



# Assessing recreational fisheries in an emerging economy: Knowledge, perceptions and attitudes of catch-and-release anglers in India



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## ABSTRACT

Across the globe, catch-and-release (C&R) angling represents a leisure activity indulged by millions. The practice of C&R is commonly advocated by conservation managers because of its potential to protect local fish populations from a range of anthropogenic threats, including over-fishing. In India, C&R angling in fresh waters has a history dating back to colonial times. Despite this, little is known about the current state of the sector. To address this, an online web-based survey was conducted to target C&R anglers who fish in Indian rivers to assess their knowledge, attitudes and perceptions relating to the status of India's freshwater C&R fisheries. From a total of 148 responses, factors such as angling quality (score of 4.6/5.0), aesthetics of surroundings (4.6/5.0), presence of other wildlife (4.4/5.0), fishery management practices (4.6/5.0) and socioeconomic benefits (4.4/5.0) were evaluated. Over 65% ( $n = 148$ ) of the anglers reported an observed decrease in the quality of fishing (e.g. a reduction in the size and/or numbers of fish available for capture). Respondents also considered deforestation (score of 4.2/5.0), water abstraction (4.4/5.0), pollution (4.4/5.0), hydropower projects (4.2/5.0) and destructive fishing techniques (4.7/5.0) as factors which threaten both the habitat and species they target. C&R practitioners were largely united regarding the benefits and willingness to contribute both their time and financial input to support conservation initiatives (score of 4.7/5.0). The current study provides the first overview of the status of C&R angling in India and explores challenges, opportunities, and priorities for future resource management.

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## 1. Introduction

Apart from being an important protein source and facilitating vital ecosystem functions (Dugan et al., 2006; Welcomme et al., 2010; Brummet et al., 2013), freshwater fish also provide recreational benefits (Pinder and Raghavan, 2013). Recreational (catch-and-release (henceforth C&R)) fishing, defined as “a non-commercial activity that captures fishes for purposes other than nutritional needs” (Granek et al., 2008; Cowx et al., 2010) is a highly indulged pastime, both in developed and developing countries. C&R has a very high participation rate (Cooke and Cowx, 2004; Granek et al., 2008; Cowx et al., 2010) and its popularity is expected

to grow in developing countries and emerging economies owing to increased wealth of their societies (FAO, 2012). For example, despite the popularity of recreational angling in India during colonial times, it is only in the past two decades that C&R angling has gained national popularity, and now represents a fast expanding market (see Everard and Kataria, 2011). Indeed, an increasing number of tour operators are offering angling as part of their wildlife and tourism packages to two of the nation's biodiversity hotspots, the Himalayas and the Western Ghats (Everard and Kataria, 2011). Of particular attraction to international anglers are the mahseers (*Tor* spp.); often considered to be the world's hardest fighting fish (TWFT, 1984), both foreign and domestic anglers frequent the upper Ganges catchment (in the Himalayas) and the Cauvery (in the Western Ghats) in pursuit of these fish.

Despite contributing a multitude of key ecological functions and societal benefits (WWF, 2006; Collen et al., 2014), freshwater ecosystems, especially rivers, comprise one of the most

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endangered and poorly protected ecosystems on earth (Dudgeon, 2011; Cooke et al., 2012). Multiple interacting threats including habitat alteration/loss, alien species, overexploitation, pollution and climate change (Xenopoulos et al., 2005; Dudgeon et al., 2006; Strayer and Dudgeon, 2010; Vörösmarty et al., 2010; McDonald et al., 2011) are widely cited as contributing to the precarious state of global freshwater biodiversity. Since freshwater fishes are integral to ecosystem function and are also a source of food and livelihood to millions (Dugan et al., 2006; Welcomme et al., 2010; Brummet et al., 2013; Reid et al., 2013), they are considered a critical component of freshwater biodiversity. Freshwater fishes are nevertheless one of the most threatened vertebrate taxa on earth (Reid et al., 2013), with more than 36% (of the 5785 species assessed by the IUCN) at the risk of extinction and over 60 species having already gone extinct since 1500 (Carrizo et al., 2013).

Despite varying levels of threat as a result of escalating anthropogenic pressures (Vishwanath et al., 2010; Dahanukar et al., 2011), India supports notably high levels of freshwater fish diversity and endemism. National fishery focused conservation and management policies have often suffered from setbacks due to jurisdictional issues, oversights, and implementation of top-down approaches (Raghavan et al., 2011); poor enforcement of existing laws (Raghavan et al., 2013) and community-based conservation initiatives often failing to protect river stretches outside their own jurisdiction (Gupta, 2013). Furthermore, the Indian Wildlife (Protection) Act, 1972, the highest legal instrument for wildlife conservation in the country (Dahanukar et al., 2011; Raghavan et al., 2013), affords no mention of freshwater fish. Additionally, very few studies on C&R angling and its potential benefits are available from India (Everard and Kataria, 2011; Pinder and Raghavan, 2013). This paper seeks to enhance current understanding of the status of recreational angling by assessing the knowledge, attitudes and perceptions of both international and domestic anglers practicing C&R angling in India.

## 2. Methods

Prior to any data collection a pilot survey was carried out. The questions formulated were based on the concerns and opinions of C&R anglers fishing in India (N. Gupta, pers. comm. with C&R anglers). Randomly selected international and domestic respondents ( $n=25$ ) from India-specific angling forums were requested to complete the survey and pinpoint any problems with its content (Andrews et al., 2003). A web-based survey was used (running for six months from November 2013 to April 2014) to facilitate quicker response times, increased response rates, and reduced costs (Oppermann, 1995; Lazar and Preece, 1999; Andrews et al., 2003). The survey design was based on a series of 23 questions (see Supplementary material). Information on the fishing locations and target fish species of interest to anglers was first determined. Further, (a) preferred fishing techniques; (b) factors influencing the angling experience; (c) changes in quality of the angling experience over the course of angling at a particular location; (d) threats to target species and fishing locations; (e) awareness of the anglers on the conservation status (International Union for Conservation of Nature/IUCN Red List of Threatened Species) of target species; (f) various conservation strategies which the C&R anglers felt was needed for the protection of target species; (g) economics of C&R angling through the amount of money spent (in US\$) annually by the anglers on angling and related activities; (h) perception on the benefit of C&R angling as a conservation strategy; (i) willingness to pay for, and get involved in a conservation initiative; and (j) anglers willingness to contribute time and money towards such initiatives was also ascertained. An option for additional comments was also provided at the end of the survey to obtain views and opinions of

anglers fishing in Indian waters. The respondents scored each criterion on a scale of 1–5, in ascending order of preference, and the mean score was calculated and represented in a tabular form.

To assess international participation, the survey was advertised globally to target anglers spanning different method disciplines. The notification of the survey was posted on global/domestic conservation and angling websites and forums, published in international/national fishing and angling magazines/newsletters, and posted on social media (Facebook, Twitter) sites. All known India-specific angling forums were also targeted. The survey was advertised every fortnight to maintain interest. No changes were made to the survey questions during the course of data collection (Zhang, 2000) and care was taken to allow only one response per individual angler to avoid dual submission (Hasler et al., 2011) by thoroughly reviewing the responses to spot any duplicate submissions.

Angling quality/experience was defined as the availability of fish (numbers/size) available for capture. The aesthetics of surroundings denoted the environment of the angling location. The presence of other wildlife refers to the visual presence of flora and fauna during angling activities. Fishery management practice considers effort applied by local fisheries/forest department towards the protection and conservation of fish communities. Local stakeholders' involvement and transparent sharing of C&R angling revenue dealt with the engagement of and financial benefits to local communities. Camp infrastructure considers the accommodation available to C&R anglers.

## 3. Results and discussion

A total of 148 responses were obtained and analysed from anglers (i.e., from United Kingdom/UK + India) specifically targeting fishing locations in India (see Fig. 1). In comparison to anglers from the UK, Indian/domestic anglers chose highly diverse and multiple fishing sites distributed across the country (see Table 1).

Many species targeted by C&R anglers in India have shown a declining trend of population and are listed as threatened in the IUCN Red List, (e.g., *Tor khudree*, *T. malabaricus* and *T. putitora*, all assessed as 'endangered'; the goonch catfish, *Bagarius bagarius* assessed as 'near threatened'; and *Schizothorax richardsonii* assessed as 'vulnerable'); but for none of these species has recreational C&R angling so far been mentioned as a threat (see species specific accounts in the IUCN Red List of Threatened Species). This has also been the case with most threatened fish species targeted by recreational anglers around the world (see Cooke et al., in press).

Apart from angling quality, aesthetics of surroundings and camp infrastructure (all directly related to C&R angling experience), ecological factors such as presence of other wildlife, fishery management practices, and the inclusion of, and financial benefits to local communities were valued by C&R anglers (see Table 1). This not only highlights the ecological and social awareness among C&R anglers, but demonstrates alignment with the current objectives of river and fish conservation policies in the region. Such awareness has the potential to assist in the co-engagement of key stakeholders (Everard and Kataria, 2011) and bridge the gap between social, economic and biological dimensions of river ecosystem conservation (Cowx and Portocarrero Aya, 2011). Indeed, an opportunity could exist where C&R anglers could become involved in future conservation programmes, and possibly assist in monitoring, data collection, enforcement and lobbying at local levels (Granek et al., 2008; Cowx et al., 2010).

'Angling quality and experience' is a key driving force for any C&R angler (Arlinghaus, 2006; Granek et al., 2008). The responses obtained regarding decrease in this experience and quality is a cause of concern not only for ecology and conservation, but also

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