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# InFish: A Professional Network to Promote Global Conservation and Responsible Use of Inland Fish

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Photo: Beth Beard


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Inland fishes and fisheries make substantial contributions to individuals, society, and the environment in a changing global landscape that includes climate, water allocations, and societal changes. However, current limitations to valuing the services provided by inland fish and their fisheries often leaves them out of key decision-making discussions. InFish is a voluntary professional network with over 120 members from over 50 organizations in over 20 countries that seeks to address challenges facing inland fish through novel approaches and international collaborations. InFish fosters opportunities to share knowledge, pursue proposals, publications, and conference-related events focused on inland fisheries. InFish has become a source of inland fisheries expertise, working collectively towards global conservation and sustainable use of inland fish through informing scientifically sound management practices. As such, InFish may serve as a model network for other natural resource challenges now and into the future.

## THE INLAND ISSUE

> Freshwater ecosystems are often ignored in the same way we ignore our own breathing; they are such an essential part of our lives that we sometimes forget them until something goes wrong.
>
> Shannon D. Bower, Fisheries Researcher, Ottawa

Inland fish (we use the general term "fish" in colloquial reference but, in most instances, "fishes" is more technically accurate as many issues affecting inland fish and their fisheries involve multiple species) are aquatic organisms found in inland waters—lakes, rivers, streams, canals, reservoirs, and other land-locked waters (FAO 2014). Although inland habitats comprise approximately 0.01% of the total surface of the earth, these species represent 9.5% of the total number of species recognized globally (Balian et al. 2008). The harvest of inland fish contribute an estimated 12.7% of the global production of fish from capture fisheries and 19.8% of fish produced from freshwaters (2017 values; FishStatJ 2019), with the remaining production coming from aquaculture (Lynch et al. 2016). While this may seem modest, the importance of inland fishery production becomes clear in the context of where and how this harvest is used. More than 90% of inland fisheries catch is used for direct, local human consumption and 95% comes from developing countries, providing high quality nutrition to predominantly rural, low income populations (FAO 2016; Fluet-Chouinard et al. 2018; Funge-Smith 2018). Non-consumptive recreational use, cultural practice, and biodiversity conservation compound the value of inland fish, often in non-monetary ways (Dudgeon et al. 2006; Cowx et al. 2010; Lynch et al. 2016). The 2015 non-market use value of global inland recreational fishing, alone, was estimated to be between US$64.55 billion and $78.55 billion (Thorpe et al. 2018).

Despite their importance, inland fisheries do not generally attract high profile funding for research and development, or factor strongly into policy decisions at the global scale as they are seen to be a resource that is already under constraints with limited potential for intensification or increased production. In comparison, new high-profile marine initiatives (e.g., the Global Ocean Commission [http://bit.ly/39lOyHv], Sea Around Us [https://bit.ly/2SNCg3q]) have increased awareness, political will, and funding for marine issues. The global inland fisheries research community faces challenges to raise the profile of this important resource; it is geographically dispersed and the lack of direct connectivity of many inland systems between countries (compared to how the ocean links many countries) further exacerbates the challenge of generating the critical mass needed for collaborative opportunities. The heterogeneity and complexity of inland fisheries further complicates efforts to build a common framework to increase awareness of their value.

## THE INFISH SOLUTION

> [It all] starts with conversations—formal and informal—between passionate scientists in the field of fisheries.
>
> Gretchen Stokes, University of Florida, Gainesville

The InFish network (Figure 1; http://infish.org/) began in 2012 as a voluntary group of fisheries researchers working on issues surrounding the important role that inland fish and fisheries play in food, livelihoods, recreation, and broader society. InFish members are dedicated fish and fisheries professionals from around the world who aim to serve as knowledge brokers for freshwater, fish, and the future. InFish is an inclusive (i.e., no membership fees) network for fisheries professionals who look beyond "the fish bowl" to other sectors that impact inland fish. By bringing together individuals and groups with similar goals and objectives, InFish seeks to build momentum in raising the global profile of inland fish by informing policy and advancing sustainable management and conservation. The network works collectively towards global conservation and sustainable use of inland fish through informing scientifically sound management practices (Table 1).

InFish is neither a classical (i.e., fee paying) organization of research professionals, such as the American Fisheries Society (AFS), nor a formal inter-governmental fishery body, such as the European Inland Fisheries and Aquaculture Advisory Commission. It does not replace the specific professional networking and development opportunities that those organizations foster. Rather, InFish aims to complement these organizations and work with them on a narrowly scoped mandate of inland fish issues.

The origins of InFish can be traced to 2010 and initial cooperation between research groups from Carleton University, the Food and Agriculture Organization of the United Nations (FAO), Michigan State University, United States Geological Survey's Great Lakes and National Climate Adaptation Science Centers, and the University of Hull International Fisheries Institute (UK) seeking to identify common research areas (outlined in Beard et al. 2011) that would help resolve some of the fundamental problems in understanding how inland fisheries operate and to promote their importance in international settings. Since then, the group has expanded to over 120 professionals working on inland fisheries that include over 50 organizations based in more than 20 countries (Figure 2). Since 2013, members of the InFish network have jointly published over 25 peer review articles, hosted numerous symposia and other conference events, and were instrumental in the organization of the 2015 Global Conference on Inland Fisheries held at the


Figure 1. InFish Research Network (http://infish.org/) logo.

Table 1. InFish Research Network (http://infish.org/) core objectives and example activities.

| | Core InFish objectives | Example InFish activities |
|---|---|---|
| | Advance understanding of inland fish | • Monthly calls, in-person meetings<br>• Conference sessions |
| | Inform policy relevant to inland fish and fishers | • Policy-maker briefings<br>• Feedback on policy initiatives |
| | Raise awareness of importance of inland fish and fisheries to food security, nutrition, and livelihoods and address relevant issues | • Syntheses and perspective pieces<br>• Conference sessions |
| | Build capacity and foster professional development within the global inland fisheries community | • >120 members (>30 student/early career)<br>• >50 organizations, >20 countries |

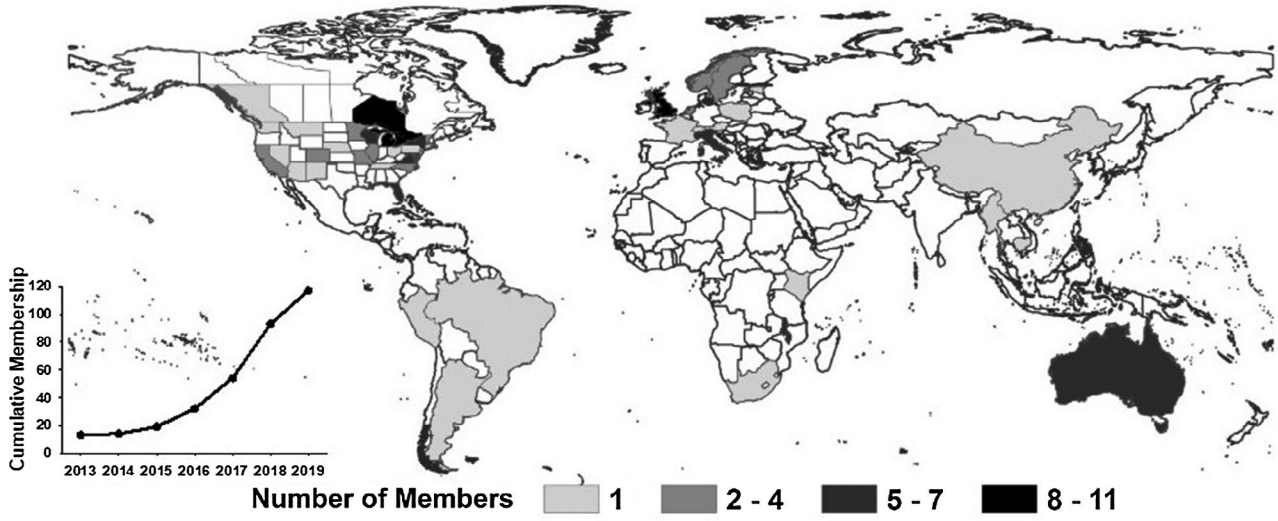


Figure 2. Geographic and temporal representation of the InFish Research Network (http://infish.org/) distribution list. Note that the locations listed are home institutions of InFish members and do not fully represent the broader regional expertise present in the network.

FAO headquarters in Rome. This event brought together more than 200 scientists, decision makers, fishery managers, and representatives from industry and nongovernmental organizations from every inhabited continent to discuss the governance, food security, information needs, and drivers associated with inland fisheries (FAO and MSU 2016).

## FOUR CORE OBJECTIVES OF INFISH

> InFish fills a niche that no other professional network can for inland fish issues.
>
> Rafaela Schinegger, University of Natural Resources and Life Sciences, Vienna

InFish network participation has grown exponentially in recent years, particularly expanding to researchers from developing countries seeking professional networking and collaborative opportunities. While members have varied interests and expertise, InFish has united as a network around four core objectives: (1) advance understanding of inland fish; (2) inform policy relevant to inland fish and fishers; (3) raise awareness of the importance of inland fish and fisheries to food security, nutrition, and livelihoods and address relevant issues; and (4) build capacity and foster professional development within the global inland fisheries community (Table 1). The measurement of success for the InFish network is the extent of progress towards these four objectives. Though these objectives are specific to InFish, we believe a similar core mission could spur establishment of other similar networks looking to "jump out of the fish bowl," look beyond small geographic areas, focus on more than a narrow suite of species, and engage with other sectors.

### Advance Understanding of Inland Fish

> The breadth of membership is clearly building towards opportunity to coalesce inland fisheries knowledge from the around the world like has not been done before.
>
> Andrew M. Deines, Exponent Incorporated, Menlo Park, California

One objective of the InFish network is to exchange ideas and advance our understanding of inland fish and fisheries issues, which has been done through conference calls, in-person

Figure 3. Attendees at a recent InFish Research Network (http://infish.org/) in-person meeting held at U.S. Geological Survey Headquarters (2018, Reston, Virginia).

meetings (Figure 3), group publications, sponsored symposia (e.g., "Extreme Events and Inland Fish" at the 2018 AFS Annual Meeting in Atlantic City, New Jersey), and serve as a resource for those who want to share their knowledge, provide input, or receive advice from other inland fisheries experts. InFish conducts monthly conference calls during which members discuss current topics, upcoming proposals and meetings, and often have research webinars from members. The network attempts to have an in-person meeting annually that typically focuses on specific topics that turn into group manuscripts (e.g., Lynch et al. 2016, 2017a, 2017b) with a goal of informing policy relevant to inland fisheries. As the network has grown, InFish has become a source of inland fisheries expertise worldwide. Various conservation groups, agencies, and academics have approached InFish for advice on strategic initiatives and research scoping.

### Inform Policy Relevant to Inland Fish and Fishers

> InFish is effective at informing policy because it fosters trust and open communication among those with experience generating policy, those in a position to deliver the united message of the network, and those with the professional connections and foresight to provide guidance on the mechanisms and steps needed to increase the chance of effective outcomes.
>
> Ralph Tingley, University of Missouri, Columbia

A second objective of the InFish network has been to help inform policy development and implementation that is relevant to inland fish and fisheries. Perhaps because a majority of InFish members have a research focus, InFish has been well positioned to identify and convey knowledge gaps at local, national, and global levels. For example, in 2018, five InFish members conducted a roundtable discussion with U.S. congressional staffers on the ecological and economic effects of extreme events (e.g., hurricanes, floods, droughts) on inland fish and their fisheries (available: http://bit.ly/39v0MO4). At a larger scale, InFish researchers have sought to improve the estimates of global inland fisheries (e.g., Deines et al. 2017; Fluet-Chouinard et al. 2018), which may ultimately raise their profile by demonstrating the value of inland fisheries for relevant policy decisions (e.g., water use). To have the greatest impact on policy, however, these research initiatives need active engagement within the management and policymaking sphere. Some InFish members are actively working at this interface through bridging organizations (e.g., Conservation International) to provide advice on relevant policy initiatives (e.g., the Convention on Biological Diversity's [CBD] post-2020 Global Biodiversity Framework and the United Nations' [UN] 2030 Agenda for Sustainable Development). However, managers and policymakers are still underrepresented in our ranks and InFish would welcome adding these valuable perspectives to our network.

### Raise Awareness of Importance of Inland Fish and Fisheries to Food Security, Nutrition, and Livelihoods and Address Relevant Issues

> InFish members are interfacing with diverse stakeholders…and through various mechanisms, including publishing manuscripts, will generate broad attention by decision makers (e.g., UN SDGs).
>
> Karen Murchie, Shedd Aquarium, Chicago

As inland fisheries are often considered invisible, especially compared with the contribution by marine fisheries to societal needs (Cooke et al. 2016), they are also rarely considered explicitly in international consultations and development agendas (e.g., UN Sustainable Development Goals, CBD Aichi Targets). Therefore, a third objective of the InFish network is to address this lack of awareness by raising the profile of the sector through proactive engagement with different water resource sectors (e.g., International Water Association annual conference, Brisbane, Australia, 2017; Sustainability and Development Conference, Ann Arbor, Michigan, 2018; International Hydropower and Fisheries conference, Albury, Australia 2018; World Water Week, Stockholm, 2018 and 2019), social media (e.g., InFish website, member Twitter accounts communicating success stories), food security workshops and accounting for their more realistic contributions to food security (e.g., improved estimation of the social, environmental, economic, and governance contributions of global small-scale fisheries through the FAO/Worldfish/Duke University Illuminating Hidden Harvest initiative), and through strategic publications highlighting the importance of inland fisheries to achieving global development targets (e.g., Lynch et al. 2016, 2017b). The InFish network will continue to promote inland fish, fisheries, and their habitats through global and regional cross-sectoral conferences to bring together stakeholders from different water resource and food sectors that impact these valuable resources.

### Build Capacity and Foster Professional Development within the Global Inland Fisheries Community

> InFish promotes the training of young professionals and fosters professional development as it is an inclusive network that facilitates collaborative discussions amongst professionals and early career scientists that are passionate about inland fisheries.
>
> Amanda Jeanson, Carleton University, Ottawa

A fourth objective of the InFish network is to grow and engage with other partner networks while creating a supportive

mentoring environment for students and early career professionals. Indeed, from its inception, the InFish network has brought together people from different career stages as an opportunity to enrich training experiences and provide a forum to collaborate with other like-minded individuals (e.g., breakout sessions at AFS meetings and World Fisheries Congresses). The network currently has over 30 student and early-career members, almost one-third of the full network. Although the majority of the founding members were based in North America, InFish is, by definition, inherently international and this is reflected by the fact that InFish now has members based in over 20 countries (Figure 2), including Argentina, Australia, Austria, Brazil, China, Malawi, Myanmar, Norway, Peru, South Africa, Thailand, and the United Kingdom, as well as members with work in additional locations. This increase in diversity was primarily through word of mouth and networking, showing that InFish is gaining credibility at an international scale. The InFish network has been developing formal and informal strategic partnerships with allied organizations such as AFS, FAO, World Wide Fund for Nature (WWF), Conservation International, the Fisheries Conservation Foundation, and the Alliance for Freshwater Life. At its most basic level, InFish provides the forum for members to engage as appropriate for their personal and professional needs.

## FUTURE OPPORTUNITIES FOR THE INFISH NETWORK

The InFish network has the potential to achieve great strides in advancing the cause of inland fish and fisheries.

Ana T. Silva, Norwegian Institute for Nature Research, Trondheim, Norway

InFish is a diverse and growing group. During our most recent in-person meeting in 2019, InFish members dedicated substantial time to a visioning exercise to ensure that our network is meeting the evolving needs of our community. One of the main goals was to galvanize our community around specific working groups, including communications, engagement, synthesis exercises, regional hubs, capacity building, and thematic topics. As our network grows in numbers and geographic footprint, these smaller groups will still help us achieve the broader objectives of the InFish network. Below, we describe what we see as growing edges for our group in terms of how we operate and what we do. These approaches, though particular for InFish, may be suitable for others looking to establish similar groups on other topics.

### Communications

InFish provides a wider, international perspective for all, with ready connection to other international researchers.

John Koehn, Arthur Rylah Institute for Environmental Research, Heidelberg, Victoria, Australia

The intent of the communications working group is to develop communications products that are both internal (within InFish) and external (focused on sharing information with the broader community). Internal communications are essential in an effort to ensure that InFish members are able to learn from each other and identify opportunities to engage. External communications focus on raising the profile of inland fisheries (e.g., Too Big To Ignore partnership, World Fish Migration Day) and also growing the InFish community (i.e., recruiting new members). InFish has developed a number of communications products, most notably a story map that details the importance of inland fisheries to livelihoods (available: https://bit.ly/3279AXB) as a complement to a peer-reviewed InFish publication (Lynch et al. 2017b). InFish members were also actively involved in developing the communication products associated with the Global Conference on Inland Fisheries, such as a brochures and graphics of the Ten Steps to Responsible Inland Fisheries (available: https://bit.ly/2V-2vKsE; https://bit.ly/2HByDIK). One additional goal for this working group is to highlight success stories in inland fisheries as important communication currency in raising the profile of inland fish issues.

### Engagement

Agency and non-academic institution members in the network are key.

Chelsie Romulo, University of Northern Colorado, Greeley

Beyond a traditional professional organization, such as AFS, which focuses on connecting individuals within the same field, InFish focuses on external connections. Engagement with the wider community (Box 1) using freshwater presents an excellent opportunity to help conserve and manage inland fishery resources and the ecosystems on which they depend. This was recognized in *The Rome Declaration: Ten Steps to Responsible Inland Fisheries* (FAO and MSU 2016) and InFish members also identified this need for a focused working group on the topic. Fishing is often not the main cause for declines in inland fisheries (though we acknowledge there are exceptions; e.g., Post et al. 2002; Embke et al. 2019); habitat loss and degradation from draining wetlands, land-based pollution, fragmentation, water abstraction, and agriculture all have substantial adverse impacts on fishery resources (FAO 2010). Consequently, engaging these additional sectors is essential for making any progress. Aquaculture, highlighted in *The Rome Declaration* and by InFish members alike, is one sector of particular interest for the InFish community. Aquaculture will be essential in many areas of the world to feed growing human populations. At present, aquaculture is the main reason for the deliberate introduction of non-native species, which has been shown to have costs and benefits to inland fisheries productivity and sustainability (FAO 2015). It will be essential to engage aquaculturists and other users of freshwater in constructive

Box 1 The wider community includes, *inter alia*, nongovernmental organizations such as WWF, International Union for Conservation of Nature, and The Nature Conservancy; intergovernmental organizations such CBD, FAO, the International Water Management Institute, UN Environment Programme, UN Educational, Scientific, and Cultural Organization, and the WorldFish Center, all of whom have shown willingness to work in a cooperative and collegial manner with the fishery sector. Professional organizations such as AFS, the Asian Fishery Society, the Fisheries Society of the British Isles, and the Alliance for Global Water Adaptation are also important. The technical sectors such as waste water treatment, hydro-electric generation, and irrigation have been more difficult to engage, but efforts must be made to do so.

and mutually beneficial dialogue. The breadth of experience within the InFish network should greatly facilitate this engagement.

### Synthesis Exercises

> InFish is well positioned to assemble and synthesize different forms of evidence to help inform policy and practice related to the management and conservation of inland fish populations and fisheries and identify knowledge gaps to be addressed with future research.
>
> Sui Phang, University of Portsmouth, UK

Synthesis of ideas and knowledge serve important roles in civil society as it is well established that decision makers prefer to rely on evidence syntheses rather than individual empirical studies (Walsh et al. 2015). Moreover, such syntheses often help to direct future research by identifying research gaps. InFish has already conducted a number of synthesis activities—some perspective articles and some reviews—but there is much room to conduct syntheses to enable evidence-informed decision making related to inland fish. The fact that freshwater fish conservation actions are absent from the Conservation Evidence database (https://bit.ly/2HxdLCn) is telling. *What inland restoration activities work? What are the best strategies for managing mosquito net fisheries? How do we best assess inland fisheries?* InFish members identified synthesis as an important working group because the network can play a role in identifying and prioritizing topics and serving as an opportunity for building diverse teams to investigate possible solutions to them. Moreover, a number of InFish members have expertise in evidence synthesis so there are additional mentoring and training opportunities.

### Regional Hubs

> We are building a community of practice within InFish…regional hubs [can provide] an opportunity for more voices to be heard and to provide forums for exploring regional issues.
>
> Ian Harrison, Conservation International, Arlington, Virginia

InFish is an expanding network of experienced and early career scientists and managers, largely operating from industrialized countries. Given the most important inland fisheries in terms of food security and livelihoods are found in countries with developing and emerging economies, it makes sense to encourage participation from like-minded scientists and managers from these regions. This participation is hampered by problems with time zones, access to stable communication channels, and cultural diversity. To overcome this issue, the network is forming a working group to explore opportunities to establish regional hubs to cater for local needs and build capacity to contribute to global issues. One mechanism under discussion is rolling out and building on the outputs and outcomes of the 2015 Global Conference on Inland Fisheries through a series of regional conferences. This would establish a platform for regional hubs and facilitate greater opportunities for collaboration to promote inland fisheries in the wider development sector.

### Capacity Building

> The experience among InFish members is exceptional, with a high potential to offer student or early career mentoring programs, however, a well-defined process may be needed to meet expectations.
>
> Julie Claussen, Fisheries Conservation Foundation, Champaign, Illinois

Mentorship of students and early-career professionals is an important part of natural resources conservation and management. The InFish network is an open forum where anyone can join; students and early career professionals are welcome and are fully engaged in network activities. The intent of the capacity building working group is to ensure that the InFish network is an even more supportive and inclusive environment. Opportunities exist for students and early-career professionals to lead or co-author InFish publications (e.g., Youn et al. 2014; Reid et al. 2018). However, there is no formal mentorship program in the network. This is challenging given there is no funding for InFish, but the working group will consider efforts to link students or early career professionals with mid/late-career professionals to further provide more engaging mentorship opportunities.

### Thematic Topics

> Timely, solution-oriented thematic topics can support science-based efforts to better inform policy.
>
> Bonnie Myers, North Carolina State University, Raleigh

Recognizing and promoting the value of inland fisheries to nutritional, economic, cultural, recreational and other important uses in terms of inland aquatic ecosystems is a core value of InFish. Beyond this, one advantage of the network is the members are highly diverse and have specific topics of interest and expertise. InFish plans to establish specific thematic working groups organically around topics of interest to subsets of members of the network. Thematic working groups are currently under consideration include: follow-up to *The Rome Declaration and its Ten Steps to Responsible Inland Fisheries* (FAO and MSU 2016), swimways and fish passage, artisanal inland fishing, sustainable aquaculture, citizen science, and local ecological knowledge. InFish provides a multi-national, science-based resource of technical expertise to inform decisions and particular focus on any of these thematic topics can help improve inland fisheries management in the future.

## VALUE OF INFISH NETWORK TO MEMBERS

> InFish provides access to a diverse network of interdisciplinary people that work on large-scale issues related to the social, economic, and ecological aspects of fish and fishery conservation. I benefit personally as an early career researcher by engaging with later-career people and learning about global issues faced by inland fisheries. In addition, I view it as a way to expand my network of collaborators and professionals.
>
> Elizabeth Nyboer, Carleton University, Ottawa

As with any professional network or community, InFish is only as good as what the members voluntarily invest to

maintain it. We believe InFish has been successful to date because members find value in it being cross-sectoral; looking beyond fisheries to engage with the broader system of water resource users. InFish provides a voice for inland fish and fisheries in the broader water resource landscape. If these issues were simple and straight forward, we would not need new ways to address them, but InFish serves a niche within our inland fisheries community to foster collaborative opportunities to tackle these complex issues at local, regional, and even global scales. While most inland fisheries management occurs at a local scale, we have found the global InFish network to be valuable for engaging in high-level policy, which can establish moral authority for local action (e.g., *The Rome Declaration and its Ten Steps to Responsible Inland Fisheries* can be downscaled to national implementation, with elements relevant to local communities).

With this specific focus on inland fish, InFish provides targeted opportunities to reach beyond formal, professional societies for academia and research. Members see value in the diversity of the network, the focus on the science–policy interface, and the informal, yet structured, opportunities to share experiences, opportunities, and collaborations. In addition, InFish is organic with no specific funding tied to the network (likewise, there are no dues or membership fees to join). This format does dictate that participants in the network contribute purely because they have a strong interest in the purpose of the group, without any obligations tied to funding, a contract, or organizational mission statement.

## AN OPEN INVITATION TO JOIN INFISH

> [InFish] provides a space to share research with and learn from people conducting similar research in different contexts around the world.
>
> Joel Betts, Michigan State University, East Lansing

The InFish network is composed of a wide variety of individuals, all of whom have a deep appreciation and commitment to the conservation and responsible use of inland fish and fisheries. As members of InFish, we are involved in protecting and enhancing these fisheries for all the values they provide to local ecosystems and the people with which they are associated. This network provides a means to share knowledge that will improve our ability as a global community to preserve global inland fisheries for future generations. We have found InFish to be helpful in increasing collaboration and funding opportunities for inland fish throughout the world through its ever-increasing communication network and inclusion of a wide variety of individuals and organizations that now actively participate in the InFish network activities.

As fisheries managers, researchers, and professionals, as well as *Fisheries* readers, we invite you to join this vibrant and exciting network and look forward to the unique skills, thoughts, and experiences you have regarding the best ways to enhance the conservation and value of inland fish locally, regionally, and globally. We also encourage you to pass this invitation along to colleagues, particularly those focused on management and policy. To learn more information on the InFish network, including recent activities and how to join, please visit http://infish.org/.


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