benefit from learning more about how other nations manage their fisheries, which could foster innovative fisheries governance approaches and promote international partnerships for achieving the 10 Steps.

Like Governance, Nutrition received a higher global advancement than job–duty ranking (Table 3), perhaps because respondents did not focus on nutrition in their jobs. Alternatively, the nutritional contributions of inland fisheries may be less recognized in the United States than in countries where inland fish play a greater role in food security and supply (FAO 2020). However, inland fisheries provide nutritional benefits in the USA (Hunt et al. 2008; Cooke et al. 2018, Embke et al. 2020) that are advancing Nutrition intranationally, while providing a template for continued research on linkages between inland fisheries production, food supply, and food security within and beyond the USA. Ultimately, putting the Steps into action will require integrating job–duty, regional, national, and international perspectives and cultivating partnerships at these scales to identify tradeoffs and synergies for implementation.

Amid limitations in time, money, and personnel, state fisheries agencies naturally tend to engage in problem-based management of the most pressing issues and species related to their state-specific mandated missions (Carlson et al. 2019). The result may be lower rankings for Steps that are unassociated with day-to-day management activities. Low rankings for Nutrition, Action Plan, and Aquaculture may reflect a tendency for these steps to be viewed as farther from the jurisdiction of state fisheries agencies than activities encompassed by higher ranked steps (e.g., Science, Communication). Human nutrition falls under the jurisdiction of health and safety rather than fisheries agencies in most states. Fisheries agencies that are responsible for health and safety generally have few nutrition staff, and tend to address nutrition only through fish consumption advisories (e.g., mercury). In addition, respondents may have ranked steps from the perspective of their employers, the majority of which were inland (rather than coastal) state fisheries agencies or universities/colleges that, in many cases, understandably prioritize fisheries management/research concerns that may not be related to Nutrition, Action Plan, and Aquaculture (Carlson et al. 2019). Moreover, respondents may have been unsure of whether or how to apply a “global” action plan locally and regionally. This is a promising area to apply lessons from fishes for which the Steps are already used (e.g., black bass; Table 1) to promote further application of the Steps to other species. Overall, our results suggest that advancing the nutritional role of inland fisheries within the context of a broader reassessment and reprioritization of management actions is unlikely in the current management climate. Although agency missions may be largely defined in legislation and historical practices, the relatively low perceived importance of action planning at job–duty and global advancement scales suggests a possible vulnerability of U.S. inland fisheries to present and future social–ecological changes (climate change, species invasion, demographic and cultural shifts; Carlson et al. 2019).

The relative importance of the Steps was similar among respondents from different U.S. regions, with one exception. Northern U.S. respondents ranked Nutrition as more important for global advancement of inland fisheries than southern respondents (median ranking: 4 [northern], 2 [southern]; KW test: $\chi^2 = 7.10$, df = 2, $P = 0.029$; Figure 2B). Northern respondents also ranked Nutrition as more important for their job duties than southern respondents, but this difference was not statistically significant (median ranking: 4 [northern], 2.5 [southern]; KW test: $\chi^2 = 1.88$, df = 2, $P = 0.391$). Such regionally variable perspectives on Nutrition may reflect the prevalence of fish–food connections via commercial fishing, ice fishing (a primarily harvest/consumption-oriented activity), and the socially and culturally important practice of cooking and eating fish on shore immediately after capture (shore lunch) in some areas of the northern USA (Islam and Berkes 2016; Cooke et al. 2018). Moreover, southern respondents may have perceived commercial aquaculture, which is relatively common in the southern United States, to have limited relevance in the global sphere for advancing inland fisheries and associated issues (e.g., food and nutrition security; Golden et al. 2017). These and other connection points to "fish as food" could scale up to influence regional patterns in respondent opinions regarding how Nutrition affects global advancement of inland fisheries.

Respondents from inland states ranked Aquaculture as more important for their job duties than respondents from coastal states (median ranking: 6 [inland], 3 [coastal]; Mann–Whitney U = 183.5, $P = 0.036$), as did fisheries administrators from the western USA compared to those from the southern USA (median ranking: 8 [western], 3 [southern]; KW test: $\chi^2 = 8.49$, df = 2, $P = 0.014$). These results may reflect inland–coastal and western–southern differences in meanings of, and contexts for, aquaculture and corresponding variability in how respondents perceived Step 9 ("Make aquaculture an important ally"). Aquaculture has a long history in inland fisheries management through hatchery-based stocking programs (e.g., black bass, trout; Table 1), particularly those that are operated by state freshwater fisheries agencies (Halverson 2008), which may help explain inland–coastal differences observed herein. Aquaculture also has a rich history in the southern USA, where it may already be viewed as a central component of fisheries management (i.e., it has already been "made an ally"), or it may be viewed as an agricultural practice separate from fisheries management. The low overall importance of Aquaculture (Table 3) is consistent with a recent survey of state fisheries agency administrators (Carlson et al. 2019), wherein aquaculture was a relatively low ranked management issue. It has been predicted that abundant stocking programs, tribal fisheries management, and competing demands for freshwater resources in the western USA (NWIFC 2019) could cause Aquaculture to be relatively highly ranked in that region compared to other regions (Carlson et al. 2019), as observed herein.

Adequacy of Prioritization and Funding

Ratings of in-state prioritization and funding varied among the Steps. Science was the highest-rated Step (42% "exceptional," 52% "adequate"), and three other Steps (Assessment, Communication, Governance) received ≥ 68% "exceptional" or "adequate" ratings (Table 4). In contrast, Nutrition and Water were rated the most ineffectively addressed Steps, both receiving 52% "inadequate" ratings. Relatively large percentages of respondents were uncertain (i.e., offered "I don't know" responses) about in-state prioritization and funding of Action Plan (42%), Nutrition (21%), and Aquaculture (15%; Table 4), again suggesting that these Steps might be viewed as outside the jurisdiction of state fisheries agencies. This result indicates an information or jurisdictional gap, and a need for multi-agency collaboration on a regional or global action plan underscoring nutritional contributions of inland fisheries (Taylor and Bartley 2016) and associated challenges, including contamination (e.g., mercury, polychlorinated biphenyls), micronutrient deficiencies (Hicks et al. 2019), and environmental justice concerns (Fitzgerald et al. 2007). Along with developing an action plan, it is important for managers and policymakers to work with researchers to devise tangible mechanisms for implementing the action plan locally and regionally.

Respondents generally perceived prioritization and funding of the Steps to be less satisfactory across the inland fisheries profession than within their respective states (Table 4). Whereas Science received 82% "exceptional" or "adequate" across-profession ratings for prioritization and funding, Nutrition, Water, and Valuation were rated most unsatisfactory, with

48–52% of respondents classifying them as "inadequate." Other Steps that received large percentages of "inadequate" ratings included Communication (43%), Governance (41%), Aquaculture (41%), and Equity (40%; Table 4). Similar to their in-state responses, respondents were most uncertain about across-profession prioritization and funding of Action Plan (50% "I don't know" responses) and Nutrition (30%). Collectively, these results indicate a need to locally and regionally operationalize an action plan that addresses inadequacies in how Nutrition, Water, Valuation, Equity, and other Steps are prioritized and funded within and beyond the inland fisheries profession (Cooke et al. 2016).

Achievability

Respondents perceived the Steps to be relatively achievable, except for Action Plan and Water, which received "not achievable" ratings of 21% and 9%, respectively (Table 5). Such ratings were primarily from western and upper Ohio River states, where water scarcity and pollution (e.g., acid mine drainage, harmful algal blooms) are pressing problems (Mekonnen and Hoekstra 2016; Acharya and Kharel 2020) that could influence interpretations of the achievability of water-related initiatives and action plans. A majority of respondents (63%) rated Nutrition as readily achievable (Table 5), the highest achievability rating and the same percentage as Science. Overall, the combination of (1) inadequate prioritization and funding and (2) high achievability for steps like Nutrition and Equity suggests that making strides in these aspects of fisheries management would be meaningful and realistic, locally to globally.

Leveraging the global importance of inland fisheries for Nutrition and Equity will facilitate progress on these steps in the USA. Inland fish promote human health by providing calories, protein, omega-3 fatty acids, vitamin A, calcium, iron, zinc, and other vitamins and minerals and supporting cardiac health, brain development, and immune system function for millions of people globally (Roos et al. 2007; Kawarazuka and Béné 2011; Zhao et al. 2016). Inland fisheries also contribute to livelihoods and Equity across the world, with 95% of global inland fisheries catches originating from small-scale operations in developing nations, and 43% from low-income food deficit countries in 2015 (Funge-Smith and Bennett 2019). These global contributions of inland fisheries to Nutrition and Equity provide context and impetus for U.S. fisheries professionals to learn from, and partner with, the many non-U.S. researchers and managers working in these areas (Funge-Smith 2018; Funge-Smith and Bennett 2019). For instance, global inland fisheries experts could be consulted to help develop collaborations among U.S.-based organizations with expertise in fisheries, food, human health, and equity—including state fisheries agencies, agricultural experiment stations, state and tribal water quality and human health agencies, sustainable seafood initiatives, and the AFS Equal Opportunities Section and Diversity, Equity, and Inclusion Standing Committee (Penaluna et al. 2017; Carlson et al. 2019). Likewise, novel partnerships between U.S. inland and marine fisheries sectors could be established to explore how fish contribute to human health and livelihoods (e.g., Hicks et al. 2019) and identify mechanisms for highlighting these contributions in U.S. fisheries management and governance programs. Such collaborations would help to advance Nutrition, Equity, and other steps in the United States by drawing upon knowledge gained from international inland fisheries initiatives.

SUMMARY AND RECOMMENDATIONS

We found that fisheries administrators and AFS GB members had similar opinions about the job–duty and global advancement importance, funding, and achievability of the 10 Steps to Responsible Inland Fisheries. They believed that Science, Communication, and Assessment are important, well-funded, and achievable Steps (Table 6). In contrast, respondents deemed Action Plan, Water, and Valuation to be inadequately prioritized and funded steps with low achievability. Nutrition and Equity were viewed as inadequately addressed but achievable steps. Consistency in responses between administrators and GB members may reflect the prevalence of state agency employees on the AFS GB. In addition, the GB includes university/college faculty that often conduct research in collaboration with state fisheries agencies with whom they might share priorities. Overall, a foundation exists for building on how the Steps are currently incorporated into U.S. inland fisheries management (Table 1) to promote broader achievement of both high- and low-ranked topics. Moreover, the similarity among administrators and GB members reveals a platform for integrating the Steps into inland fisheries management at multiple scales (e.g., local, national, international) to address wide-ranging topics in fisheries conservation and elevate the importance of inland fisheries globally. This is no easy task, but we provide the following recommendations based on insights from our surveys:

(1) *Leverage existing resources and collaborations to achieve the Steps.* State fisheries agencies and their partners already have programs and expertise to address some of the

Steps. For instance, Science, Communication, and Assessment are central components of inland fisheries management within U.S. states and across the country. Uniformity in views on the Steps among administrators and GB members suggests a foundation for leveraging resources and partnerships within and across states in support of the Steps, including those not currently emphasized (e.g., Nutrition, Action Plan, Water). However, a science-based approach to management must continue alongside efforts to communicate the importance and management applicability of the Steps and ensure equitable access to inland fisheries resources locally, regionally, and globally.

(2) *Champion steps that are underemphasized yet attainable.* Respondents believed that Nutrition and Equity are inadequately prioritized, yet highly achievable Steps. Collaborative efforts to showcase the nutritional dimensions of freshwater ecosystems and promote equitable access to aquatic resources would raise the profile of inland fisheries and create a more diverse and inclusive fisheries workforce. Fully addressing Equity—including the cultural, economic, and environmental values of inland fisheries—will require new approaches and committed action to foster partnerships with diverse communities and reduce barriers to engaging them in fisheries science and management. Likewise, innovative thinking and partnerships among managers, policymakers, and researchers within and outside the USA will be required to locally, regionally, and globally operationalize a Nutrition- and Equity-focused Action Plan and promote coordinated achievement of multiple steps.

(3) *Implement the Steps by creating and enhancing collaborations among state fisheries agencies and their partners.* While some steps are feasible for individual fisheries agencies to address, other steps—and the large-scale, long-term issues that they encompass (e.g., climate change, species invasion, water quality/quantity)—are beyond the purview of individual organizations (Carlson et al. 2019). For instance, Action Plan, Water, and Governance may be impractical for any agency to address independently, perhaps explaining their relatively low perceived achievability. However, implementing the Steps can and should be a collaborative endeavor. Action Plan, Water, and Governance will become more tractable through partnerships among organizations with wide-ranging expertise in fisheries (e.g., state, federal, and tribal fisheries agencies, cooperative fish and wildlife research units, nongovernmental organizations, cooperative

extension programs, agricultural experiment stations) and other disciplines (e.g., state, federal, and tribal agencies involved in nutrition, food safety, food security, water management, and economics). Multi-agency partnerships could also stimulate greater public awareness of the Steps, and may foster increased support for legislation, policy, or agency efforts to implement them.

(4) *Support the Steps by sustaining inland fisheries monitoring and stakeholder engagement programs.* Although it may be impractical for individual fisheries agencies to address all of the Steps, they often collect information that is essential for doing so. For instance, many agencies practice Assessment and Science by gathering and analyzing long-term data on inland fisheries, and Communication by operating stakeholder engagement programs. These efforts are invaluable for developing approaches to implement other steps (e.g., Valuation, Nutrition, Equity), both within agencies and through multi-agency collaborations. As such, there should be continued efforts to sustain the ability of agencies to monitor inland fish and habitats and engage with stakeholders across space and time.

(5) Continue surveying fisheries stakeholders about the Steps. Despite providing insights for inland fisheries management, our surveys (here and Carlson et al. 2019) have only encompassed state fisheries agency administrators, GB members, and agricultural experiment station directors. As with all groups of people, these respondents likely have personal and professional experiences and potential biases that influence perceptions of the 10 Steps. As such, it would be valuable to also survey inland and marine fisheries biologists and researchers in state, federal, and tribal agencies; scientists at universities and agricultural experiment stations; administrators in federal and tribal fisheries agencies; fisheries and aquaculture professionals from different countries and those who work for international organizations (e.g., Food and Agriculture Organization of the United Nations, WorldFish, International Union for Conservation of Nature); and other fisheries stakeholders, including organized inland fisheries advocacy groups (e.g., Bass Anglers Sportsman Society, Trout Unlimited). Surveying these diverse individuals and organizations would increase knowledge for implementing the Steps—particularly those requiring local, national, and international partnerships (e.g., Action Plan, Water, Governance)—and thereby advance inland fisheries management.

(6) *Identify and apply lessons learned from fisheries management programs that embody the Steps.* Management programs for fishes such as black bass tend to be well developed, large-scale, and long-term, exemplifying many of the Steps in action (Table 1). These programs warrant thorough evaluation relative to the Steps. What elements are most important for program success? What challenges exist, and how can they be remedied to achieve program goals? Lessons learned can be used to integrate the Steps into other inland fisheries management programs.

(7) *Evaluate progress toward the Steps across the world*. We encourage assessments of the Steps in different countries, including developing nations where inland fisheries make critical contributions to human health and livelihoods (Funge-Smith and Bennett 2019). Countries can use this information to enhance fisheries management programs while promoting broader awareness of the Steps throughout the world.

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REFERENCES

Acharya, B. S., and G. Kharel. 2020. Acid mine drainage from coal mining in the United States—an overview. Journal of Hydrology 588:125061.

Allen, M. S., K. I. Tugend, and M. J. Mann. 2003. Largemouth Bass abundance and angler catch rates following a habitat enhancement project at Lake Kissimmee, Florida. North American Journal of Fisheries Management 23:845–855.

Carlson, A. K., W. W. Taylor, M. T. Kinnison, S. M. P. Sullivan, M. J. Weber, R. T. Melstrom, P. A. Venturelli, M. R. Wuellner, R. M. Newman, K. J. Hartman, G. B. Zydlewski, D. R. DeVries, S. M. Gray, D. M. Infante, M. A. Pegg, and R. M. Harrell. 2019. Threats to freshwater fisheries in the United States: perspectives and investments of state administrators and Agricultural Experiment Station directors. Fisheries 44:276–287.

Chen, R. J., K. M. Hunt, and R. B. Ditton. 2003. Estimating the economic impacts of a trophy Largemouth Bass fishery: issues and applications. North American Journal of Fisheries Management 23:835–844.

Cooke, S. J., E. H. Allison, T. D. Beard Jr., R. Arlinghaus, A. H. Arthington, D. M. Bartley, I. G. Cowx, C. Fuentevilla, N. J. Leonard, K. Lorenzen, A. J. Lynch, V. M. Nguyen, S.-J. Youn, W. W. Taylor, and R. L. Welcomme. 2016. On the sustainability of inland fisheries: finding a future for the forgotten. Ambio 45:753–764.

Cooke, S. J., W. M. Twardek, R. J. Lennox, A. J. Zolderdo, S. D. Bower, L. F. G. Gutowsky, A. J. Danylchuk, R. Arlinghaus, and D. Beard. 2018. The nexus of fun and nutrition: recreational fishing is also about food. Fish and Fisheries 19:201–224.

Dieterman, D. J., R. J. H. Hoxmeier, and E. J. Krumm. 2019. Associations between biotic integrity and sport fish populations in upper Midwest, USA rivers, with emphasis on Smallmouth Bass. Environmental Management 63:732–746.

Dotson, J. R., K. I. Bonvechio, B. C. Thompson, W. E. Johnson, N. A. Trippel, J. B. Furse, S. Gornak, C. K. McDaniel, W. F. Pouder, and E. H. Leone. 2015. Effects of large-scale habitat enhancement strategies on Florida Bass fisheries. Pages 387–404 *in* M. D. Tringali, J. M. Long, T. W. Birdsong, and M. S. Allen, editors. Black bass diversity: multidisciplinary science for conservation. American Fisheries Society, Symposium 82, Bethesda, Maryland.

Dutterer, A. C., C. Wiley, B. Wattendorf, J. R. Dotson, and W. F. Pouder. 2014. TrophyCatch: a conservation program for trophy bass in Florida. Florida Scientist 77:167–183.

Embke, H. S., T. D. Beard Jr, A. J. Lynch, and M. J. Vander Zanden. 2020. Fishing for food: quantifying recreational fisheries harvest in Wisconsin lakes. Fisheries 45:647–655.

FAO (Food and Agriculture Organization of the United Nations). 2020. The state of world fisheries and aquaculture: sustainability in action. Available: https://bit.ly/3EeqMMz (January 2021).

Fitzgerald, E. F., S. A. Hwang, M. Gomez, B. Bush, B.-Z.Yang, and A. Tarbell. 2007. Environmental and occupational exposures and serum PCB concentrations and patterns among Mohawk men at Akwesasne. Journal of Exposure Science and Environmental Epidemiology 17:269–278.

Funge-Smith, S. J. 2018. Review of the state of world fishery resources: inland fisheries. Food and Agriculture Organization of the United Nations. FAO Fisheries and Aquaculture Circular No. C942 Rev. 3, Rome. Available: https://bit.ly/3b9cnVp (September 2021).

Funge-Smith, S., and A. Bennett. 2019. A fresh look at inland fisheries and their role in food security and livelihoods. Fish and Fisheries 20:1176–1195.

FWC (Florida Fish and Wildlife Conservation Commission). 2011. Black bass management plan. Florida Fish and Wildlife Conservation Commission. Available: https://bit.ly/3GjVNRc (January 2021).

Golden, C. D., K. L. Seto, M. M. Dey, O. L. Chen, J. A. Gephart, S. S. Myers, M. Smith, B. Vaitla, and E. H. Allison. 2017. Does aquaculture support the needs of nutritionally vulnerable nations? Frontiers in Marine Science 4:159.

Halverson, M. A. 2008. Stocking trends: a quantitative review of governmental fish stocking in the United States, 1931 to 2004. Fisheries 33(2):69–75.

Hansen, J. F., G. G. Sass, J. W. Gaeta, G. A. Hansen, D. A. Isermann, J. Lyons, and M. J. Vander Zanden. 2015. Largemouth Bass management in Wisconsin: intraspecific and interspecific implications of abundance increases. Pages 193–206 *in* M. D. Tringali, J. M. Long, T. W. Birdsong, and M. S. Allen, editors. Black bass diversity: multidisciplinary science for conservation. American Fisheries Society, Symposium 82, Bethesda, Maryland.

Hicks, C. C., P. J. Cohen, N. A. J. Graham, K. L. Nash, E. H. Allison, C. D'Lima, D. J. Mills, M. Roscher, S. H. Thilsted, A. L. Thorne-Lyman, and M. A. MacNeil. 2019. Harnessing global fisheries to tackle micronutrient deficiencies. Nature 574:95–98.

Hunt, K. M., H. L. Schramm Jr., T. J. Lang, J. W. Neal, and C. P. Hutt. 2008. Status of urban and community fishing programs nationwide. Pages 177–202 *in* R. T. Eades, J. W. Neal, T. J. Lang, K. M. Hunt, and P. Pajak, editors. Urban and community fisheries programs: development, management, and evaluation. American Fisheries Society, Symposium 67, Bethesda, Maryland.

Isermann, D. A., J. B. Maxwell, and M. C. McInerny. 2013. Temporal and regional trends in black bass release rates in Minnesota. North American Journal of Fisheries Management 33:344–350.

Islam, D., and F. Berkes. 2016. Indigenous peoples' fisheries and food security: a case from northern Canada. Food Security 8:815–826.

Kawarazuka, N., and C. Béné. 2011. The potential role of small fish species in improving micronutrient deficiencies in developing countries: building evidence. Public Health Nutrition 14:1927–1938.

Long, J. M., M. S. Allen, W. F. Porak, and C. D. Suski. 2015. A historical perspective of black bass management in the United States. Pages 99–122 *in* M. D. Tringali, J. M. Long, T. W. Birdsong, and M. S. Allen, editors. Black bass diversity: multidisciplinary science for conservation. American Fisheries Society, Symposium 82, Bethesda, Maryland.

Lynch, A. J., D. M. Bartley, T. D. Beard Jr., I. G. Cowx, S. Funge-Smith, W. W. Taylor, and S. J. Cooke. 2020. Examining progress towards achieving the 10 Steps of the Rome Declaration on Responsible Inland Fisheries. Fish and Fisheries 21:190–203.

Mekonnen, M. M., and A. Y. Hoekstra. 2016. Four billion people facing severe water scarcity. Science Advances 2:e1500323.

NWIFC (Northwest Indian Fisheries Commission). 2019. Tribal natural resource management: annual report 2019. Treaty Indian Tribes in Western Washington. Available: https://bit.ly/3nr4m42 (January 2021).

Paragamian, V. L. 1991. Stream sedimentation and abundance of Smallmouth Bass. Proceedings of the First International Smallmouth Bass Symposium 1991:55–60.

Penaluna, B. E., I. Arismendi, C. M. Moffitt, and Z. L. Penney. 2017. Nine proposed action areas to enhance diversity and inclusion in the American Fisheries Society. Fisheries 42:399–402.

Philipp, D. P., C. A. Toline, M. F. Kubacki, D. B. F. Philipp, and F. J. S. Phelan. 1997. The impact of catch-and-release angling on the reproductive success of Smallmouth Bass and Largemouth Bass. North American Journal of Fisheries Management 17:557–567.

Reid, A. J., A. K. Carlson, I. F. Creed, E. J. Eliason, P. A. Gell, P. T. J. Johnson, K. A. Kidd, T. J. MacCormack, J. D. Olden, S. J. Ormerod, J. P. Smol, W. W. Taylor, K. Tockner, J. C. Vermaire, D. Dudgeon, and S. J. Cooke. Emerging threats and persistent conservation challenges for freshwater biodiversity. Biological Reviews 94:849–873.

Roos, N., C. Chamnan, D. Loeung, J. Jakobsen, and S. H. Thilsted. 2007. Freshwater fish as a dietary source of vitamin A in Cambodia. Food Chemistry 103:1104–1111.

Schall, M. K., T. Wertz, G. D. Smith, V. S. Blazer, and T. Wagner. 2019. Movement dynamics of Smallmouth Bass (*Micropterus dolomieu*) in a large river-tributary system. Fisheries Management and Ecology 26:590–599.

Seguy, L., and J. M. Long. 2021. Perceived ecological threats and economic benefits of non-native black bass in the United States. Fisheries 46(2):56–65.

Simonson, T. D. 2001. Wisconsin's black bass management plan. Wisconsin Department of Natural Resources. Bureau of Fisheries Management, Administrative Report No. 54, Madison, Wisconsin. Available: https://bit.ly/3BfZX8K (January 2021).

Swingle, H. S. 1970. History of warmwater pond culture in the United States. Pages 95–105 *in* N. G. Benson, editor. A century of fisheries in North America. American Fisheries Society, Special Publication 7, Bethesda, Maryland.

Taylor, A. T., J. M. Long, M. D. Tringali, and B. L. Barthel. 2019. Conservation of black bass diversity: an emerging management paradigm. Fisheries 44(1):20–36.

Taylor, W. W., and Bartley, D. M. 2016. Call to action–The "Rome Declaration": 10 Steps to Responsible Inland Fisheries. Fisheries 41:269,318–319.

U.S. Census Bureau. 2020. Geographic terms and definitions. U.S. Department of Commerce, Washington, D.C. Available: https://bit.ly/3jCZ58u (January 2021).

Venturelli, P. A., K. Hyder, and C. Skov. 2017. Angler apps as a source of recreational fisheries data: opportunities, challenges and proposed standards. Fish and Fisheries 18:578–595.

Welcomme, R. L. 2011. An overview of global catch statistics for inland fish. ICES Journal of Marine Science 68:1751–1756.

Zhao, L., J. Sun, Y. Yang, X. Ma, Y. Wang, and Y. Xiang. 2016. Fish consumption and all-cause mortality: A meta-analysis of cohort studies. European Journal of Clinical Nutrition 70:155–161.

Table Captions

Table 1. Themes and descriptions of the 10 Steps to Responsible Inland Fisheries developed at the Global Conference on Inland Fisheries: Freshwater, Fish and the Future, convened at Food and Agriculture Organization of the United Nations Headquarters in Rome, January 26–28, 2015. Linkages between the Steps and U.S. inland fisheries management are exemplified for black bass *Micropterus* spp. given their wide distribution, popularity, and socioeconomic importance.

Table 2. Types of questions and measures used for the fisheries administrator (FA) and American Fisheries Society Governing Board (GB) member surveys.

Table 3. Median rankings (interquartile range) of the Steps by importance at two scales: job duties (Duties) and global advancement of inland fisheries conservation (Global). Within columns, rankings are organized from most to least important (largest to smallest median).

Table 4. Percentages of respondents (n = 45–49) who stated that the Steps are currently being prioritized and funded “Exceptionally well,” “Adequately,” “Inadequately,” or “I don’t know” in the U.S. state where they primarily work (before comma) and across the inland fisheries profession (after comma).

Table 5. Percentages of respondents (n = 47–48) who rated the Steps with different levels of overall achievability (i.e., “Readily achievable,” “Achievable with some difficulty,” “Not achievable,” “I don’t know”).

Table 6. Rankings of the Steps, including category-specific rankings for job–duty importance (Duties), global advancement importance (Global), in-state prioritization and funding (State), across-profession prioritization and funding (Profession), and achievability. “Overall” indicates overall rankings calculated by summing category-specific rankings; the lower the sum, the higher the overall ranking. Category-specific rankings for State and Profession were calculated from sums of the "Exceptional" and "Adequate" groups; rankings for Achievability were calculated from the "Readily achievable" group. In the table, the same number within a column indicates a tie.

Figure Captions

Figure 1. Global marine and inland capture fisheries landings and aquaculture production in 1950–2018. Data from FAO (2020).

Figure 2. Violin plot displaying the distribution of Step rankings across respondents relative to importance for (A) job duties and (B) global advancement of inland fisheries. Note the y-axis scale, where larger numbers correspond with higher rankings (greater importance). White triangles are median rankings, thick black bars are interquartile ranges, thin black lines are upper and lower adjacent values, and violin shape represents probability density (width = ranking frequency). In panel B, Nutrition is marked with an asterisk because it had significant differences in median rankings between administrators in the northern and southern (but not western) USA ($P = 0.029$, KW test). See Table 1 for descriptions of the Steps.

Table 1. Themes and descriptions of the Ten Steps to Responsible Inland Fisheries developed at the Global Conference on Inland Fisheries: Freshwater, Fish and the Future, convened at FAO Headquarters in Rome, Italy, January 26–28, 2015. Linkages between the Steps and U.S. inland fisheries management are exemplified for black bass Micropterus spp., given their wide distribution, popularity, and socioeconomic importance.

Step	Theme	Description	Black bass examples
1	Assessment	Improve the assessment of biological production to enable science-based management	Assessment via spring electrofishing, nest/egg/larva/fry counts, summer seining, bioenergetics simulations, angler citizen-science programs, angler apps, and remote sensing (Paragamian 1991; Dutterer et al. 2014; Venturelli et al. 2017)
2	Valuation	Correctly value inland aquatic ecosystems	Valuation via stakeholder surveys (e.g., creel, mail, online), economic analyses, fishing tournaments and publicity, and Micropterus spp. conservation programs (e.g., genetic integrity, watersheds; Chen et al. 2003; Dieterman et al. 2019; Taylor et al. 2019)
3	Nutrition	Promote the nutritional value of inland fisheries	Nutrition via historical (and limited current) use as food fish, role as predators in inland fisheries that make important nutritional contributions (Isermann et al. 2013; Long et al. 2015; Embke et al. 2020)
4	Science	Develop and improve science-based approaches to fishery management	Science via diverse research, including biotic/abiotic population drivers, experimental analysis of catch-and-release angling effects, and use of big data to evaluate long-term, large-scale effects of harvest regulations and climate change (Swingle 1970; Philipp et al. 1997; Hansen et al. 2015)
5	Communication	Improve communication among freshwater users	Communication via public outreach, angler motivation/attitude/behavior research, trophy fish citizen science programs, and Micropterus-focused indices of biotic integrity to convey importance of watershed conservation (FWC 2011; Dutterer et al. 2014; Dieterman et al. 2019)
6	Governance	Improve governance, especially for shared water bodies	Governance via movement research and associated transboundary management programs, which are important as ranges of Micropterus spp. expand due to climate change and legal and illegal introductions (Schall et al. 2019; Seguy and Long 2021)

7	Water	Develop collaborative approaches to cross-sectoral integration in water-resource development agendas	Water via research on linkages between Micropterus populations, water resource development, and water quality, designed to produce water management approaches that fully consider fisheries (Allen et al. 2003; Dotson et al. 2015)
8	Equity	Respect equity and rights of stakeholders	Equity via community fisheries programs that create accessible fishing opportunities for black bass and other species and support broader aspects of the angling experience (e.g., outdoor recreation, nature appreciation, time with family/friends, food provisioning; Hunt et al. 2008)
9	Aquaculture	Make aquaculture an important ally	Aquaculture via Micropterus spp. stocking programs, which were historically abundant, serve important purposes today (e.g., creating/rehabilitating fisheries, supporting freshwater mussel conservation), and demand attention to genetic concerns (Long et al. 2015)
10	Action plan	Develop an action plan for global inland fisheries	Action plan via state-agency black bass management plans that encompass the Steps, and action plans that protect endemic black bass (Shoal Bass Micropterus cataractae, Guadalupe Bass M. treculii) at watershed scales (Simonson 2001; FWC 2011; Taylor et al. 2019)

Table 2. Types of questions and measures used for the fisheries administrator (FA) and American Fisheries Society Governing Board (GB) member surveys.

Topic	Survey	Measures
Employer	GB	Type of employer (current or most recent, if retired; e.g., state agency, federal agency, university)
Job duties	Both	Percentage of work hours spent performing different roles (biologist, technician, manager, researcher, administrator, professor, consultant, other—please specify)
Career duration	Both	Years served in fisheries (not counting college/university education)
Work location	GB	Names of the U.S. state(s) or country(ies) where one's work occurs
Agency location	FA	Optional question about U.S. state agency where employed
Importance (duties)	Both	Ranked importance of the Steps relative to performing one's job duties
Importance (global)	Both	Ranked importance of the Steps relative to advancement of inland fisheries science, management, and governance throughout the world
Status (in-state)	Both	Rating of how the Steps are being prioritized and funded in the U.S. state where one works
Status (profession)	Both	Rating of how the Steps are being prioritized and funded across the fisheries profession
Achievability	Both	Rating of achievability (relative ease/difficulty of accomplishment) of the Steps
Other steps	Both	Proposed additions to the Steps based on one's professional experience (open-ended)
Explanation (duties)	Both	Optional explanation why some of the Steps are more important than others for performing one's job duties

Explanation (global)	Both	Optional explanation why some of the Steps are more important than others for advancing inland fisheries science, management, and governance throughout the world
Comments	Both	Optional comments about survey

Table 3. Median rankings (interquartile range) of the Steps by importance at two scales: job duties (Duties) and global advancement of inland fisheries conservation (Global). Within columns, rankings are organized from most to least important (largest to smallest median).

Duties	Global
Science 7 (6)	Governance 7 (3)
Communication 7 (5)	Science 6.5 (5)
Assessment 6 (4)	Communication 6 (2)
Valuation 6 (4)	Valuation 6 (6)
Equity 6 (4)	Water 6 (4)
Water 6 (3)	Equity 5.5 (4)
Governance 6 (3)	Assessment 5 (5)
Aquaculture 4 (6)	Aquaculture 4 (5)
Nutrition 3 (6)	Nutrition 4 (5.75)
Action Plan 2 (5)	Action Plan 2 (6)

Table 4. Percentages of respondents (n = 45–49) who stated that the Steps are currently being prioritized and funded "Exceptionally well," "Adequately," "Inadequately," or "I don't know" in the U.S. state where they primarily work (before comma) and across the inland fisheries profession (after comma).

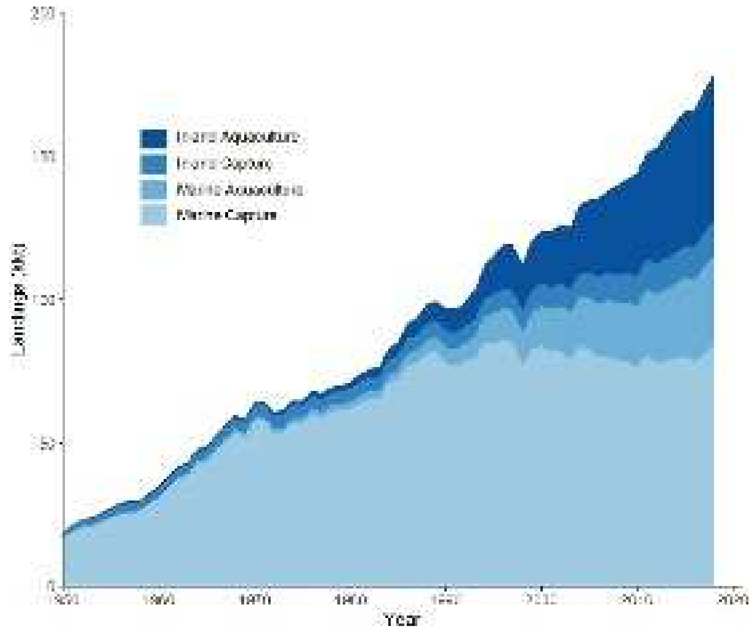
Step	Theme	% Exceptionally well	% Adequately	% Inadequately	% I don't know
1	Assessment	19, 13	65, 50	14, 26	2, 11
2	Valuation	2, 4	47, 31	45, 52	6, 13
3	Nutrition	0, 2	27, 20	52, 48	21, 30
4	Science	42, 28	52, 54	4, 11	2, 7
5	Communication	2, 2	66, 44	30, 43	2, 11
6	Governance	6, 2	73, 44	17, 41	4, 13
7	Water	4, 2	42, 29	52, 52	2, 17
8	Equity	9, 2	53, 38	32, 40	6, 20
9	Aquaculture	6, 0	38, 37	41, 41	15, 22
10	Action plan	0, 2	8, 11	50, 37	42, 50

Table 5. Percentages of respondents (n = 47–48) who rated the Steps with different levels of overall achievability (i.e., "Readily achievable," "Achievable with some difficulty," "Not achievable," "I don't know").

Step	Theme	% Readily	% Some difficulty	% Not achievable	% I don't know
1	Assessment	48	50	0	2
2	Valuation	19	67	8	6
3	Nutrition	63	27	0	10
4	Science	63	33	0	4
5	Communication	43	55	0	2
6	Governance	15	79	4	2
7	Water	15	68	9	8
8	Equity	34	62	2	2
9	Aquaculture	29	59	4	8
10	Action plan	9	49	21	21

Table 6. Rankings of the Steps, including category-specific rankings for job-duty importance (Duties), global advancement importance (Global), in-state prioritization and funding (State), across-profession prioritization and funding (Profession), and achievability. "Overall" indicates overall rankings calculated by summing category-specific rankings; the lower the sum, the higher the overall ranking. Category-specific rankings for State and Profession were calculated from sums of the "Exceptional" and "Adequate" groups; rankings for Achievability were calculated from the "Readily achievable" group. In the table, the same number within a column indicates a tie.

		Importance		Prioritization & Funding			
Step	Theme	Duties	Global	State	Profession	Achievability	Overall
1	Assessment	3	7	2	2	3	3
2	Valuation	3	3	6	7	7	6
3	Nutrition	9	8	9	9	1	9
4	Science	1	2	1	1	1	1
5	Communication	1	3	4	3	4	2
6	Governance	3	1	3	3	8	4
7	Water	3	3	7	8	8	7
8	Equity	3	6	5	5	5	5
9	Aquaculture	8	8	7	6	6	8
10	Action plan	10	10	10	10	10	10



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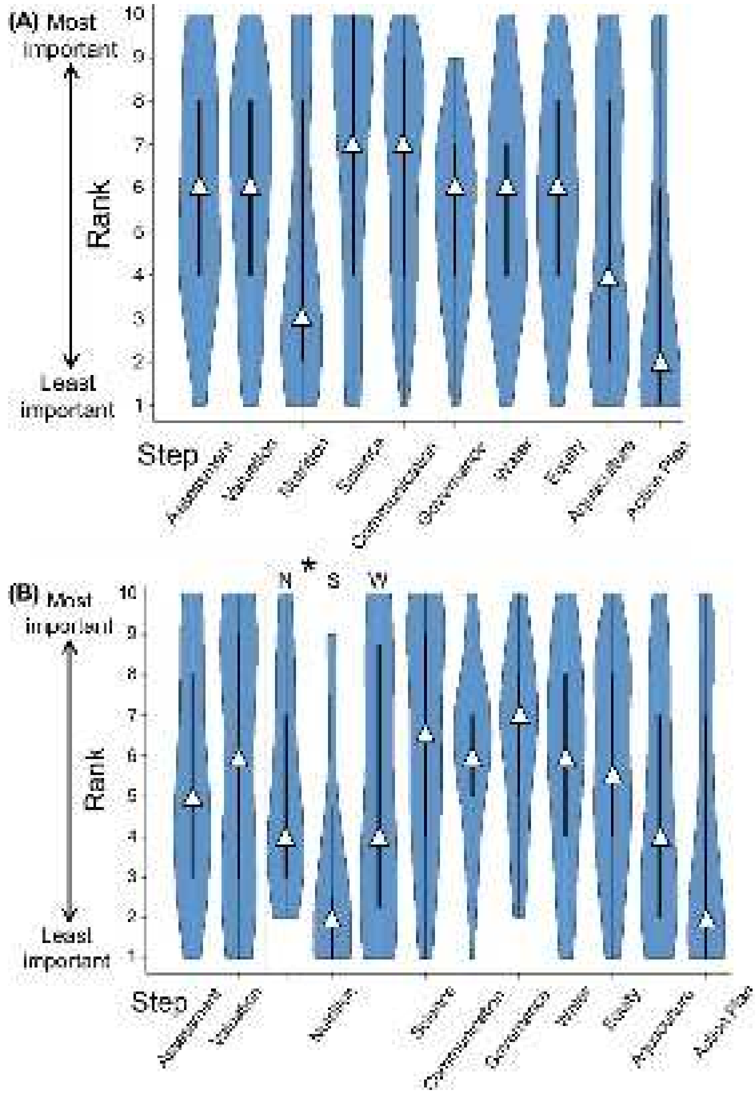

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