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Involving recreational fisheries stakeholders in development of research and conservation priorities for mahseer (*Tor* spp.) of India through collaborative workshops

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ABSTRACT

The mahseer (*Tor* spp.) of India are a group of potamodromous cyprinids currently facing numerous challenges in their native ranges including overfishing, pollution, and hydropower development. As a result of such challenges, four of the seven Indian species of *Tor* have been listed as 'Endangered' on the IUCN Red List, including two of the most popular recreationally fished species, *Tor khudree* and *Tor putitora*. Stakeholders in the mahseer recreational fishery may serve as an ally for this group of iconic fishes, fostering aquatic stewardship and providing livelihood alternatives for poachers. Yet, information regarding species-specific responses to recreational fishing practices is lacking and a 2009 decree equating fishing with hunting in the Indian Wildlife Protection Act (1972) has since 2011 effectively banned angling within protected areas and rendered the future of mahseer recreational fisheries elsewhere uncertain. In 2014, our team collaborated with local organizations, fisheries professionals, non-governmental organizations (NGOs), and anglers to conduct two stakeholder workshops designed to develop a research agenda for various species of Indian mahseer. General knowledge gaps identified in the two workshops were very similar and included biological, sociological, and economic considerations. The resulting research priorities in both locations strongly highlighted local context, indicating that while opportunities for addressing knowledge gaps through collaboration exist at the national scale, there is a need for regional- or fishery-specific governance strategies and approaches to mahseer research and conservation.

1. Introduction

Stakeholder engagement, the active participation of individuals in planning, research, or management processes that impact them (Sloan, 2009), has become a popular topic in fisheries research (e.g., in the US, Feeney et al., 2010; in the UK, Hartley and Robertson, 2008; in Europe, Mackinson et al., 2011; for spatial planning, Pomeroy and Douvere, 2008). A number of concerns associated with the incorporation of stakeholder engagement into research have been identified (e.g., negative impacts on scientific integrity, Abbot and Guijt 1997; the potential exclusion of already marginalized groups from the engagement process, Kothari 2001; Prell et al., 2008; potential consequences of negative trust relationships, Smith et al., 2013). Other studies, however, have noted that incorporating local context led to improved research outcomes as a result of access to more relevant information (e.g., anticipating problems or conflict, Koontz and Thomas 2006; facilitating social learning, promoting trust among collaborators, Yochum et al., 2011). These benefits may be critical for developing sound management strategies for data deficient recreational fisheries. For example, Arlinghaus and Krause (2013) suggested that under certain conditions stakeholder estimates of population size could be as reliable as more traditional stock assessment methods. Other benefits associated with the stakeholder engagement process include improved relationships between researchers and the public, the development of ongoing partnerships, and acceptance and self-enforcement of

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management decisions based on research outcomes (Reed, 2008; Steyaert et al., 2007).

Recreational fisheries have been recognized as a complex social-ecological system, where changes to either component results in changes to the other (Mora et al., 2009). In these systems, wicked problems, or problems that by their nature are difficult to solve due to a combination of complexity and stochasticity, can arise which require extensive communication and efforts among numerous disciplines to tackle effectively (Jentoft and Chuenpagdee, 2009). Stakeholder engagement and partnership strategies have proven successful in recreational fisheries research and conservation efforts by incorporating multiple viewpoints and facilitating angler participation to engender cooperation and support (e.g. see Armitage et al., 2008; Granek et al., 2008; Hartley and Robertson, 2006). Indeed, when consultation and participatory conditions are met, harnessing the support of freshwater and marine anglers can contribute greatly to aquatic stewardship (Cowx et al., 2010; Granek et al., 2008; Tufts et al., 2015; but see also Danylchuk and Cooke, 2011).

An example of this potential can be found in the management and conservation challenges surrounding the mahseer (*Tor* spp.) recreational fishery of India. Mahseer are a group of large-bodied potamodromous cyprinids targeted by commercial, subsistence and recreational fishers in Asia. Despite the fact that four of the seven *Tor* species in India have been listed as endangered (an additional species is listed as 'Near Threatened', IUCN, 2015), very little information is currently available describing the ecology of these species (but see Bhatt et al., 2004; Bhatt and Pandit, 2016; Nautiyal et al., 2008; Nautiyal, 2014 describing migration behaviours and ecology of *Tor putitora*). Catch and release (C&R) was advocated as an angling ethic in the 1970s in an effort to control poaching activities after anglers noted a decline in the body size and rate of catch (Gupta et al., 2015a). In an effort to mitigate concerns surrounding the state of the fishery, anglers developed 'coalitions' and leased property along river reaches, developing training programs for guides and monitoring river activities to reduce poaching (Everard and Kataria, 2011; Gupta et al., 2015b; Pinder and Raghavan, 2013). Angler catch data collected from a former angling camp on the Cauvery River has demonstrated an increase in catch rate (along with concomitant decreases in body size), indicating strong recruitment has occurred since this type of fisheries management model was established (Pinder et al., 2015b). However, in 2009, a legislative decree equating C&R fishing with hunting effectively shut down the recreational fishery in protected areas, while leaving other locales virtually unaffected. This uneven application of regulations has since resulted in anecdotal reports of elevated poaching and illegal fishing activity within the Cauvery Wildlife Sanctuary (Pinder et al., 2015a,b).

In 2013, WWF India issued a report detailing the current status and challenges surrounding mahseer conservation (see WWF-India, 2013). A key report finding was the need to develop an evidence based research agenda to support mahseer conservation. In 2014, our team collaborated with local organizations, fisheries professionals, NGOs, and anglers in two regions to conduct stakeholder workshops designed to meet this need by facilitating discussions to clarify the current state of mahseer research, identify key knowledge gaps constraining mahseer conservation, and to develop a research agenda based on the outcomes of these discussions.

2. Methods

The goal of both stakeholder workshops was to collaborate with researchers, industry and stakeholder partners to identify key knowledge gaps and develop a research agenda for mahseer that addresses these knowledge gaps and supports current and future research and conservation efforts. The unique characteristics of each location, and associated fisheries, threats, and focal species necessitated different approaches for each workshop. In both cases, preparation consisted of identifying local experts in the target areas to seek their partnership in facilitating workshops through planning and participation (as per Reed et al., 2006). These facilitators populated a balanced list of key stakeholders from multiple arenas, including fisheries and forestry managers (Karnataka Department of Fisheries, Uttarakhand Department of Forests and Ecotourism), representatives from fishing associations (including the Coorg Wildlife Society, the Wildlife Association of South India, Jungle Lodges, The Himalayan Outback, Baobab Educational Adventures), lodge and homestay owners, anglers, and representatives from conservation NGOs (WWF India and Zoo Outreach Organization).

The South India workshop took place at Jungle Lodges and Resorts, Bannerghatta Nature Camp, Bangalore, Karnataka on March 28 and 29, 2014, with 30 people in attendance. Mahseer recreational fishing is firmly established in the southern states, including Karnataka (Gupta et al., 2015b; Sehgal 1999). Participants in this workshop were interested in discussing developments in the recreational fishery, including rules and regulations governing fishing activity, and the angling ban in protected areas. The North India workshop took place on April 5, 2014 at the Byasi Beach Camp, Rishikesh, Uttarakhand, on the banks of the Ganges River, and on April 6, 2014 at Atali Ganga, Rishikesh, Uttarakhand, with 18 people in attendance. Mahseer recreational fishing is growing as a tourism industry in the northern states (including Uttarakhand), though it is not known to be a popular activity undertaken by many domestic recreational anglers. Participants of this workshop were interested in discussions regarding the role of tourism in promoting the sport, and strategies for achieving balance between tourism- and locally-based activities (e.g., small-scale commercial and subsistence fishing).

The nature and type of both workshops was developed in response to the preferences of participants and partners. For example, the workshop held in South India (Bannerghatta) was very structured, with specific time frames allotted for presentations and discussion. In North India (Byasi/Atali Ganaga), the workshop process was more flexible, leaving more time for ad hoc discussions and deviations from planned topics. Time frames were estimated for individual topics and were adjusted according to how much/how little participants had to contribute.

Both workshops were scheduled over two days, with different goals set for each day. We opted to provide numerous opportunities for relationship-building and conversation prior to initiating discussion regarding the research agenda (as per Allen et al., 2011; Reed, 2008). For example, on Day 1, participants identified local and regional-scale issues impacting mahseer, discussed the management and conservation context for these issues, and background topics associated with the research (i.e., current state of recreational fisheries research, C&R research and associated best practices; Figs. 1 and 2). This method transformed the process from a top-down scenario to a bottom-up process in accordance with Reed's (2008) best practices for stakeholder engagement, and afforded the opportunity to discuss any potential flashpoint issues in an open atmosphere. These flashpoint issues were aired, but not considered an essential part of the research agenda by any attendees. The list of knowledge gaps was populated at the end of Day 1 in both workshops. The second day (Day 2) was devoted to developing a research agenda for mahseer based on knowledge gaps and discussion from Day 1.

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